

CHALLENGES OF THE SMES IN THE 21ST CENTURY

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Purpose: This study aims to identify the challenges, difficulties and opportunities for the SME sector in the Visegrad Group (V4) countries in the 21st century in the area of innovation and development, in particular digitalization. This research is justified by the prominent economic role of the SME sector and the key importance of adapting to the rapid pace of digitalization.

Design/methodology/approach A literature review on this topic was used for the research, based on the Web of Science database. The scope of articles included in the survey was limited to peer-reviewed journal articles in English and published up to 2021. The process of selecting suitable studies for the search consisted of several steps, each of which aimed to include or exclude articles based on predefined criteria.

Findings: The literature review has revealed significant gaps in the subject area. One of these is the lack of research on SMEs in the V4 countries. Another gap is the study of the relationship between SMEs and cloud computing from a computer science perspective, but other areas, not including the economic area, are less studied.

Research limitations/implications: The limitations of the research include the database on which the study is based, the volume of the database and the criteria for the articles included in the study.

Social implications: The study provides an overview for academics of who is working on the topic, from what aspect research has been done so far, and the links between publications. However, it may also be of interest to professionals interested in the subject area, if they want to see what areas are worth addressing, taking into account or just want to get a more comprehensive picture of the V4 SMEs in relation to digitalization.

Originality/value: The importance of the study lies in the fact that it sheds light on the unanswered questions in the field and on the areas that have been little or not at all investigated by researchers. It can be used as a guideline for future studies in the field of cloud computing adoption by SMEs.

Keywords: challenges, digitalization, SMEs, literature review.

Category of the paper: Research paper.

1. Introduction

Today, information and communications technology (ICT), in particular the internet and embedded systems technologies, are evolving rapidly, giving rise to a range of new technologies such as cyber-physical systems, the internet of things, cloud computing and big data analytics (Liu, Xu, 2017), but also manufacturing automation (Miśkiewicz, Wolniak, 2020) and 3D printing.

For businesses - not just SMEs - to succeed, the industrial revolution known as Industry 4.0, based on the use of cyber-physical systems, must be a success. In order to successfully adopt and implement new technologies, companies must first address the factors that will facilitate Industry 4.0 (Cieciora et al., 2020). For example, human resources, ICT, economic and financial factors and risks (Stock, Seliger, 2016; Tokarčík et al., 2021). Industry 4.0 has also brought with it cloud-based services, which are growing in popularity among businesses and individuals. However, implementing Industry 4.0 may reveal several challenges, such as a lack of computer/IT/digital skills, which is one of the most pressing concerns (Wielki, 2017). Digital transformation is not only increasing the range of skills and competences required, but also the knowledge associated with them, as the use of new tools affects the form and way of working at all levels of the business (Gajdzik, Grebski, 2022).

The concept of cloud computing (CC) has emerged in recent years as a dynamic response to the challenges associated with shrinking IT financial resources and expanding IT requirements (Dincă et al., 2019).

On-demand self-service, broad network access, resource pooling, quick elasticity, and measurable service are the five main characteristics of cloud computing (National Institute of Standards and Technology's, 2011) that give the greatest benefits. For SMEs, cloud computing offers to bring tangible business benefits at a cheaper cost because they only pay for the resources they require, allowing them to get a decent return on their limited resources (Moeuf et al., 2017). Furthermore, SMEs can benefit from adopting CC, for example by being more responsive to business requirements and gaining global access (Avram, 2014), and also gain a competitive advantage (Luo et al., 2018).

Small- and medium-sized enterprises (SMEs) are the engine of the European Union (EU), with more than 20 million SMEs operating in the EU (Clark, 2021b), providing jobs for nearly 84 million people (Clark, 2021a). Their contribution to GDP averages around 50% (Clark, 2021b). Recognising the importance of these enterprises, the EU launches from time to time a number of initiatives and programmes to help SMEs compete (European Commission, 2022).

The SME sector is facing number of challenges (e.g. generational change, inflexible corporate governance, digitalisation) which are often not addressed by the programmes designed to support them.

In this context, the following question arises: How do articles related to the application of cloud services by SMEs in the Visegrad Group (V4) countries appear in the literature?

The relevance of the study is that it deals with a topical issue regarding the take-up of cloud services, as their application offers many opportunities and benefits, and is justified by the prominent role of SMEs.

Aim of the study:

- a) A review of the literature related to the V4 countries regarding the adoption of cloud services by SMEs, which will allow us to identify the different aspects, and
- b) to establish a literature framework as a starting point for the widest possible adoption of cloud-based services, given the rapid pace of digitization and the increasing adoption of cloud-based services, which is the direction in which many economies will increasingly shift in the future.

The study is divided into 4 main sections, which are as follows: section 1 describes the situation of SMEs in general and in the V4 countries; section 2 describes the research methodology used in this study. Section 3 presents the results of the bibliometric survey; finally, section 4 is the conclusions.

2. Small- and medium-sized enterprises (SMEs)

The SME sector is of great importance worldwide, whether in developing countries or the European Union (EU), as is demonstrated by the fact that the SME sector makes up the vast majority of businesses worldwide, providing millions of jobs and contributing significantly to economic growth (International Labour Organisation, 2019). According to the OECD (2019) study, while SMEs lag behind large companies in terms of innovation, they play an important role in innovation, especially start-ups, and are also active in major innovation breakthroughs. SMEs are also of practical importance in the sense that a large proportion of them are family-owned (European Commission, 2021d), which results in marked differences in management and operations compared to non-family-owned businesses (Steinerowska-Streb, 2021).

Table 1.
Share of SMEs in V4 countries

	EU	Czech Republic	Hungary	Poland	Slovakia
Number of enterprises	22,567,300	1,026,907	582,917	1,732,623	475,229
SMEs in Total Enterprises (%)	99,8	99,8	99,8	99,8	99,9
Total employment (%)	65,2	66,4	68,3	67,1	72,7
SMEs' employment	83,397,941	2,501,184	1,899,936	6,125,825	1,183,736
DESI score	50,7	47,4	41,2	41	43,2
Skills & innovation	-	below the EU average	well below the EU average	well below the EU average	well below the EU average
Performance of EU Member States' innovation systems	-	Moderate Innovator	Emerging Innovators	Emerging Innovators	Emerging Innovators

Source: (European Commission, 2021a, 2021b, 2021c, 2021d, 2021f, 2021g, 2021h).

Based on European Commission data, SMEs account for a significant portion of total firms in the countries listed in Table 3. SMEs have a vital role in producing jobs and enabling a competitive environment in V4 countries. It can be seen that the SME sector is clearly the basis of the economy in the V4 countries, with a share of SMEs above 95% in all the countries surveyed. The last row of the table shows the innovativeness of the countries compared to the EU average. The Czech Republic is the best performer in terms of innovation, as although it is below the EU innovation average, it is still far ahead of the V4 countries in this area, mainly due to its higher use of ICT technology.

In the context of innovation, CC technologies should also be mentioned, as research conducted in EU countries shows that CC adoption and deployment rates by enterprises are low (41%). It is also worth noting that the deployment rates of cloud services vary significantly not only across countries but also across economic sectors within a given country (Eurostat, 2021). As digitalization plays an important role in innovation, the Digital Economy and Society Index (DESI) scores are included in the table. The DESI scores show that all four countries underperform in digitalization, with the Czech Republic (47,4) being closest to the EU average (50,7) and rising above the V4 (European Commission, 2021a).

3. Cloud computing

Cloud computing (CC) or cloud-based service is transforming the way organizations and industries operate. Access to business-relevant data and analytics will not only help organizations gain a competitive advantage but will also become critical to their survival as cloud usage increases (Xu, 2012).

Cloud computing has been a widely studied topic in both industry and academia (Bayramusta, Nasir, 2016). The economical, scalable and anytime, anywhere features of shared resources are just some of the features that have fostered and increased interest in the technology (Abbas et al., 2015; Orehovački et al., 2018). Other advantages of CC technology include the fact that resources are made available to users and are released from the shared resource on demand (Abdalla, Varol, 2019). On-demand resource provisioning ensures optimal allocation of resources and it is cost-effective (Prasad, Rao, 2014). Users are thus relieved from investing heavily in IT infrastructure (National Institute of Standards and Technology's, 2011), as they use the resources provided by the cloud service provider and pay as they use them. On the other hand, cloud service providers can lease the freed resources to other users after an agreement with the user. Another advantage of cloud computing is the ease of use, as customers do not need to have high expertise in cloud services technology, as the management of technology and services is transferred from the user to the service provider (Hayes, 2008).

Cloud-based services are usually categorized in two ways, firstly by what the service covers and secondly by the model within which the user uses the service. These can be based on whether the CC is private, public, community or hybrid, or whether the user chooses to use the software (SaaS), the platform (PaaS) or the infrastructure as a service (IaaS) (Rittinghouse, Ransome, 2017).

4. Methodology

We used the Web of Science database for the bibliometric search to examine the terms related to the difficulties, challenges, advantages and disadvantages of adopting cloud services for SMEs in the title, abstract and keywords of the article. The research query yielded 1150 hits. The database was searched using the following Boolean expression: “sme cloud adopt* (Topic) or sme cloud challenge* (Topic) or sme cloud *advantage* (Topic) or sme cloud barrier* (Topic) and sme* visegrad group (Topic) or sme* v4 (Topic) or small- and medium-sized enterprise* (Topic) and English (Languages) and Slovakia OR Poland OR Hungary OR Czech Republic (Countries/Regions)”. No time range option was used in the database search, thus the articles included in the search are dated by their Web of Science results according to their publication date between 1995 and 2021.

The data were analyzed using VOSviewer software. The VOSviewer is free software and it can be used to create a bibliometric map of authors based on co-citation or keywords based on co-occurrence information (van Eck, Waltman, 2010).

The aim of the research was to identify the factors influencing the shift of SMEs towards cloud services. The main topics of the selected articles are presented in order to provide a more detailed view of the literature on cloud computing adoption by SMEs. The results of this research are presented below, highlighting the identified limiting and facilitating factors and the main points observed concerning them.

5. Results

The bibliometric search using the Web of Science (WOS) database of terms related to the difficulties, challenges, advantages and disadvantages of adopting cloud services for SMEs in the title, abstract and keywords of the article, yielded 1150 hits.

5.1. Analysis

Figure 1 shows the distribution of the papers over time. The first paper was published on this topic in 1995. However, the interest in the topic started in the early 2010s, and between 2011 and 2018 the number of studies published on the topic has relatively multiplied.

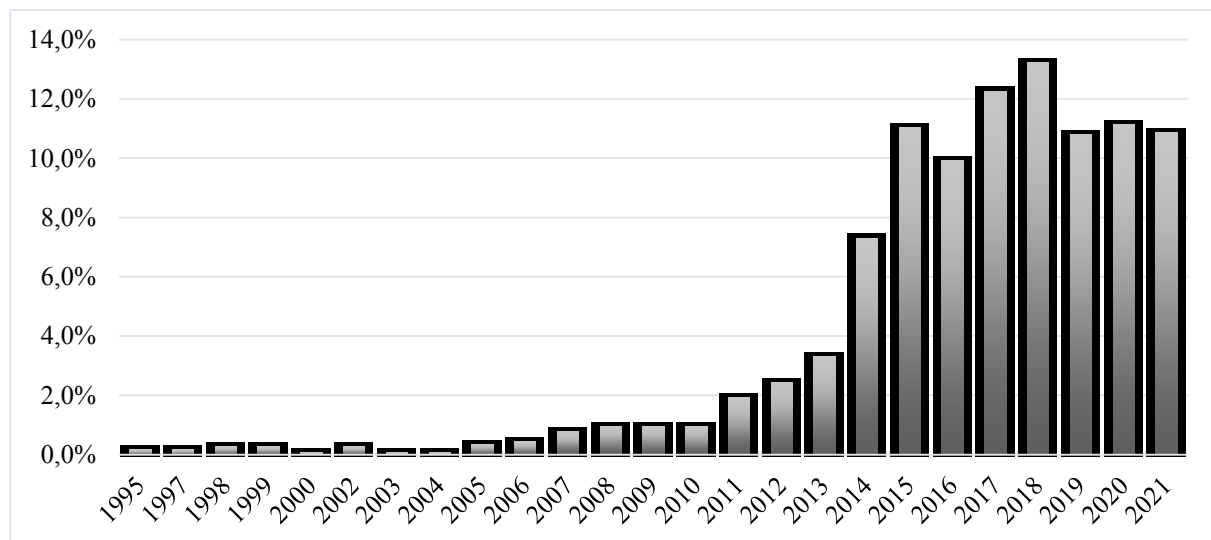


Figure 1. Publication by year between 1995-2021.

Source: Prepared by researcher based on WOS database.

Figure 2 shows that most SME CC adopting papers are published in WOS Categories of Economic (41,9%), Business (31,1%) and Management (30,3%). Surprisingly, besides the economic and financial aspects, the publications representing the IT area are far behind, although the technological aspect could justify a higher proportion of publications on the subject.

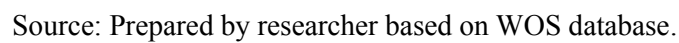


Figure 3 shows the results of the analysis applied to the keywords of the publications included in the research. The threshold we set for the analysis was that a keyword should occur at least 5 times, and 138 items met this criterion, from which VOSviewer created 13 clusters, each cluster being marked with a different color. The lines between the circles mean the links between them and the closer the circles, the stronger the link between them. As expected, SME/SMEs and Small- and medium-sized enterprises are the most frequent and most prominent terms (bigger circle means more frequent mentioning), but innovation, competitiveness, COVID and risk management also stand out. In terms of clusters, the blue, yellow, light blue and purple clusters stand out as the most prominent, proving to be the most powerful and closely related.

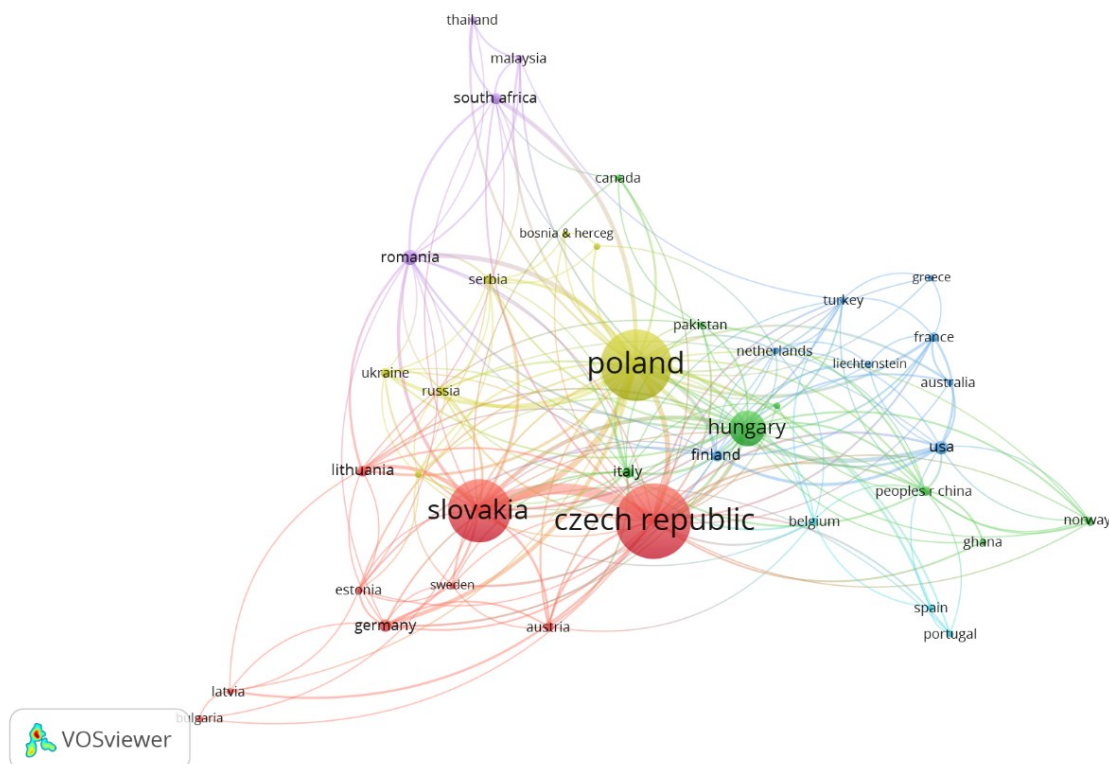


Figure 4. Main clusters co-authorship by countries.

Source: Prepared by researcher based on WOS database.

Figure 4 shows the co-authored countries in at least 2 publications. The figure shows 40 countries in 6 clusters, with 210 connections between them. It can be seen that the collaboration between the Czech Republic and Slovakia is significant, with several joint publications and a cluster. However, it can also be seen that Poland and Hungary have a smaller share of joint publications. Furthermore, while Poland is relatively close to Slovakia and the Czech Republic, Hungary appears almost isolated in terms of clusters. The latter may also be due to the small number of publications attributed to the few Hungarian authors included in the study. It is also interesting to note that Slovakia and the Czech Republic co-publish with researchers from many countries, including Germany, Bulgaria, South Africa and even China, and are almost linked to all parts of the world. Meanwhile, Hungary shows a similarly broad international cooperation, but the connectivity between the V4 is below expectations.

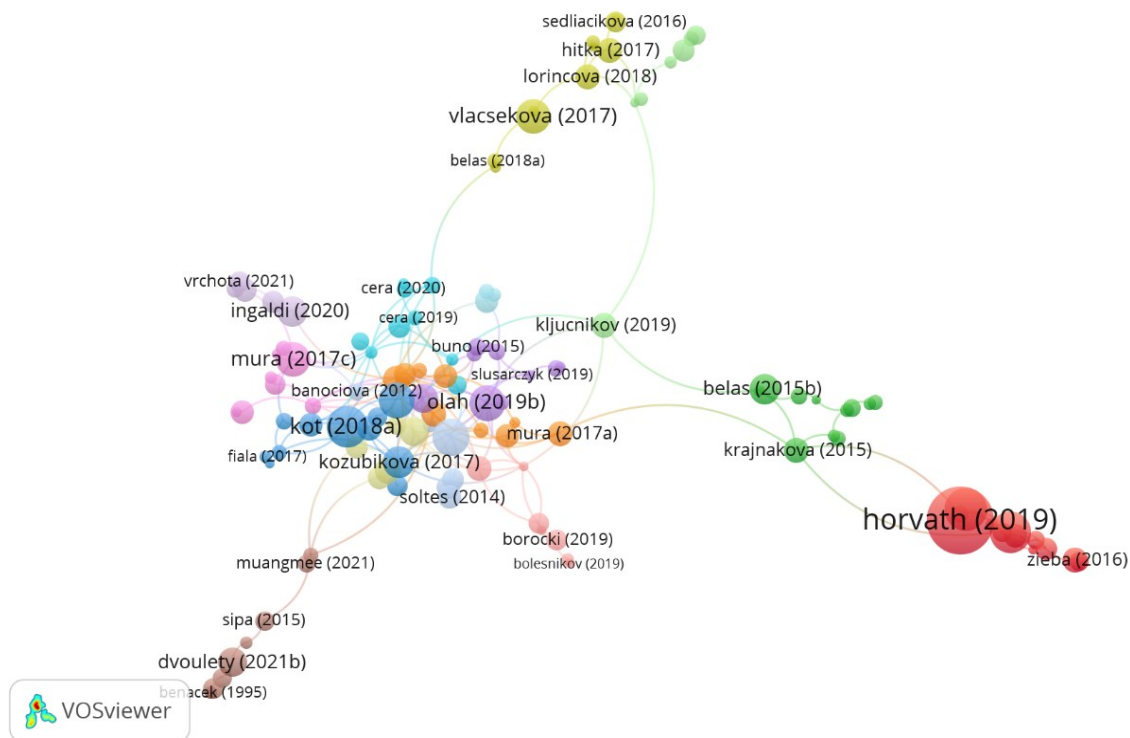


Figure 5. Citation by documents.

Source: Prepared by researcher based on WOS database.

Figure 5 shows the most cited publications and how they relate to the other publications included in the study. A threshold has also been set here to show only those studies that have been cited at least 5 times by others. This applied to 309 of the 1150 studies, but only 121 of these were closely related. As shown in the figure, one of the most cited publications (11) is by Horváth and Szabó (2019), but it can be seen that it is relatively distinct from the other studies. This is also due to the fact that this study focuses more on the implementation of Industry 4.0 and less on cloud services. This is followed by the studies by Belás and colleagues (2015), and Kozubíková and colleagues (2017) with 10-10 links. Also worth mentioning for its central role (Kot, 2018) with 6 links.

Table 2.

Top 10 most cited publications in the analysis

Authors	Publication title	Cited by	Keywords
Horváth and Szabó (2019)	Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities?	207	Industry 4.0; Digital strategy; Management functions; Lean; Qualitative; Supply chain
Laukkanen et al. (2013)	The effect of strategic orientations on business performance in SMEs A multigroup analysis comparing Hungary and Finland	88	Finland; Growth; Business performance; Hungary; Small-to-medium-sized enterprises; Strategic orientation
Haseeb, Hussain, Ślusarczyk, et al. (2019)	Industry 4.0: A Solution towards Technology Challenges of Sustainable Business Performance	80	Industry 4; 0; big data; business performance; IoT; smart factory; SMEs

Cont. table 2.

Kot (2018)	Sustainable Supply Chain Management in Small and Medium Enterprises	78	Innovativeness; IT capability; Employee empowerment; Firm performance; Poland; Small to medium-sized enterprises; Information technology
Kmieciak et al. (2012)	Innovativeness, empowerment and IT capability: evidence from SMEs	75	small and medium enterprises; supply chain; sustainability
Belás et al. (2015)	The Business Environment of Small and Medium Enterprises in selected Regions of the Czech Republic and Slovakia	62	Small and medium-sized enterprises; business environment; motives for business; business risks; SMEs in society; business optimism
Haseeb, Hussain, Kot, et al. (2019)	Role of Social and Technological Challenges in Achieving a Sustainable Competitive Advantage and Sustainable Business Performance	57	entrepreneurs; economic risk; financial risk; SMEs; source of risk
Oláh et al. (2019)	Analysis and Comparison of Economic and Financial Risk Sources in SMEs of the Visegrad Group and Serbia	57	social challenges; technological challenges; strategy alignment; competitive advantage; sustainable business performance
Mura and Vlacsekova (2017)	Effect of motivational tools on employee satisfaction in small and medium enterprises	53	motivation; motivation factors; motivational tools; small and medium-sized enterprises; Slovakia
Mura et al. (2017)	Development Trends in Human Resource Management in Small and Medium Enterprises in the Visegrad Group	52	human resource management; small and medium enterprises; development and trends in human resource management; Visegrad Group

Source: Prepared by researcher based on WOS database.

Table 2 shows which are the 10 most cited. As shown in the table, the most cited publication is Horváth and Szabó (2019), which is cited in 207 papers, but it can be seen that it is relatively distinct from the other studies. This is followed by a study by Laukkanen and colleagues with 85 citations from 2013. In last place is research by Mura and colleagues (2017), which has been cited 52 times since its publication.

Table 3.

Challenges/barriers/(dis)advantages of cloud computing adoption

Barriers - Difficulties	Risk
economic - financial	Risk of a security breach
cultural	Problems accessing data or software
technical	Difficulties in unsubscribing or changing service provider
legal	Uncertainty about the location of the data
implementation	High cost of buying CC services
competencies/resources	Insufficient knowledge of CC
	low risk-taking propensity, tradition
	Uncertainty about applicable law, jurisdiction, dispute resolution mechanism

Source: Prepared by researcher based on WOS database.

Table 3 summarises the barriers, difficulties and risks found in the literature that SMEs face when adopting cloud computing. The first column of the table summarises the barriers in 6 groups of factors. The idea of grouping barriers and difficulties in this way is taken from the research carried out by Orzes et al. (2018), as well as from the literature on Industry 4.0. The economic-financial group includes factors such as financial resources and profitability,

keeping the costs at a reasonable level - cost cutting, lack of clearly defined economic benefits and tax incentives, finance planning (risk management and efficiency), and high cost of acquiring specialists, difficulties in obtaining a loan.

The legal factors are legal jurisdiction, legal data security concerns and lack of standards and uncertainty about the reliability of the systems. The competencies/resources group includes factors such as lack of evaluation of usefulness, lack of qualified staff, the resistance of employees, lack of employee training, continuous staff rotation, ignorance of its capabilities and lack of knowledge regarding cloud computing options.

The technical difficulties include slow internet connection, difficult interoperability/compatibility, security and data protection, technical issues (data management, data extraction, portability), dependence on the operation of the Internet connection and weak IT infrastructure. Implementation problems included high coordination effort, need to find a suitable research partner, change control, ownership and customization and lack of methodical approach for implementation.

And the cultural difficulties of cloud-based services include companies do not feel the need to introduce this technology, disagreement regarding the benefits of the leadership, lack of trust, low risk-taking attitude of family-owned SMEs, no need for new business models, no management preparation, and lack of supportive functional structure of the organization, managers also do not feel the necessity to change the state of the IT department, lack of local support factors were listed.

Table 4.
Contributing factors to implement cloud computing

	Contributes to implementing
Cultural	organization structure and process
	generation-change
	innovativeness
	trust for IT artefacts
Technical	IoT technology, IT capability
	privacy
	safety
	reliability of CC
	usefulness, functionality, convenience
Competencies/resources	the managers' know-how on cloud computing
	the knowledge and skills needed to apply CC
Economic - financial	cost reduction
	investments in innovation
	perceived costs of implementing the technology

Source: Prepared by researcher based on WOS database.

Table 4 presents the factors that facilitate the implementation of cloud computing and groups them according to the principle of barriers and difficulties. The publications reviewed show that, in cultural terms, the ability and willingness of a company to innovate, its attitude towards IT tools, and its confidence, but also its corporate operations, have a major impact on the adoption and diffusion of cloud computing. The attitude of managers and executives also

contributes significantly to the uptake of CC technology, as a supportive climate can help to increase the willingness to innovate and adapt quickly to market needs. The uptake of CC services by SMEs is facilitated by technical factors such as the IT infrastructure of the company, the availability of CC in the region or country, but also the perception of the technology or service in terms of functionality, utility and usability. In connection with this, the economic and financial aspects show the financial benefits of using the cloud-computing and the financial outlay that can be made.

6. Research gap(s) in the literature of V4 SMEs

In conducting the literature review, several observations and findings were made based on studies on the trends, attitudes and circumstances of SMEs in the V4 countries in the cloud services sector. These are:

- the literature on cloud services is still relatively new, so there are still many open questions,
- there is little focus on the V4 countries as a whole as a target group, although there is not much research on the individual members of the group or on comparing them with each other,
- similar situation for SMEs in the V4 countries,

Furthermore, most of the research is a literature review or quantitative research, with a low number of qualitative studies on the topic.

In addition, characteristics specific to family-owned and SMEs, such as difficulties of generational change, innovation gap vs low risk-taking behavior of SMEs as family businesses.

7. Conclusion

Our present research was triggered by the aforementioned points, which resulted in the identification of both the factors that discourage SMEs from opening up to cloud services and the factors that contribute to the adoption of CC. This paper has identified key gaps in the SME and cloud computing implementing literature, specifically considering the Visegrad Group.

The paper includes presented several key findings:

- there is a lot of potential in understanding, deploying and testing cloud services, with the market value of cloud services exceeding USD 350 billion in 2021 and forecast to grow further to 2030 (Varghese, Buyya, 2018; GVR, 2022),

- the low level of digitalisation and innovation disparities in the V4 countries is a significant barrier to the adoption of CC technology (European Commission, 2021c, 2021b),
- CC is a multidisciplinary topic due to the nature of CC technology, but publications in the economic field are predominant.

Innovation, and the willingness to innovate, also fosters competitiveness, which is essential for companies to succeed (Saunila, 2020). Small and medium-sized businesses (SMEs) are an expanding market for cloud providers since they are considered the engine of the economy. SMEs make up the majority of a developing country's business businesses. Since a result, this research has important implications for cloud providers and technology practitioners, as it will help them recognise the elements that influence cloud adoption. The results of the research indicate that the benefits of cloud computing still outweigh the difficulties associated with its adaptation. The perceived risks and the existence of different types of cloud services mostly negatively affect the adoption of cloud computing by SMEs, and the legal aspects of the service raise similarly more questions than might be expected. Cloud computing is a new technology that is still being labelled disruptive. SMEs, particularly in V4, are mostly unaware of the benefits of using cloud services. As a result, cloud providers should take a variety of steps to raise awareness of the technology's benefits. When creating cloud services for SMEs, they should focus on useful utilities and user-friendly interfaces so that consumers with low technological understanding may readily use them. Furthermore, cloud providers must provide a clear instruction or navigation system to help users in SMEs through the smooth operation of the services, increasing their confidence in cloud technology. However, in addition to the design of the software and the service, education and the right digital skills are also important, as we have already mentioned.

7.1. Limitations and future directions

As a suggestion for the future of research, a similar study involving other databases, such as ScienceDirect and Scopus, could provide further insights on the topic and provide additional insights to help us identify the drivers for the adoption and use of cloud services and to overcome barriers. Furthermore, it may be worthwhile to carry out a similar study, possibly extended to the European Union.

A major limitation of the study is that it was not possible to obtain a general classification in relation to other databases, as data for the bibliometric method in this study were only obtained from one database (Web of Science).

References

1. Abbas, A., Bilal, K., Zhang, L., Khan, S.U. (2015). A cloud based health insurance plan recommendation system: A user centered approach. *Future Generation Computer Systems*, 43-44: 99-109. doi:10.1016/j.future.2014.08.010.
2. Abdalla, P.A., Varol, A. (2019). *Advantages to Disadvantages of Cloud Computing for Small-Sized Business*. 7th International Symposium on Digital Forensics and Security (ISDFS). IEEE, pp. 1-6.
3. Avram, M G. (2014). Advantages and Challenges of Adopting Cloud Computing from an Enterprise Perspective. *Procedia Technology*, 12, 529-534. doi:10.1016/j.protcy.2013.12.525.
4. Bayramusta, M., Nasir, V.A. (2016). A fad or future of IT?: A comprehensive literature review on the cloud computing research. *International Journal of Information Management*, 36(4), 635-644. doi:10.1016/j.ijinfomgt.2016.04.006.
5. Belás, J., Demjan, V., Habánik, J., Hudáková, M., Sipko, J. (2015). The business environment of small and medium-sized enterprises in selected regions of the Czech Republic and Slovakia. *E+M Ekonomie a Management*, 18(1), 95-110. doi:10.15240/tul/001/2015-1-008.
6. Cieciora, M., Bołkunow, W., Gago, P., Rzeźnik-Knotek, M. (2020). Critical success factors of ERP/CRM implementation in SMEs in Poland: pilot study. *Scientific Papers of Silesian University of Technology – Organization and Management Series*, 148, 103-116. doi:10.29119/1641-3466.2020.148.7.
7. Clark, D. (2021a). *Number of people employed by small and medium-sized enterprises (SMEs) in the European Union (EU27) from 2008 to 2021, by enterprise size*. Retrieved from <https://www.statista.com/statistics/936845/employment-by-smes-in-european-union/>, 2.04.2022.
8. Clark, D. (2021b). *Number of small and medium-sized enterprises (SMEs) in the European Union (EU27) from 2008 to 2021, by size*. Retrieved from <https://www.statista.com/statistics/878412/number-of-smes-in-europe-by-size/>, 2.04.2022.
9. Dincă, V.M., Dima, A.M., Rozsa, Z. (2019). Determinants of Cloud Computing Adoption by Romanian Smes in the Digital Economy. *Journal of Business Economics and Management*, 20(4), 798-820. doi:10.3846/jbem.2019.9856.
10. European Commission (2021a). *The Digital Economy and Society Index (DESI)*. Retrieved from <https://digital-strategy.ec.europa.eu/en/policies/desi>, 15.05.2022.
11. European Commission (2021b). *EIS 2021 Executive summary (EN)*. Retrieved from <https://ec.europa.eu/docsroom/documents/46411/attachments/1/translations/en/renditions/native>, 15.05.2022.

12. European Commission (2021c). *EU27 - SME Fact Sheet 2021*. Retrieved from <https://ec.europa.eu/docsroom/documents/46060>, 15.05.2022.
13. European Commission (2021d). *Family business*. Retrieved from https://single-market-economy.ec.europa.eu/smes/supporting-entrepreneurship/family-business_en, 25.08.2022.
14. European Commission (2022). *Entrepreneurship and small and medium-sized enterprises (SMEs)*. Retrieved from https://ec.europa.eu/growth/smes_enhttps://ec.europa.eu/growth/smes_en, 12.04.2022.
15. Eurostat (2021). *Cloud computing - statistics on the use by enterprises*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Cloud_computing_-_statistics_on_the_use_by_enterprises, 15.05.2022.
16. Gajdzik, B., Grebski, M. (2022). Human factor in Industry 4.0: about skills of operators in steelworks 4.0. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 157, 119-132. doi:<http://dx.doi.org/10.29119/1641-3466.2022.157.7>.
17. GVR (2022). *Cloud Computing Market Size, Share & Trends Analysis Report*. Retrieved from https://www.grandviewresearch.com/industry-analysis/cloud-computing-industry?utm_source=prnewswire&utm_medium=referral&utm_campaign=ict_01-sep-21&utm_term=cloud-computing-market&utm_content=rd1, 15.05.2022.
18. Haseeb, M., Hussain, H.I., Kot, S., Androniceanu, A., Jermisittiparsert, K. (2019). Role of Social and Technological Challenges in Achieving a Sustainable Competitive Advantage and Sustainable Business Performance. *Sustainability*, 11(14), 3811. doi:10.3390/su11143811.
19. Haseeb, M., Hussain, H.I., Ślusarczyk, B., Jermisittiparsert, K. (2019). Industry 4.0: A Solution towards Technology Challenges of Sustainable Business Performance. *Social Sciences*, 8(5), 154. doi:10.3390/socsci8050154.
20. Hayes, B. (2008). Cloud computing. *Communications of the ACM*, 51(7), 9-11. doi:10.1145/1364782.1364786.
21. Horváth, D., Szabó, R. Z. (2019). Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? *Technological Forecasting and Social Change*, 146, 119-132. doi:10.1016/j.techfore.2019.05.021.
22. International Labour Organisation (2019). *The power of small: Unlocking the potential of SMEs*. Retrieved from <https://www.ilo.org/infostories/en-GB/Stories/Employment/SMEs#power-of-small>, 14.05.2022.
23. Kmiecik, R., Michna, A., Meczynska, A. (2012). Innovativeness, empowerment and IT capability: evidence from SMEs. *Industrial Management & Data Systems*, 112(5), 707-728. doi:10.1108/02635571211232280.
24. Kot, S. (2018). Sustainable Supply Chain Management in Small and Medium Enterprises. *Sustainability*, 10(4), 1143. doi:10.3390/su10041143.

25. Kozubíková, L., Homolka, L., Kristalas, D. (2017). The Effect of Business Environment and Entrepreneurs' Gender on Perception of Financial Risk in The Smes Sector. *Journal of Competitiveness*, 9(1), 36-50. doi:10.7441/joc.2017.01.03.
26. Laukkanen, T., Nagy, G., Hirvonen, S., Reijonen, H., Pasanen, M. (2013). The effect of strategic orientations on business performance in SMEs. *International Marketing Review*, 30(6), 510-535. doi:10.1108/imr-09-2011-0230.
27. Liu, Y., Xu, X. (2017). Industry 4.0 and Cloud Manufacturing: A Comparative Analysis. *Journal of Manufacturing Science and Engineering*, 139(3), 034701. doi:10.1115/1.4034667.
28. Luo, X., Zhang, W., Bose, R., Li, H., Chung, Q.B. (2018). Producing competitive advantage from an infrastructure technology: The case of cloud computing. *Information Systems Management*, 35(2), 147-160. doi:10.1080/10580530.2018.1440732.
29. Miśkiewicz, R., Wolniak, R. (2020). Practical Application of the Industry 4.0 Concept in a Steel Company. *Sustainability*, 12(14), 5776. doi:10.3390/su12145776.
30. Moeuf, A., Pellerin, R., Lamouri, S., Tamayo-Giraldo, S., Barbaray, R. (2017). The industrial management of SMEs in the era of Industry 4.0. *International Journal of Production Research*, 56(3), 1118-1136. doi:10.1080/00207543.2017.1372647.
31. Mura, L., Ključnikov, A., Tvaronavičienė, M., Androniceanu, A. (2017). Development Trends in Human Resource Management in Small and Medium Enterprises in the Visegrad Group. *Acta Polytechnica Hungarica*, 14(7), 105-122.
32. Mura, L., Vlacsekova, D. (2017). Effect of motivational tools on employee satisfaction in small and medium enterprises. *Oeconomia Copernicana*, 8(1), 111. doi:10.24136/oc.v8i1.8.
33. National Institute of Standards and Technology's. (2011). *Final Version of NIST Cloud Computing Definition Published*. Retrieved from <https://www.nist.gov/news-events/news/2011/10/final-version-nist-cloud-computing-definition-published>, 27.01.2022.
34. Oláh, J., Kovács, S., Virglerova, Z., Lakner, Z., Kovacova, M., Popp, J. (2019). Analysis and Comparison of Economic and Financial Risk Sources in SMEs of the Visegrad Group and Serbia. *Sustainability*, 11(7), 1853. doi:10.3390/su11071853.
35. Orehovački, T., Babić, S., Etinger, D. (2018). Identifying Relevance of Security, Privacy, Trust, and Adoption Dimensions Concerning Cloud Computing Applications Employed in Educational Settings. In: D. Nicholson (Ed.), *Advances in Human Factors in Cybersecurity. AHFE 2017, Vol. 593* (pp. 308-320). Springer.
36. Orzes, G., Rauch, E., Bednar, S., Poklemba, R. (2018). *Industry 4.0 Implementation Barriers in Small and Medium Sized Enterprises: A Focus Group Study*. IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), pp. 1348-1352.

37. Prasad, A.S., Rao, S. (2014). A Mechanism Design Approach to Resource Procurement in Cloud Computing. *IEEE Transactions on Computers*, 63(1), 17-30. doi:10.1109/tc.2013.106.
38. Rittinghouse, J.W., Ransome, J.F. (2017). What Is the Cloud? *Cloud Computing - Implementation, Management, and Security*. CRC press.
39. Saunila, M. (2020). Innovation capability in SMEs: A systematic review of the literature. *Journal of Innovation & Knowledge*, 5(4), 260-265. doi:10.1016/j.jik.2019.11.002.
40. Steinerowska-Streb, I. (2021). Internationalization of Polish enterprises. A comparative analysis of family and non-family businesses. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 150, 255-266. doi:10.29119/1641-3466.2021.150.19.
41. Stock, T., Seliger, G. (2016). Opportunities of Sustainable Manufacturing in Industry 4.0. *Procedia CIRP*, 40, 536-541. doi:10.1016/j.procir.2016.01.129.
42. Tokarčík, A., Pavolová, H., Bakalár, T., Bednárová, L. (2021). Impact of Innovations on the Saving of the Production Company's Working Time Fund. *Modern Management Review*, 26(4): 119-131. doi:10.7862/rz.2021.mmr.29.
43. van Eck, N.J., Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538. doi:10.1007/s11192-009-0146-3.
44. Varghese, B., Buyya, R. (2018). Next generation cloud computing: New trends and research directions. *Future Generation Computer Systems*, 79, 849-861. doi:10.1016/j.future.2017.09.020.
45. Wielki, J. (2017). The Impact of the Internet of Things Concept Development on Changes in the Operations of Modern Enterprises. *Polish Journal of Management Studies*, 15(1), 262-274. doi:10.17512/pjms.2017.15.1.25.
46. Xu, X. (2012). From cloud computing to cloud manufacturing. *Robotics and Computer-Integrated Manufacturing*, 28(1), 75-86. doi:10.1016/j.rcim.2011.07.002.