DEMAND FOR EMPLOYEES' DIGITAL SKILLS IN THE CONTEXT OF BANKING 4.0

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Abstract: *Digitalisation and technical development in the financial service sector have aimed to secure, increase the quality, and satisfy the interests of both customers and financial institutions in the current turbulent era. Together with this situation, there is a need to develop digital employees' competencies in the financial sector. This paper aims to analyse the topical issue of digitalisation and demand for employees' digital skills in connection with the COVID-19 pandemic situation based on global secondary data and primary data collected by the authors in the Czech Republic. The main research objective of the paper is to provide a theoretical framework for digitalisation and its drivers in the financial sector, introduce the phenomenon of Banking 4.0 concerning the required competencies, and identify gaps and barriers for faster and more effective development based on the literature review and selected primary and secondary and data analysis. Descriptive statistics and Spearman's rank correlation coefficient have been used to fulfil this goal. A semi-structured in-depth interview with three human resources (HR) specialists of a selected Czech bank also has been conducted. The paper brings an overview of the latest research studies in the field of digital competencies in general and specifically in the financial sector. Although the primary data is limited in scope (i.e. ten middle-sized and large financial and insurance companies), it provides a unique view of the situation with digitalisation in financial institutions. It shows current developments, trends and barriers within the example of a bank case study. The paper is motivated by the current situation in the banking sector in connection with digitalisation. It aims to emphasise the growing influence of digital technologies on employees, managers and companies, and the importance of systematically implementing digital skills development approaches on the companies' strategic level.*

Keywords: *Bank transformation, digital technologies, industry 4.0, human resource development, digital competencies.*

JEL Classification: *M53, O33, G21.*

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Introduction

The high pace of strategic and organisational changes in the current financial services sector is not only caused by the fundamental transformation in the institutional and competitive environment but also by the rapid expansion of technological innovations (Menshikova et al., 2017). The restructuring of the modern labour market and traditional human resources qualification requirements is to a large extent impacted by Industry 4.0 (Smirnova et al., 2019) that is directly connected with a transformation of knowledge sharing processes, data processing and integration and value orientation, which the companies consider essential for their success

(Blštáková et al., 2020). Customer centricity, personalisation, mobility and agile corporate culture are becoming key factors to ensure an innovative pace of development in the digital environment (Ajupov et al., 2019). In this regard, the demand for highly educated specialists directly involved in customer service in banking and insurance institutions has been increasing especially as a lack of a qualified workforce is among the most important drivers for Industry 4.0 (Stentoft & Rajkumar, 2020).

Taking into account the growing importance of digitalisation, it should be noted that it has an ambiguous influence on the financial services sector. On the one side, digitalisation helps to increase customer loyalty, reduce human error and cope with the leading competitors (Rathi Meena & Parimalarani, 2020). On the other side, all these changes require banks and insurance companies to rethink their way of operating, increase the delivery speed of banking and insurance services and expand the digital network for their provision (Evdokimova et al., 2018).

The nature of work is changing due to emerging invasive technologies. These changes in the financial services sector primarily concern the number of employees needed. At the same time, the demand for employees' skills and competencies required for effectively utilising digital technologies is becoming a focus area in the conditions of the transformation of the financial services (Folea & Folcut, 2019). Digital skills usually have more importance than the sole ability to use applications or operate a digital device (Van Laar et al., 2020). They also include digital information processing and communication (Aesaert et al., 2014), critical thinking (Starkey, 2011), the ability to work on shared documents and projects in online collaborative platforms (Balau & Utz, 2017), and the problem solving skills needed to find creative solutions and transfer knowledge to new working conditions (Barak, 2018). Oberländer et al. (2020) emphasised the fact that there is a gap between the existing and needed digital competencies to respond to the challenges of the fully digitalised workplace in the future. An insufficient level of the users' digital skills can cause the ineffective utilisation of the banking accounting system and other types of information systems processing the data (Lingga, 2020).

The paper aims to analyse the data from the financial sector in digitalisation based on secondary data and, primarily, from the point of view of digital competencies in this sector. Firstly, key drivers for digitalisation in the financial service sector and Banking 4.0 are analysed there. Technological developments in financial services are demanding for the employees' digital competencies in this sector. As the latest studies on employees' digital competencies in this field confirm, both companies and employees consider digital competencies development to be important and pay attention to their systematic development and training. However, not always in an acceptable way. Based on the literature review, key findings are also supported by the authors' primary quantitative and qualitative data within several Czech companies operating in the financial sector. Data introduced in the paper mainly focuses on the topical issue and the present situation in Czech bigger banks within a turbulent environment in the financial sector. There are also specified digital competencies needed in the financial sector, identified gaps and also actions taken to overcome barriers for their increased improvement. The survey also helped to determine limits for digital competencies development caused by the effect of the COVID-19 pandemic.

1. Financial Services Sector in the Context of Digitalisation

In recent years, the banking and insurance companies continue to be renewed by emerging models of investment and regulations, ongoing digitalisation and technological advances. Due to a rapid change in the tools, skills and competencies that employees require, continuous development of digital skills has to be supported by employers (Trias Pinto & Gendre, 2016).

Overall, digitalisation of the financial services segment may be regarded to improve the existing range of banking and insurance services with new technological solutions aimed to secure and satisfy the interests of banks and insurance companies, their customers and the state (Evdokimova et al., 2018). In this case, digitalisation leads to the implementation of so-called Banking 4.0. Mehdiabadi et al. (2020) identify Banking 4.0 as the use of Industry 4.0 technologies for digitalising assets, creating a digital identity, providing special offers to customers and offering customisation. Banking 4.0 is characterised by open, flexible

and integrated architecture, thereby ensuring customer experience and performance experience. Votintseva et al. (2019) emphasise that the implementation of Banking 4.0 results in creating a new business model influenced by competition for digital banking services, flexible management, access to the data source, and the level of investment in high-performance technologies for reducing cyber risks.

1.1 The Key Drivers for Banking 4.0 Development

The modern banking sector has undergone dramatic changes, which does not allow it to remain as conservative and stable as before. The existence of such interrelated factors as changing consumers' behaviour and preferences, ongoing legal regulations, the emergence of new competitors, technological opportunities and the COVID-19 restrictions have accelerated digital transformation in the banking sector. Considering this, a clear vision of digitalisation characterised by innovation, being ahead of the competition, and a willingness to take risks is notably needed to be developed by banks (Niemand et al., 2020).

Regarding *changing consumer behaviour,* they increasingly prefer using different communication channels, which were not required earlier (e.g. social media, smartphones, chatbots). In such conditions, the interaction between banks and their customers should contribute to creating fully integrated user-friendly omnichannel customer experiences with banking services across all possible devices. Consequently, banks should focus on increasing financial literacy and digital literacy as they are interconnected (Andreou & Anyfantaki, 2020). Recent studies of the consumer habits of bank customers (PwC Financial Services, 2018) have shown that the role of mobile banking is on the rise and highly preferable for at least 15% of customers. Such a change is driven by the preferences and expectations of the young generation, so-called millennials. Regarding choosing a primary bank, people still consider the existence of a local branch important, and this opinion does not depend on the customers' age (PwC Financial Services, 2018).

Aspects of consumer behaviour related to the use of banking services based on artificial intelligence (AI) require special attention. The presence of AI in some services can be both actively propagated (e.g. investment robot-advising that proved its usefulness) and hidden (e.g. credit scoring, financial fraud detection, and money laundering prevention) (Tao et al., 2021). Users are inclined not to trust what is not understood. It is also relevant for AI when the basis of decision-making by neural networks is too difficult to understand (Burgt, 2020). However, over time, the attitude towards AI becomes more positive from both bank employees and consumers of banking services (Ryzhkova et al., 2020). In their research about the influence of AI on the banking sector, Kaur et al. (2020) empathise that using AI is beneficial for banking, according to 71.4% of the respondents.

Current transformation in the banking industry is driven by increased global competition, lower costs and reduced barriers to entering the banking market. Modern FinTech companies might not supplement traditional banking, but they improve access to finance, opening up opportunities for new types of projects and attracting new categories of investors (Bollaert et al., 2021). The most powerful influence is caused by *the emergence of new competitors* in the form of the digital native banks, each of which has a different background (Büchi et al., 2019):

- Beta banks (spin-off organisations of traditional banks or joint ventures);
- Neobanks (independent FinTech start-ups that use partner bank licenses);
- Challenger banks (newcomers in the banking market compete directly by challenging the consolidated players);
- Big Tech banks (organisations formed by large technology companies, for which a banking sector is not a core business, co-called GAFA: Google, Amazon, Facebook and Apple);
- Retail banks (organisations made up of large distribution groups) (Mekinjić, 2019).

The Payment Services Directive (PSD 2), valid from January 2018, liberalises the market of financial services in the European Union to a great extent, thereby forcing banks to develop their responses to the threat of new competition or possibilities of cooperation. The crucial element of this *new legal regulation* refers to the obligation of banks to provide access to their customer data (Mekinjić, 2019). Whereas the banks' business models are increasingly based on algorithms and data analytics, new skills

will also be required from banking supervisors soon. As a result, banking supervisors have to be qualified enough to control the data sets protection in different systems against cybersecurity threats (Grym et al., 2018). It is also expected that PSD 2 regulation will lead to a much greater exchange of data between banks and regulators. One example of such data exchange is the Analytical Credit Dataset (AnaCredit) framework proposed by the European Central Bank in 2014. AnaCredit will collect information on a borrower-by-borrower or loan-by-loan basis from credit registers operated by the national central banks of the European System of Central Banks or from other granular data sources (Thun, 2015).

The Basel Committee on Banking Supervision (BCBS 239) issued 14 principles for effective risk data aggregation and reporting on risks in January 2013. The need for their compliance with global and local banks encourages them to increase their data storage and analytics capacity (Orgeldinger, 2018). The implementation of a technological platform for effective risk reporting and robust data governance is asked for in these principles. This is due to the need to know exactly where, by whom, for what purpose and frequency specific bank data are used. Although this legal regulation leads to searching for new automated solutions for reporting (71% of banks) and increases the need for analytical skills, 35% of banks' employees still do not have them at the appropriate level. Therefore, banks involve non-staff personnel with analytical skills from external sources (Harreis et al., 2017).

Industry 4.0 provides the banking sector with various *technological opportunities*, such as self-service bank terminals, chatbots, mobile banking, blockchain and AI-based fraud detection technology (Kaur et al., 2020). Intensive deployment of data mining or cognitive computing techniques on banks' day-to-day activities is not surprising because banks have access to their customers' specific anonymised data (Mekinjić, 2019). The banking sector mainly adopts data mining techniques for the following purposes (Hassani et al., 2018):

- security and fraud detection;
- risk management;
- investment banking;
- customer relationship management (customer profiling, segmentation and cross-/up-selling);
- other advanced supports (e.g. branching strategy or performance evaluation).

Banks are also actively using such automation technologies as robotic process automation or intelligent process automation (Bellman & Göransson, 2019; Vijai et al., 2020). This development not only places a demand on digital competencies for IT professionals but also for all those who are users and providers of data within the financial sector.

1.2 Digital Employees' Skills in Banking and Insurance Companies: Secondary Data Analysis

The data in Chapter 1.1 pointed to a trend in digitalisation and technology development in the financial sector. Several research studies that focused on the importance and scale of digital competencies in companies have already been published in the last few years. Tab. 1 provides an overview of several of the most recent studies in the field of digital competencies. The authors' names and further details about these studies are also briefly described in Tab. 1.

The main findings confirm the importance of the topic and retain attention to existing gaps in digital competencies in many countries and companies around the world.

As shown in the literature search in Chapter 1.1, modern banking is undergoing significant technological changes. Their need is further accelerated in the context of the COVID-19 pandemic, when a number of processes need to be addressed in the online environment. This increases the requirements for employees' digital competencies and is becoming a key phenomenon in the financial sector. The results of the research conducted by Hach et al. (2018) emphasise that banks still do not have sufficient digital competencies in their workforce. Another study on Romanian graduate students (Folea & Folcut, 2019) shows that information processing and communication skills are among basic digital skills required for their future job in the banking sector, as stated by 53% of the respondents. A list of advanced digital skills required for successfully operating in the banking sector is headed by application development (38%), and followed by web programming (23%) and user interface design (23%). At the same time, each second respondent employed in the banking sector states that graduates do not have digital skills needed for work in the modern business

Tab. 1: Overview of the latest research in the field of employees' digital competencies

Year	Authors	Name	Number of respondents	Main findings
2020	BrainStation	The digital skill survey	Not specified	83% of respondents rate data literacy in their organisation as medium or low. The lack of data literacy has an impact on the success of the organisation (89%).
2019	Abel-Koch et al.	European SME survey: Going digital	2,586 companies with 20–249 employees in Poland, France, Great Britain, Spain and Germany	The lack of digital skills both among employees and in the external labour market is a major obstacle for businesses in all 5 countries.
2019	O'Loughlin et al.	CCC Global digital skill survey	Not specified (IT professionals in organisations around the world)	19% of businesses have adopted digital technologies and changed business processes, mischievous people, culture, and thinking have not yet adapted.
2018	Kane et al.	Coming of age digitally: Learning, Leadership, and Legacy	More than 4,300 managers, executives and analysts from 123 countries	44% of employees are constantly updating their skills so that they can do their job effectively in the digital environment.
2016	ECDL Foundation	Perception and Reality: Measuring Digital Skills in Europe	Switzerland (2,050), Austria (1,260), Germany (673), Denmark (183), Finland (62)	In countries that are considered digitally advanced, there are significant skills gaps.
2016	Curtarelli et al.	ICT for work: Digital skills in the workplace	7,800 workplaces in Germany, Finland, Great Britain, Portugal, Sweden and Slovakia	15% of workplaces report the existence of gaps in digital skills of their employees.

Source: own

environment. The majority of respondents from the banking sector (85%) also believe that additional in-house training is especially needed for recently hired workers.

The newest studies in employees' digital skills in the financial services sector are presented in Tab. 2.

According to the research provided by Shook et al. (2018), only one of four employees in the insurance sector is ready to work with intelligent technologies. This in turn makes the growing skills gap a crucial factor impacting insurance executives' workforce strategy (43%). Despite this fact, only four percent of insurance executives plan to greatly enrich investments in reskilling their employees over the next three years. As was pointed out by the Harvey Nash and KPMG survey (2018), insurance companies are more effective at understanding the impact of digitalisation on their company than companies in other industries (48% versus 43%), but less effective with hiring and developing employees with digital skills (19% versus 24%). In a study by Malhotra and Mistry (2015), employees in the insurance sector were asked about their readiness to learn and develop their potential. It has been claimed that the majority (64%) are looking for learning opportunities and evaluated digital skills, emotional intelligence,

Tab. 2: Overview of the latest research about digital competencies in banking and insurance companies

Year	Authors	Name	Number of respondents	Main findings
2020	Brassel, J.	Impact of the digitalisation on the employment market in banking	3,200 job vacancies in the banking sector in Switzerland	9% of all job vacancies in banking require experience with digital products, focus on them, or involve digital transformation projects.
2018	Hach et al.	The digitalization race: Can financial service providers hack the pace?	60 respondents from 10 countries working in banks of all different sizes	Only 14% of employees have highly advanced digital savviness.
2018	Shook et al.	Future workforce survey – Banking realizing the full value of AI	100 CEOs and top executives and more than 1,300 bank employees working with AI from 11 countries	Digital technology (i.e. virtual or augmented reality) can provide realistic simulations to help bank employees to master new tasks.
2018	Shook et al.	Future workforce survey – Insurance realizing the full value of AI	100 CEOs and top executives and almost 1,000 insurance employees working with AI from 11 countries	57% of the respondents saw themselves as 'highly skilled and highly willing' to learn new capabilities.
2017	Oxford Economics & SAP Success Factors	Digital leadership in financial services	More than 500 executives and employees from financial services in 21 countries	41% of executives rate digital proficiency as the most important quality for a manager of the future to possess.
2016	Ernst & Young	Transforming talent: The banker of the future. Global banking outlook	Not specified	In the roles of research analyst, call centre staff and high-net-worth personal advisors, digital and interpersonal skills will be challenging to automate.
2015	Malhotra, R. & Mistry, S.	The insurance workforce of the future: Why will so many insurers fail to achieve their digital potential?	Not specified	One of the most significant changes involve rethinking of the insurance companies' approach to enabling their workforces due to digitalisation.

Source: own

critical thinking and communication skills as the competencies most needed for the future. The Willis Tower Watson (2017) study analysed the Czech insurance market and its readiness for the digital revolution. The data from 49 respondents drawn in 2016 from 23 different insurance entities and organisations confirmed that insurance companies perceive digitalisation and process automation as the main trend until 2020. The current IT architecture and systems not allowing full use of new technologies (38%), costs (17%) and lack of skilled people (13%) were considered as the main obstacles in the new technologies implementation (Willis Towers Watson, 2017).

Digitalisation goes hand in hand with job flexibility, and it affects a large extent of the employees' competencies requirements in the banking sector. As an example, Československá obchodní banka (ČSOB), one of the leading players in the Czech financial services market, can be mentioned. This bank supports the education of employees driven by the need to utilise digital technologies in their daily work. For this purpose, inspiring events, educational activities such as lectures and workshops, and self-study with microlearning videos on digital competencies are regularly carried out. Such inspiring events aim to show employees current technological trends and acquaint them with the latest opportunities in the field of digitalisation. Examples here are digital breakfasts, where participants learn to use online tools to simplify work effectively and Inspiration Day conferences, where employees can be inspired by innovations and the success

stories of other companies in the banking sector. ČSOB has also successfully implemented a special programme focused on the education of managers, called Digital Bootcamp. Its goal is to provide managers with an overview of technological trends, agile organisation and modern project management, and prepare them for work in a constantly changing digital environment (DigiSkills, 2020).

2. Research Methodology

The paper focuses on digitalisation, digital technologies and their influence on employees' competencies in bank and insurance companies in the Czech Republic. The aim of this paper was based on the literature review to examine the current implementation of digital technologies in business practice within the context of its impact on the demand for employees' digital skills in the Czech banking and insurance sector. The methodology of this paper consists of the following main stages (see Fig. 1).

In the first phase, scientific papers primarily sourced from the Web of Science and Scopus databases were analysed. The keywords used for searching them were: digital skills, digital technology, 4th digital revolution, Banking 4.0, skills demand, digital transformation, future workforce, 21st-century skills, employee training, skills gaps, etc. The results were presented in Chapters 1 and 1.1.

In the second phase, the secondary information sources about the current state of the employees' digital competencies in companies worldwide were studied and processed.

In the third phase, this paper applied a quantitative approach to examine a research problem. The situation was analysed based on primary data gained from the semi-structured interview and introduced in the case study in Chapter 3.1. The primary data research has been developed based on the results of foreign studies of this issue (see Chapter 1.2) and included the following steps (see Fig. 2):

Fig. 1: Methodology of the research paper

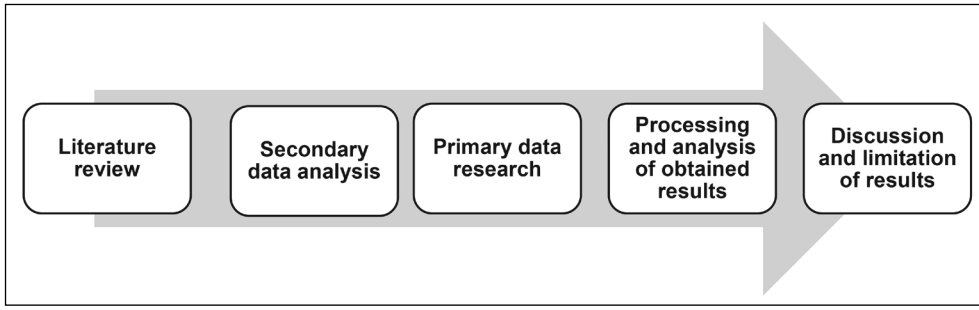

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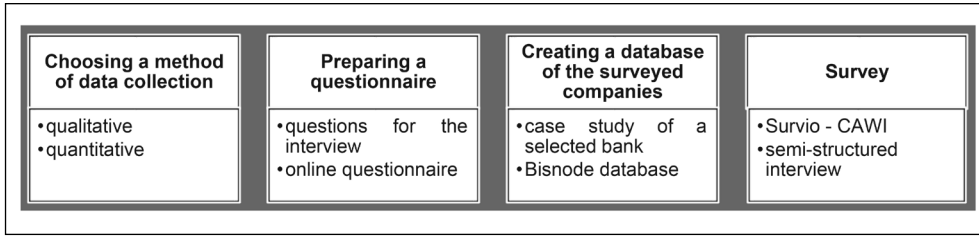
Fig. 2: Stages of primary data research



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The primary data collection was carried out under two methods:

- collection of quantitative data using the CAWI method and structured questionnaire;
- collection of qualitative data based on the semi-structured interview with one big Czech bank.

The survey was prepared based on secondary data analysis (see Tab. 1). The questionnaire consists of 19 questions that contain:

- closed questions with one or more possible answers;
- scales that express the respondents' attitude to the researched issue;
- one open question;
- four identification questions to characterise the companies involved in the research.

The preparation of the database of the companies invited to participate in the survey was proceeded based on the data available in the MagnusWeb Bisnode database of all Czech economic entities on 1 June 2020. It is important to note that the survey primarily focused on all companies in the database after cleansing the records based on the criteria described below. For this paper, only data from the companies in the banking and insurance sector are used.

The representative sample in the banking and insurance sector from the MagnusWeb Bisnode consists of 79 companies. First of all, businesses with significant negative events in their history were removed from the representative sample. In the next step, the functionality of the websites of these companies was verified. Finally, after removing companies that did not mention their corporate email on the website, 69 companies were selected for participating in this study.

The final respondents in this survey have been identified as follows. First of all, banks and insurance companies have got an invitation to take part in this research at the email address indicated in the Bisnode database or on their official website. Next, based on the prior agreement with senior management of the banks and insurance companies that had expressed interest in cooperation, the link to the questionnaire was sent to their employees who specialised in digitalisation and the employee's digital skills development.

The quantitative data was collected and processed by the online Survio software in July 2020. As a result, 13 responses were obtained. Consequently, the return rate of the questionnaire was 18.85%. This paper analyses the data obtained from the representatives of the seven large (i.e. with more than 250 employees) and three medium-sized (i.e. with 50–249 employees) Czech banks and insurance companies operating in Prague. The data obtained from the representatives of the three small companies (i.e. with 1–9 employees) were excluded from the analysis for the reason that these companies do not plan any steps for closing the gap in their employees' digital competencies and do not consider this as a topical issue within a long-term human resources management strategy.

The collection of qualitative data was based on a semi-structured interview with one big Czech bank. A semi-structured in-depth interview with three human resources (HR) specialists of a selected Czech bank was conducted to deeper describe the processes in the digital competencies development in the banking sector.

In the fourth phase, the quantitative data obtained from the Czech banking and insurance companies were processed and analysed using descriptive statistics and Spearman's rank correlation coefficient. For this purpose, it has been suggested that the null hypothesis (*H0*) does not confirm the relationship between three individual ordinal variables (i.e. that the value of the Spearman's rank correlation coefficient is equal to zero). The variables' values expressed the respondents' consent with selected statements using the Likert scale presented by the options 'strongly agree', 'agree', 'neither agree nor disagree', 'disagree' and 'strongly disagree'. In the beginning, the data were coded by the numbers 1, 2, 3, 4, 5 (i.e. the value 1 means the highest degree of agreement and the value 5 the lowest level of agreement with the stated statement). Then the data was processed in IBM SPSS Statistics 26 by using the function Analyze – Correlate – Bivariate – Spearman correlation coefficient. The quantitative and qualitative data analysis results are presented in more detail in Chapter 3 and Chapter 3.1, respectively.

3. Digitalisation in the Financial Sectors: Primary Data and Research Results

The data presented in this chapter include quantitative data collected within the selected Czech companies and in a case study describing

Tab. 3: The Spearman's rank correlation coefficient

Variables	Statistical coefficients	Variable 1	Variable 2	Variable 3
Variable 1	Spearman's rank correlation coefficient	1.000	0.058	0.044
	Two-tailed test of significance	–	0.873	0.903
Variable 2	Spearman's rank correlation coefficient	0.058	1.000	0.404
	Two-tailed test of significance	0.873	–	0.247
Variable 3	Spearman's rank correlation coefficient	0.044	0.404	1.000
	Two-tailed test of significance	0.903	0.247	–

Source: own

the situation in one Czech bank. All respondents from the Czech financial sector confirmed using digital technologies for their day-to-day activities. It is important for interpreting the results as there are ten respondents from large financial institutions where digital technologies are a part of their core business.

By using Spearman's rank correlation coefficient (see Tab. 3), the authors have verified if there is any relationship between the respondents' reaction to the following statements:

- Variable 1: "Some tasks in my company will become obsolete due to the utilisation of digital technologies."
- Variable 2: "The use of digital technologies increases the need for employees' training in my company."
- Variable 3: "The topics of employee competence development are part of a long-term human resources management strategy in my company."

For variables 1 and 2, the value of Spearman's rank correlation coefficient is equal to 0.058. Due to the fact that the p-value equal to 0.873 is higher at either of the 1% and 5% levels of significance, there is no statistically significant relationship between the increasing need for the employees' training in digital technologies usage and possible tasks automation as a result of their utilisation. In case of the variables 1 and 3, the value of Spearman's rank correlation coefficient is also not equal to zero (i.e. 0.044), and the p-value equal to 0.903 is much higher than 0.01 and 0.05. There is also no statistically significant relationship between the topic of employee competence development in the long-term human resources management strategy and the automation of some job tasks in Czech banking and insurance companies. As it might be seen from Tab. 3, there is no statistically significant relationship between variables 2 and 3 too.

The descriptive statistics results have shown that skills connected to data processing are ranked among the most important digital skills needed in the financial sector (see Fig. 3). Advanced data skills (data management or advanced analytics) are required in 50% of the surveyed financial institutions. Also, 60% of the respondents see the importance of the general skills necessary for problem-solving in the digital environment.

It should be emphasised that 90% of the respondents consider the level of digital competencies of their employees as usual. It corresponds to the fact that 80% of the respondents agreed with the statement (50% of which strongly agreed) that digital technologies increase the need for employee training.

Internal training (90% of all respondents) is seen as the most recognised reaction to the gap in digital competencies. Recruitment of new employees having desired competencies (40% of the respondents) and external training (30% of the respondents) also seem significant. Another possible reaction to the corporate learning training and development strategy seems to be a niche. If we compare the respondents' views from large and medium-sized enterprises, we can identify important differences. One of them is that large companies most often use internal training for existing employees compared to other possible steps, actually in 100% of the cases (see Fig. 4).

Taking into account the frequency in which employees need to renew their digital competencies, the results demonstrate quite

Fig. 3: **Most needed employee digital skills in the Czech banking and insurance sector**

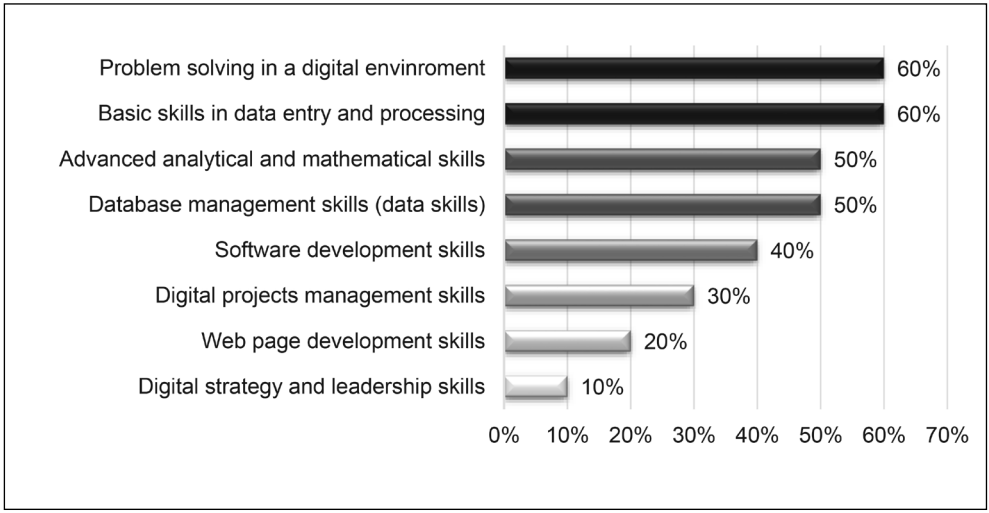

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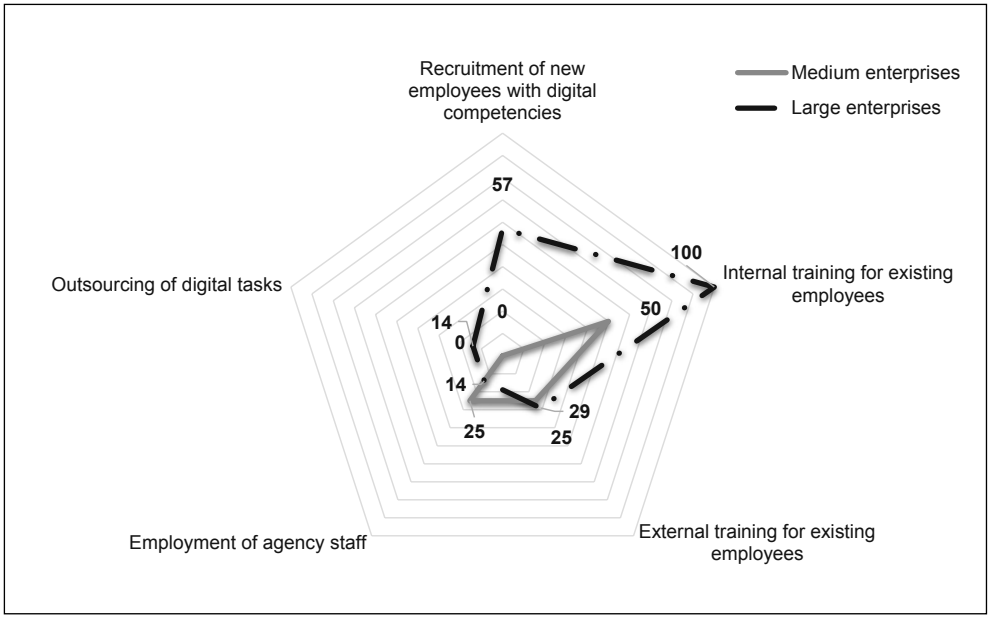
Fig. 4: **Steps planned for closing the gap in employee digital competencies in the Czech banking and insurance companies**



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a dynamic environment (see Fig. 5). 50% of the respondents see the frequency approx. once a year. However, 30% of the respondents see renewing the digital competencies as a continuous process. The major source for improving employees' digital competencies is expectedly internal training provided by the employer (approx. 80%).

According to the obtained data, the next areas for improving digital skills in the financial services sector have been identified:

- working in the cloud, mobile technology involvement;
- automation and machine learning;
- digital communication, sharing content and performance measurement;

Fig. 5: **Frequency of renewing employee digital competencies in the Czech financial services sector**

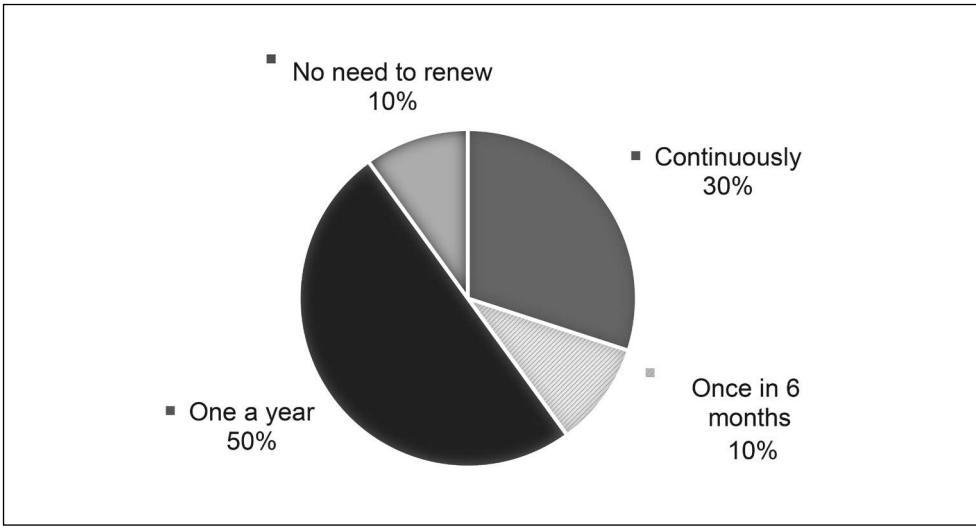

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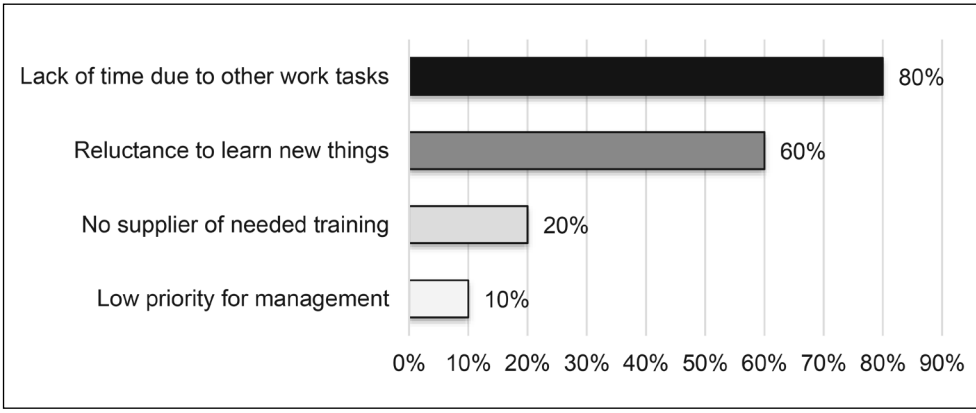
Fig. 6: **Major barriers for employee digital competencies development in the Czech banking and insurance sector**



Source: own

Tab. 4: Reaction of the Czech banking and insurance companies to the COVID-19 pandemic

Company's reaction to the COVID-19 pandemic	% answers
The company accepted digital technologies but employees did not adapt to them	70%
The company aims successfully toward being digital	20%
Digital company (fully digital processes; cloud)	10%
Total	**100%**

Source: own

- data encryption, creating data sets and efficiently working with them;
- solving problems with digital technologies;
- programming in Python, Visual Basic and other languages;
- creating effective materials using G Suite.

The main obstacles for developing employees' digital competencies are connected with the general workload of employees in the financial sector, which is confirmed by 80% of the respondents (see Fig. 6). The general reluctance to learn new things is also important. The financial sector is considered conservative, which seems to be a negative factor for digital transformation. At the same time, high costs of digital training are not a barrier, which is positive for the sector.

In addition to the authors' survey being focused on general digital competencies development in the financial services sector, the respondents were also asked about the current situation caused by the COVID-19 pandemic (see Tab. 4). 30% of financial institutions are fully or almost fully digital, which means that the impact was not significant. The remaining problems the sector faces are connected with the employees' digital technologies acceptance.

All the respondents confirmed that they try to react to barriers caused by the COVID-19 pandemic. None of the respondents claimed that their company has already started to change business processes and infrastructure, only is planning to do so or even avoid daily use of any digital technologies.

3.1 Digitalisation in the Banking Sector: A Case Study of One Czech Bank

As a part of the primary data collection, the authors of this paper conducted an in-depth semi-structured interview with three human resource professionals in one big Czech financial institution. Key findings obtained from this interview are introduced in this chapter.

Digitalisation in the Czech financial sector in the last few years places great demands on companies in this sector. Moreover, the turbulent environment in the last few months of the year 2020 connected with the pandemic situation increased the need for digital technologies in the financial sector. It often accelerated the digitalisation of most financial services. In turn, the demand for the employees' digital competencies has increased significantly. As a consequence, systematic training in this area is becoming a part of the strategic approach. The data gained for this case study demonstrates how the current situation has influenced one of the biggest Czech banks. The case study aims to show the effects of the current situation based on the example of a large Czech bank and confirm the facts presented in the previous part of the paper.

The selected bank is a large organisation with approx. 7,000 employees. The topic of digitalisation in this bank is considered an important part of its corporate strategy and also as one of the key pillars of the HR strategy. There are also some specifics in this bank in terms of digital processes and digital training. It is not enough for employees only to know how to work with digital technologies and not be afraid of them, but to strive to be digital towards clients and be their partner regardless of the circumstances. The role of bank employees as mentors and guides for clients in an online environment is increasing.

The process of digitalisation in the bank enhanced by the management agility and workforce diversity requires ongoing employee development activities. For this reason, the bank's human resource development strategy includes online training activities aimed at developing key 21st-century employees' skills (e.g. data skills), improving personal and team

efficiency, effective work with CRM (Customer Relationship Management) systems and data evaluation, as well as work with client applications such as smart banking. Digital security and digital detox are also among the critical directions for further development. An additional internal banking platform supports the transfer of knowledge and experience between employees who participated in such online courses across the whole organisation.

It should be noted that the employee competency models used in the bank have changed a lot over time. Today, a willingness to communicate and cooperate in agile teams connected across departments throughout the company is extremely important. The bank also identifies these employees' competencies as the most valuable due to the ongoing digitalisation:

- flexibility;
- ability to learn new technologies and practices;
- adaptability to new job conditions, procedures and opportunities;
- innovative mindset;
- understanding the data available and processing it.

The bank has not as yet measured the level of its employees' data competencies. The situation is complicated by the fact that the labour force in the bank is very diverse, and the level of employees' data competencies in the various departments can vary greatly. At the same time, the human resource managers working in the bank assess their data skills at 6–7 points out of 10.

To ensure continuity in internal employee training, the bank uses such digital tools and applications as Skype, OneNote, SharePoint, Google Forms and Office 365, which is still not being fully utilised. Cisco Webex is used for providing external educational activities. Microsoft Teams should replace Skype in the future, but it is currently used with very limited functionality. When there is a need to develop online services further, the bank is limited mainly by the obligation to protect client data. The security issue is connected with the longer implementation of the new digital technologies and requires a prior risk analysis. As a result, external clients will switch to Microsoft Teams earlier than internal bank employees.

Due to the current COVID-19 pandemic, the need for the employees' training in this bank remains stable, but the need to learn online is being enhanced. There was no need to heavily invest in online learning activities as the bank uses tools and technologies that have already been utilised for this purpose. The demand for internal online staff training has increased. The available internal training courses focused on how to teach employees to use various digital applications in their job effectively. In connection with this, the bank encounters the challenge of engaging employees in distance learning and keeping their attention because training in the online environment is more demanding. Developing employees' digital competencies is a priority for this bank. For this reason, the bank plans to invest at least 50% of the learning and development budget in improving digital and data competencies next year.

Digitalisation and process automation is perceived in this bank as a space for retraining and requalification of the existing workforce that is not connected with a job loss risk. Human resources managers do not have to be digital gurus but some kind of early adopters with social intelligence, empathy, openness to changes, and a mindset to learn new things. It is expected that as a result of the increasing automation of daily tasks, human resource managers at this bank will not have less work, but it will be different. Software robots are gradually taking over routine tasks that respond to simple questions or information searches. In contrast, more complex tasks such as business partnerships, advice and coaching will remain for the people.

Key findings from this case study show that it is necessary to preserve the human factor in the HR strategy of this bank. The main task of the human resource managers is not only to support senior management in making strategic decisions but also to help employees retrain and adapt to the changing nature of their work. Personalisation and use of data to a much greater extent is a priority for this bank for future years.

4. Discussion

Findings from this survey demonstrate that digitalisation is a catalyst for change and boosting innovations, automation and modernising technology systems across all industries. The financial services sector is no exception. Digital learning, both the learning of digital skills and digital technologies, is becoming crucial for getting digital literacy into the modern

workforce (Ceemet European Tech & Industry Employers, 2018). The latest research provided by The Economist Intelligence Unit among 305 global banking executives, on behalf of Temenos (2020), explored the main elements of banking digitalisation due to the necessity to deploy new technologies and reshape company culture to stay competitive in the current business environment. According to this study, 66% of the respondents believe that new technologies such as artificial intelligence (AI), machine learning, blockchain, or the Internet of Things (IoT) will continue to be key drivers for global banking for the next five years.

Cedefop's European skills and jobs survey (2014) examined the level of information communication technology (ICT) skills required to perform a job by surveying around 49,000 adult employees in all EU27 member states and the United Kingdom. This study found that only 16% of employees in financial, insurance and real estate services evaluate advanced levels of ICT skills as extremely necessary for doing their daily work routine, but 80% of them agree that basic ICT skills are essential (European Centre for the Development of Vocational Training, 2016). PwC's (2019) survey revealed that technical skills, data analytics proficiency and design thinking are among the competencies required to make digital workforce transformation in financial services successful.

The data presented in the paper confirmed that companies in the financial sector see digitalisation as important and perceive the importance of regularly developing their employees' digital competencies and should consider it a strategic aspect of their further development. Systematic implementation of training and development in the area is crucial for future success. There is no doubt that COVID-19 pandemic has made the digital transformation in the financial sector more urgent. Opportunities and threats, for which banks expected to prepare for years, have been approaching fast. Banks have to innovate, reinvent, and redefine themselves to meet these challenges (Accenture, 2020).

Undoubtedly, the research sample (i.e. 69 Czech companies), a relatively small sample size (i.e. ten large and medium-sized banks and insurance companies) and a relatively low response rate (i.e. 18.85%) are among the most important limitations of this study. Therefore findings from this survey cannot be generalised. Nevertheless the paper brings valuable and up to date information in digitalisation in banking sector. Moreover findings are also supported with the qualitative data presented in the case study of one big bank. Conducting similar research in the financial services sector in other European countries and comparing the results with the data obtained in the Czech Republic may be one of the possible directions for future research. The authors also plan to map this very topical issue from the employees' point of view and compare the perception of this issue from the perspective of all companies (not only in the financial sector) and employees. The topic gives room for further research.

Conclusion

Nowadays, many financial companies struggle with technological barriers and the lack of employees' willingness to continuous training and development at the workplace. The paper aimed to provide a theoretical framework for digitalisation and its drivers in the financial sector. It introduced the phenomenon of Banking 4.0 concerning the required competencies and identified gaps and barriers for their faster and more effective development. Findings presented in the paper showed that the need for employees' digital skills is growing, and banks and insurance companies are aware of this, thereby bringing systematic approaches supporting digital skills development to the strategic level. These institutions often pay attention to these skills while recruiting. Also, this paper's primary quantitative and qualitative data confirmed this trend in the the banking and insurance sector. It is primarily about basic data entering, processing, digital literacy but advanced data skills are also often required in the financial sector. Even though the findings presented in this paper cannot be generalised, and have the limitations mentioned above, this paper deals with a very topical issue and brings new incentives for further research. The results obtained shed light on the actual state of the digitalisation and technological development crucial today in the global financial sector.

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References

Abel-Koch, J., Al Abaidi, L., El Kasmi, S., Fernandez Acebedo, M., Morin, L., & Tapczewska, A. (2019). *Going Digital. The Challenges Facing European SMEs: European SME Survey 2019* (Research Paper). Frankfurt am Main: KfW Bankengruppe. Retrieved March 15, 2020, from https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-Studien-und-Materialien/PDF-Dateien-Paper-and-Proceedings-(EN)/European-SME-Survey-2019.pdf

Ajupov, A. A., Ahmadullina, A. A., Belyaev, R. M., & Sizova, A. I. (2019). Assessment of the Level of Development of Digital Technologies in the Banking Sector. *Helix, 9*(4), 5248–5251. https://doi.org/10.29042/2019-5248-5251

Accenture. (2020). *Banking Technology Vision 2020* (Research Report). Dublin: Accenture. Retrieved November 15, 2020, from https://www.accenture.com/us-en/insights/banking/coronavirus-technology-vision-banking-2020

Aesaert, K., Van Nijlen, D., Vanderlinde, R., & Van Braak, J. (2014). Direct Measures of Digital Information Processing and Communication Skills in Primary Education: Using Item Response Theory for the Development and Validation of an ICT Competence Scale. *Computers & Education, 76,* 168–181. https://doi.org/10.1016/j.compedu.2014.03.013

Andreou, P. C., & Anyfantaki, S. (2020). Financial Literacy and Its Influence on Internet Banking Behavior. *European Management Journal, 39*(5), 658–674. https://doi.org/10.1016/j.emj.2020.12.001

Barak, M. (2018). Are Digital Natives Open to Change? Examining Flexible Thinking and Resistance to Change. *Computers & Education, 121,* 115–123. https://doi.org/10.1016/j.compedu.2018.01.016

Bălău, N., & Utz, S. (2017). Information sharing as strategic behaviour: The role of information display, social motivation and time pressure. *Behaviour & Information Technology, 36*(6), 589–605. https://doi.org/10.1080/0144929X.2016.1267263

Bellman, M., & Göransson, G. (2019). *Intelligent Process Automation: Building the Bridge between Robotic Process Automation and Artificial Intelligence* (Master's Thesis). KTH Royal Institute of Technology, Stockholm.

Blštáková, J., Joniakova, Z., Jankelova, N., Stachová, K., & Stacho, Z. (2020). Reflection of Digitalization on Business Values: The Results of Examining Values of People Management in a Digital Age. *Sustainability, 12*(12), 5202. https://doi.org/10.3390/su12125202

Bollaert, H., Lopez-de-Silanes, F., & Schwienbacher, A. (2021). Fintech and Access to Finance. *Journal of Corporate Finance*, *68,* 101941. https://doi.org/10.1016/j.jcorpfin.2021.101941

BrainStation. (2020). *The 2020 Digital Skill Survey* (Data Survey Result). Prague: BrainStation. Retrieved June 1, 2020, from https://brainstation.io/research/digital-skills-survey-2020-results/data

Brassel, J. (2020). *Impact of the Digitalisation on the Employment Market in Banking* (Quantitative and Qualitative Analysis). Zurich, Geneva: Von Rundstedt, Arbeitgeber Banken. Retrieved November 17, 2020, from https://www.arbeitgeber-banken.ch/files/content/pdf/Brochure_Digitalisation_in_Banking.pdf

Büchi, G., Fasolo, L., Cugno, M., Yerbetto, A., & Castagnoli, R. (2019). New Banks in the 4th Industrial Revolution: A Review and Typology. In *Proceedings of the 22nd Excellence in Services International Conference* (pp. 74–96). Thessaloniki: Perrotis College.

Burgt, J. V. D. (2020). Explainable AI in Banking. *Journal of Digital Banking, 4*(4), 344–350.

Ceemet European Tech & Industry Employers. (2018). *Digitalisation and the World of Skills and Education* (Report). Brussels: Ceemet. Retrieved November 18, 2020, from https://www.ceemet.org/sites/default/files/ceemet_digitalisation_and_skills_report_spreads.pdf

Curtarelli, M., Gualtieri, V., Shater Janatti, M., & Donlevy, V. (2016). *ICT for work: Digital skills in the workplace* (Final Report). Luxemburg: Ecorys & Danish Technological Institute for the European Commission. https://doi.org/10.2759/498467

DigiSkills. (2020). *ČSOB: Banka, která jde dopředu nejen svými službami, ale také v péči o své zaměstnance [ČSOB: A bank that goes forward not only with its services, but also with the care of its employees]*. Retrieved October 26, 2020, from https://www.digiskills.cz/blog/csob-banka-ktera-jde-dopredu-nejen-svymi-sluzbami-ale-take-v-peci-o-sve-zamestnance

ECDL Foundation. (2016). *Perception and Reality: Measuring Digital Skills in Europe* (Position Paper). Retrieved April 1, 2020, from https://icdl.sharefile.com/share/view/se6434a0cd064b8d8

Ernst & Young. (2016). *Transforming Talent: The Banker of the Future. Global Banking Outlook 2016*. Retrieved November 17, 2020, from https://issuu.com/eyfsoconsulting/docs/ey-transforming-talent-the-banker-o

European Centre for the Development of Vocational Training. (2016). *The Great Divide: Digitalisation and Digital Skill Gaps in the EU Workforce* (#ESJsurvey Insight No 9). Thessaloniki: Cedefop. Retrieved November 18, 2020, from https://www.cedefop.europa.eu/files/esj_insight_9_digital_skills_final.pdf

Evdokimova, Y., Bondarenko, A., & Shinkareva, O. (2018). Digital Banks: Development Trends. In Y. Silin, Y. Animitsa, E. Dvoryadkina, & V. Blaginin (Eds.), *Proceedings of the 2nd International Scientific Conference on New Industrialization: Global, National, Regional Dimension SICNI 2018* (pp. 151–153). Paris: Atlantis Press. https://doi.org/10.2991/sicni-18.2019.30

Folea, A., & Folcut, O. (2019). Analysis of the Digital Skills in the EU Labor Market. A Case Study of the Banking Sector. *European Journal of Economics and Business Studies, 5*(2), 66–78. https://doi.org/10.26417/ejes.v5i2.p66-78

Grym, A., Koskinen, A., & Manninen, O. (2018). *Nordic Banks Go Digital*. Helsinki: Bank of Finland. Retrieved October 23, 2020, from https://www.bofbulletin.fi/en/2018/2/nordic-banks-go-digital/

Hach, W., Steger, S., & Beckert, R. (2018). *The Digitalization Race: Can Financial Service Providers Hack the Pace?* Munich: Roland Berger. Retrieved November 17, 2020, from https://www.rolandberger.com/publications/publication_pdf/roland_berger_retail_banking_survey_en.pdf

Harvey Nash & KPMG CIO. (2018). *The Transformational CIO. Harvey Nash/KPMG CIO Survey 2018. Insurance Industry Findings*. Retrieved November 18, 2020, from https://assets.kpmg/content/dam/kpmg/xx/pdf/2018/09/cio-survey-2018-insurance-sector-report.pdf

Harreis, H., Ho, T., Machado, J., Merrath, P., Rowshankish, K., & Tavakoli, A. (2017). *Living with BCBS 239* (Survey). McKinsey & Company, Institute of International Finance. Retrieved October 23, 2020, from https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Risk/Our%20Insights/Living%20with%20BCBS%20239/Living-with-BCBS-239.pdf?shouldIndex=false

Hassani, H., Huang, X., & Silva, E. (2018). Digitalisation and Big Data Mining in Banking. *Big Data and Cognitive Computing, 2*(18), 18. https://doi.org/10.3390/bdcc2030018

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2018). *Coming of age digitally: Learning, Leadership, and Legacy* (MIT Sloan Management Review). Deloitte University Press. Retrieved April 10, 2020, from https://www2.deloitte.com/us/en/insights/focus/digital-maturity/coming-of-age-digitally-learning-leadership-legacy.html

Kaur, N., Sahdev, S. L., Sharma, M., & Siddiqui, L. (2020). Banking 4.0: The Influence of Artificial Intelligence on the Banking Industry & How AI is Changing the Face of Modern Day Banks. *International Journal of Management, 11*(6), 577–585. https://doi.org/10.34218/IJM.11.6.2020.049

Lingga, I. S. (2020). Analyzing the Importance of User Competency to the Effectiveness of Accounting Information System in Banking Sector. In A. H. Prasetyo (Ed.), *Proceedings of the 3rd Asia Pacific Management Research Conference APMRC 2019* (pp. 117–122). Paris: Atlantis Press. https://doi.org/10.2991/aebmr.k.200812.021

Malhotra, R., & Mistry, S. (2015). *The Insurance Workforce of the Future: Why Will so Many Insurers Fail to Achieve Their Digital Potential*. Sydney: Accenture Strategy. Retrieved November 18, 2020, from https://www.accenture.com/t00010101t000000__w__/de-de/_acnmedia/pdf-6/accenture-insurance-workforce-of-the-future-final.pdf

Mehdiabadi, A., Tabatabeinasab, M., Spulbar, C., Karbassi Yazdi, A., & Birau, R. (2020). Are We Ready for a Challenge of Banks 4.0? Designing a Roadmap for Banking Systems in Industry 4.0. *International Journal of Financial Studies, 8*(2), 328. https://doi.org/10.3390/ijfs8020032

Mekinjić, B. (2019). The Impact of Industry 4.0 on the Transformation of the Banking Sector. *Journal of Contemporary Economics, 1*(1), 7–28. https://doi.org/10.7251/JOCE1901006M

Menshikova, M., Romolini, A., Sabbatelli, I., & De Marco, M. (2017). The Role of Digital Tools and Platforms for Training Programmes Developed by the Organisations of the Banking Sector. In S. Za, M. Drăgoicea, & M. Cavallari (Eds.), *Proceedings of the 8th International Conference Exploring Service Science IESS 2017* (pp. 309–322). Cham: Springer. https://doi.org/10.1007/978-3-319-56925-3_25

Niemand, T., Rigtering, J. P. C., Kallmünzer, A., Kraus, S., & Maalaoui, A. (2020). Digitalization in the Financial Industry: A Contingency Approach of Entrepreneurial Orientation and Strategic Vision on Digitalization. *European Management Journal, 39*(3), 317–326. https://doi.org/10.1016/j.emj.2020.04.008

Oberländer, M., Beinicke, A., & Bipp, T. (2020). Digital Competencies: A Review of the Literature and Applications in the Workplace. *Computers & Education, 146,* 103752. https://doi.org/10.1016/j.compedu.2019.103752

O'Loughlin, M., Pareek, S., O'Connor, B., Duffield, G., & Glynn, N. (2019). *CCC Global Digital Skill Survey 2019.* Palo Alto: Cloud Credential Council. Retrieved April 17, 2020, from https://www.cloudcredential.org/blog/the-ccc-global-digital-skills-survey-2019-report-is-out/

Orgeldinger, J. (2018). The Implementation of Basel Committee BCBS 239: Short Analysis of the New Rules for Data Management. *Journal of Central Banking Theory and Practice, 7*(3), 57–72. https://doi.org/10.2478/jcbtp-2018-0023

Oxford Economics & SAP Success Factors. (2017). *Digital Leadership in Financial Services*. Retrieved November 17, 2020, from https://www.oxfordeconomics.com/publication/open/272816

PwC Financial Services. (2018). *PwC's 2018 Digital Banking Consumer Survey: Mobile Users Set the Agenda*. Retrieved October 20, 2020, from https://www.pwc.com/us/en/financial-services/publications/assets/pwc-fsi-whitepaper-digital-banking-consumer-survey.pdf

PwC. (2019). *Fit to Compete: Accelerating Digital Workforce Transformation in Financial Services*. Retrieved November 17, 2020, from https://www.pwc.com/gx/en/issues/upskilling/pwc-digital-upskilling.pdf

Rathi Meena, M., & Parimalarani, G. (2020). Impact of Digital Transformation on Employment in Banking Sector. *International Journal of Scientific & Technology Research, 9*(1), 4912–4916.

Ryzhkova, M., Soboleva, E., Sazonova, A., & Chikov, M. (2020). Consumers' Perception of Artificial Intelligence in Banking Sector. In A. Vankevich, & T. Ilina (Eds.), *Proceedings of the 17th International Conference of Students and Young Scientists "Prospects of Fundamental Sciences Development"* (pp. 1–9). *SHS Web of Conferences, 80,* 01019. https://doi.org/10.1051/shsconf/20208001019

Shook, E. I., Knickrehm, M. A., Costonis, M., Woolf, A., & Lavelle, K. (2018a). *Future Workforce Survey – Insurance Realizing the Full Value of AI.* Dublin: Accenture. Retrieved November 18, 2020, from https://www.accenture.com/_acnmedia/pdf-79/accenture-insurance-report-ai-future-workforce-survey.pdf

Shook, E. I., Knickrehm, M. A., Mcintyre, A., Woolf, A., Browne, H., & Lavelle, K. (2018b). *Future Workforce Survey – Banking Realizing the Full Value of AI.* Dublin: Accenture. Retrieved November 17, 2020, from https://www.accenture.com/_acnmedia/PDF-77/Accenture-Workforce-Banking-Survey-Report#:~:text=The%20workforce%20of%20the%20future,by%2014%20percent%20by%202022.

Smirnova, A. M., Zaychenko, I. M., & Bagaeva, I. V. (2019). Formation of Requirements for Human Resources in the Conditions of Digital Transformation of Business. In I. V. Ilin (Ed.), *Proceedings of the International Conference on Digital Technologies in Logistics and Infrastructure ICDTLI 2019* (pp. 280–285). Paris: Atlantis Press. https://doi.org/10.2991/icdtli-19.2019.50

Starkey, L. (2011). Evaluating Learning in the 21st Century: A Digital Age Learning Matrix. *Technology, Pedagogy and Education, 20*(1), 19–39. https://doi.org/10.1080/1475939X.2011.554021

Stentoft, J., & Rajkumar, C. (2020). The Relevance for Industry 4.0 and Its Relationship with Moving Manufacturing Out, Back and Staying at Home. *International Journal of Production Research, 58*(10), 2953–2973. https://doi.org/10.1080/00207543.2019.1660823

Tao, R., Su, C.-W., Xiao, Y., Dai, K., & Khalid, F. (2021). Robo Advisors, Algorithmic Trading and Investment Management: Wonders of Fourth Industrial Revolution in Financial Markets. *Technological Forecasting and Social Change, 163,* 120421. https://doi.org/10.1016/j.techfore.2020.120421

The Economist Intelligence Unit. (2020). *Forging New Frontiers: Advanced Technologies Will Revolutionise Banking*. Retrieved November 18, 2020, from https://www.temenos.com/wp-content/uploads/2020/05/EIU-2020-report-2020-May-27.pdf

Thun, C. (2015). *AnaCredit Gives Banks an Opportunity to Improve Data Management, but Challenges Remain* (Whitepaper SP35631/101215/ind -104A). New York, NY:

Moody's Analytics. Retrieved October 23, 2020, from https://www.moodysanalytics.com/-/media/whitepaper/2015/2015-01-07-anacredit-gives-banks-an-opportunity-to-improve-data-management-but-challenges-remain.pdf

Trias Pinto, C., & Gendre, P. (2016*). Digitalisation and innovative business models in the European financial sector, impact on employment and customers (own-initiative opinion)* (Report No. CCMI/147-EESC-2016). Bruxelles: European Economic and Social Committee. Retrieved November 18, 2020, from https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/digitalisation-and-innovative-business-models-european-financial-sector-impact-employment-and-customers-own-initiative

Van Laar, E., Van Deursen, A. J. A. M., Van Dijk, J. A. G. M., & De Haan, J. (2020). Measuring the Levels of 21st-Century Digital Skills among Professionals Working within the Creative Industries: A Performance-Based Approach. *Poetics, 81,* 101434. https://doi.org/10.1016/j.poetic.2020.101434

Vijai, C., Suriyalakshmi, S. M., & Elayaraja, M. (2020). The Future of Robotic Process Automation (RPA) in the Banking Sector for Better Customer Experience. *Shanlax International Journal of Commerce, 8*(2), 61–65. https://doi.org/10.34293/commerce.v8i2.1709

Votintseva, L., Andreeva, M., Kovalenin, I., & Votintsev, R. (2019). Digital Transformation of Russian Banking Institutions: Assessments and Prospects. In *Proceedings of the 2nd International Scientific Conference on Digital Transformation on Manufacturing, Infrastructure and Service DTMIS 2018* (pp. 1–6). Bristol: Institute of Physics Publishing. https://doi.org//10.1088/1757-899X/497/1/012101

Willis Towers Watson. (2017). *Czech insurance market in 2020: Are you ready for the digital revolution?* (Report). London: Willis Towers Watson. Retrieved November 22, 2020, from https://www.willistowerswatson.com/-/media/WTW/Insights/2017/03/Czech-insurance-market-in-2020.pdf?modified=20170330161520