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THREE YEARS LATER – THE INTEGRATION AND CONTINUITY OF DIGITAL SOLUTIONS AT SUBSIDIARIES IN HUNGARY AFTER THE COVID-19 PANDEMIC

HÁROM ÉVVEL KÉSŐBB – A DIGITÁLIS MEGOLDÁSOK INTEGRÁCIÓJA ÉS FOLYTONOSSÁGA A MAGYARORSZÁGI LEÁNYVÁLLALATOKNÁL A COVID-19 PANDÉMIA UTÁN

The COVID-19 pandemic precipitated widespread adoption of digital solutions, including applications, intranets, social media, online communication platforms, and other online and remote business solutions. While some of these practices persisted in the post-COVID era, others were modified or abandoned. This study investigates the digital practices of six automotive and electronics subsidiaries in Hungary during the pandemic and over the subsequent three years. The authors' findings indicate that practices beneficial to companies, such as technological innovations, online training, or meetings, remained integral to operations even after the pandemic. However, the continuity of other practices, such as working from home or remote work, depended on the nature of the position (whether it is related to physical production) and the company's organizational and business culture (in both home and host countries).

Keywords: **multinational companies, Covid-19 pandemic, corporate digitalisation, resilience, Hungary**

A COVID-19 világjárvány felgyorsította a digitális megoldások széles körű elterjedését, beleértve az applikációkat, intranet megoldásokat, közösségi médiát, online kommunikációs platformokat és egyéb online és távoli üzleti megoldásokat. Bár e gyakorlatok közül néhány a COVID utáni korszakban is fennmaradt, másokat módosítottak vagy elhagytak. Ez a tanulmány hat magyarországi autóipari és elektronikai leányvállalat pandémia alatti és az azt követő három évben alkalmazott digitális gyakorlatait vizsgálja. Az eredmények azt mutatják, hogy a vállalatok számára előnyös gyakorlatok, mint például a technológiai innovációk, az online képzés vagy az értekezletek, a pandémia után is szerves részét képezték a működésnek. Más gyakorlatok, így az otthoni munka vagy a távmunka azonban a pozíció jellegétől (fizikai termeléssel kapcsolatos-e) és a vállalat szervezeti és üzleti kultúrájától függött (mind az anyacég, mind a leányvállalat országában).

Kulcsszavak: **multinacionális vállalatok, COVID-19 világjárvány, vállalati digitalizáció, ellenálló-képesség, Magyarország**

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The impact of transformative changes on company operations has been a longstanding subject in economic and business theory and empirics. Schumpeter (1942) introduced the concept of creative destruction as central to capitalism. He argues that "(t)hose revolutions are not strictly incessant; they occur in discrete rushes which are separated from each other by spans of comparative quiet. The process as a whole works incessantly however, in the sense that there is always either revolution or absorption of the results of revolution, both together forming what are known as business cycles" (Schumpeter, 1942, p. 83).

The effects of digital transformation and automation are continuous (Brynjolfsson & McAfee, 2014). However, various crises and other discontinuous changes have significantly accelerated this process. Technological innovations that would have spread more slowly under normal circumstances are rapidly integrated into everyday life and economic functioning during crises, with lasting effects on organizations and societies. The literature refers to the anticipation of external influences as crisis-driven innovation (Archibugi et al., 2013; Hausman & Johnston, 2014) and forced innovation and adaptive innovation (Roe & Wood, 1975; Kirton, 1976).

Like other crises, COVID-19 triggered these changes (Amankwah-Amoah et al., 2021), but due to company closures, additional special changes appeared, primarily in connection with the actual physical presence (or absence) of the labour force. These affected the place of work, means of communication, business trips and many other fields (Zou et al., 2020; Obrenovic et al., 2020; Andrews et al., 2021; Foss, 2021; Khan et al., 2023;). These kinds of actions had a significant influence on how businesses operated on a daily basis, and it was assumed that some of these solutions would be there to stay. In this article, we examine the enduring impact of the pandemic-induced digital transition. Through the analysis of the practices of six automotive and electronics subsidiaries during COVID-19 and then three years later, we evaluate whether the pandemic acted as a temporary accelerator or a long term catalyst for digitization.

The aim of this article is to examine the extent to which digital practices adopted during the COVID-19 crisis–such as online communication, remote work, digital supply chains, and training–have persisted three years later in foreign-owned automotive and electronics subsidiaries operating in Hungary. The study seeks to identify the organizational, cultural, and functional factors that have shaped the retention or discontinuation of these practices, thereby contributing to a better understanding of long-term digital transformation processes in a post-crisis context.

We address the issues if these digital solutions are really here to stay now that the pandemic is over. Are these digital solutions still integral to these companies? Is digitization an ongoing tendency in Hungary, accelerated by the pandemic, or was it just a temporary solution, invoked by the special circumstances of the pandemic? Thus our research question is: how have digital solutions introduced during the COVID-19 pandemic been integrated and sustained in the operations of foreign-owned electronics and automotive manufacturing subsidiaries in Hungary, and what factors influence their continuity or abandonment in the post-pandemic period?

The article is structured as follows. First, we present the background to our analysis: the impact of the pandemic on firms in terms of using digital tools. Then our methodology is briefly presented, followed by the results of our investigation, discussion and conclusion.

Background

During the COVID-19 pandemic, firms resorted to various types of digitization in order to overcome the challenges caused by the pandemic (Almeida et al., 2020; Bürgel et al., 2023; Zia et al., 2023). Nearly all businesses used digital solutions (Apedo-Amah et al., 2020; Kuriakose & Tran, 2020; Pla-Baber, 2021; Sass et al., 2021; Mont et al., 2021; Hassoun et al., 2023), but the degree of adoption varied by industry, company size and location (Apedo-Amah et al., 2020; Kim, 2020). Similar developments have been identified in Hungary (see e.g. Sass et al., 2021; Endrődi-Kovás & Stukovszky, 2022; Kiss-Dobronyi et al., 2024; Kőműves et al., 2024).

The pandemic increased the amount of work done from home (Foss, 2021; Zou et al., 2020; Sass et al, 2021), established models for remote business negotiations and hiring (Zou et al., 2020), and increased e-commerce usage (Andrews et al., 2021). Everyday business routines included the use of applications, intranets, social media, online communication platforms, and other online solutions (Obrenovic et al., 2020; Andrews et al., 2021; Foss, 2021; Khan et al., 2023).

In addition to digitization, many companies were forced to innovate and transform their business models due to the impacts of the pandemic (Heinonen & Strandvik, 2021). However, while basic technologies were widely implemented, more advanced tools, like Big Data analytics and Artificial Intelligence (AI), saw limited adoption (Bettiol et al., 2021). Factors influencing these transitions included the company's digital infrastructure, managerial mindset and historical innovation practices (Archibugi et al., 2013).

Companies mainly used technologies that were already available, already in use but to a limited extent in the firm, or that could be easily and quickly obtained and adopted (Bai et al., 2021). So, the changes were not without precedent. The pandemic-related crisis only accelerated those changes by removing managers' hesitation and preventing employees' resistance regarding introducing new technology (Amankwah-Amoah et al., 2021).

Digitization was an important part of crisis handling measures and firms with digitization experience could manage the crisis more efficiently. Previous experience with and increased use of digital solutions increased the crisis resilience of companies not only in developed nations (Acciarini et al., 2021; Bürgel et al., 2023), but also in less developed countries (Khalil et al., 2022) and not only among large but also among small and medium-sized firms (Marolt et al., 2024). Digitally-enabled firms had a

lower decline in sales (Abidi et al., 2023) and higher business efficiency (Grijalba et al., 2024). The access to digital infrastructure and increased digitization also contributed to higher performance (Fejes & Stocker, 2024; Vo et al., 2022).

In addition to previous experience and infrastructure access, the company's and its managements' way of thinking was also an important influencing factor. Companies that saw the crisis as an opportunity and invested in new industries (Zou et al., 2020) or innovated (Santos et al., 2021) reacted more successfully to the pandemic-related crisis. The resilient operation of companies is influenced by whether the necessary changes can be organically integrated into the company's operation, and path dependency (Pavitt et al., 1989) can play a major role here. A company that was innovative in the past will be so in the future (Archibugi et al., 2013), so changes are part of its learning process and are not alien to its corporate operation. This partly explains why companies in Hungary, demonstrated varying degrees of resilience during the pandemic depending on their prior digital capabilities (Sass et al., 2021; Khalil et al., 2022; Kiss-Dobronyi et al., 2024). Digital transformations during COVID-19 also highlighted inequalities in digital infrastructure. In countries like Hungary, where infrastructure and skills were moderately developed, firms faced challenges in scaling digital solutions. Despite this, organizations with pre-existing digital tools adapted more effectively, showcasing the value of prior investment in IT capabilities (Acciarini et al., 2021).

As for the long-term effects, during the pandemic, employee collaboration (teamwork, team size), performance evaluation and reward systems were heavily impacted by remote work. Remote work might have diminished loyalty, together with the rise in the employment of contract labourers and part-timers (Foss, 2021). A decrease in business travel and an increase in online meetings were predicted to be two universal and lasting changes, which would remain with the firms even after the pandemic was over (Dyba & Di Maria, 2024). Additionally, the emergence of new digital products and services based on the principle of flexibility was predicted (Almeida et al., 2020).

As we saw, the COVID-19 pandemic served as a powerful catalyst for digital transformation across industries, compelling companies to reconfigure their operational models, technology infrastructure, and strategic priorities. But it is rarely analysed, what happened in this field after the pandemic? Have firms continued to use the digital tools adopted during the pandemic in their operations? There are few studies comparing the pre- and post-pandemic era in that respect. Studies emphasize that digital transformation in the post-pandemic context is not merely an emergency response, but a strategic necessity deeply tied to organizational resilience, innovation, and long-term performance (Cardoso et al., 2025). While firms adopted remote work, e-commerce platforms, and cloud-based tools to ensure continuity, the effectiveness of these efforts hinged on digital maturity, leadership commitment, and dynamic capabilities (Ben-Zvi & Luftman, 2022; Madzík & Sieber, 2024). For Hungarian SMEs, the role of management is also emphasized (Gyimesi & Fejes, 2023). Empirical research reveals that, particularly in emerging and digitally constrained markets like Ghana and China, the crisis accelerated the adoption of mobile applications, blockchain, and innovative marketing strategies, which were there to stay even in the post-pandemic era (Fodouop Kouam, 2025; Jibril et al., 2024). Furthermore, digital transformation has evolved beyond technological deployment to encompass sustainability, agility, and stakeholder-centric innovation, positioning IT as a core enabler of both competitiveness and resilience in the post-pandemic economy (Ben-Zvi & Luftman, 2022; Soto-Acosta, 2023). Despite uneven progress, especially among SMEs and in developing contexts, the literature converges on the view that digital transformation must be treated as a continuous, strategic, and multidimensional endeavor and that firms tend to keep the digital solutions they introduced during the COVID-pandemic even in the post-pandemic era.

Methodology

Our research involved semi-structured interviews with managers of 15 foreign-owned automotive and electronics subsidiaries operating in Hungary, during the pandemic (for more details on the interview and analysis procedures, see Sass et al. (2021)) and short follow-up interviews with the representatives of six of these firms three years later. (Convenience sampling was applied, whereby we have selected participants who were most readily available from the previous sample of 15 firms.) The initial inquiry explored the pandemic's impact on operations, the role of state subsidies in helping firms coping with this impact, and the company's crisis management strategies (Sass et al., 2021). The follow-up focused on the persistence of digital practices and the rationale behind their retention or discontinuation. The follow-up interviews were conducted online, with the same managers, who were interviewed in the first round. The online interviews took place between February and March 2024 and lasted between 20 to 30 minutes. Participants were informed about the nature of the research and gave their voluntary consent before participating. The research ensured the confidentiality of participants' and their companies' identities. No identifiable information is disclosed in the study about the firms involved. Responses were anonymized during both data collection and analysis to protect privacy.

The follow-up sample was made up of four automotive companies and two electronics firms (See Table 1), encompassing both medium-sized and large organizations. Among them, five were established through greenfield investments and one was an acquisition. This targeted selection allowed for a detailed exploration of industry-specific dynamics. The data collection aimed to capture variations in practices based on organizational size, production processes, and corporate culture.

To ensure rigour, the study triangulated findings from interviews with internal company reports and publicly

available data, including articles in economic dailies and weeklies. The analysis involved coding interview transcripts to identify recurring themes, such as the adoption, modification or abandonment of digital practices.

Results

The most important findings concerning the companies, which took part in the interview round, are summarized in Table 1.

Company B retained most of the routines established during the COVID-19 pandemic, as they proved to be effective, and the company continuously increased the number of employees during the period under review. As for continuing the practices established during the COVID-19 pandemic, remote work or home office options were maintained. The company management decided in which areas remote work was possible (this obviously affected areas not directly related to production, such as finance), but then the middle management level could determine if

Table 1

Results of the interviews

	Company A	Company B	Company C	Company D	Company E	Company F
Sector	electronics	electronics	automotive	automotive	automotive	automotive
Headquartered in	Switzerland	USA	China	Germany	Germany	Austria
Number of employees						
A/ during the pandemic (2020)	10	3400	2100	1400	2300	600
B/ after the pandemic (2023)	50	3900	1600	1450	2500	450
Received government support during the pandemic?	No	Yes	Yes	Yes	Yes	No
Increase in the number of employees after COVID	continuous growth (each year)	continuous growth (each year)	continuous decrease (each year)	steady increase but last year decrease	continuous growth (each year)	first year growth then steady decline
Online training						
A/ during the pandemic	Yes	Yes	Yes	Yes	Yes	Yes
B/ after	Yes	Yes	Yes	Yes	Yes	Yes
Remote work						
A/ during the pandemic	Yes	Yes	Yes	Yes	Yes	Yes
B/ after	No	Yes	Yes	Yes	Yes	Yes
DSN						
A/ during the pandemic	Yes	Yes	No	No	Yes	No
B/ after	Yes	Yes	Yes	Yes	Yes	No
Other digital solutions						
A/ during the pandemic	Yes	Yes	Yes	Yes	No	No
B/ after	Yes	Yes	Yes	Yes	No	No

Source: compiled by the authors based on the company interviews

Note: 'A/during the pandemic' refers to digital solutions, which were introduced during the pandemic; number of employees rounded to keep the anonymity of the respondents

As Table 1 shows, the companies in our sample show a high similarity in introducing and keeping digital solutions. Differences can be explained by the special position of the company in question or by the nature of its products, markets or activities. Company A is in the process of establishing itself in Hungary, in the phase of a quick growth from basically zero during the COVID-related crisis. Furthermore, due to the special nature of its product, it was affected positively by the COVID-related economic crisis with continuous and quick growth in sales. In spite of this, various measures were taken to both prevent the spread of the virus and ensure the increased use of digital tools in the firm. This is the only firm in the sample, where remote work was not introduced, the reason is its smallness in terms of the number of employees and the low number of white-collar workers.

they wanted to apply it to their team. As our interviewee stated, "*The most important thing is that the work gets done*". This also raises the issue of traceability. Despite the above, our interviewee considers on-site work a sign of loyalty and believes that the extent to which people expect the home office option compared to on-site work may play a role, even during layoffs. A substantial proportion of personal meetings shifted towards online meetings, and online training has become more prominent. The threat of the pandemic was given greater weight in the emergency plan; thus, it also enhanced the company's responsiveness, which can be considered a long-term benefit.

Company C introduced digital practices during the COVID-19 pandemic that were not a priority before or would have been developed without the pandemic but were

accelerated under its pressure. As for solutions affecting employees, some of the practices introduced during the COVID-19 pandemic, such as online meetings and the shift of international partnerships to the online arena, have been maintained due to their apparent benefits (cost reduction), while those practices that are exclusively beneficial to the employees, such as remote work or home office, have partially withered in the period after the pandemic (not eliminated, but significantly reduced and have not become automatic). The interviewee highlighted the existence of different practices between subsidiaries of the parent company and the mostly obvious differences according to job roles. Here, too, just as in the case of Company B, the decision-making authority lies with the line manager. The discovered pattern suggests that in areas with greater flexibility (and where considering the state of mind is also important), the home office option is more likely to persist.

In the case of Company D, the COVID-19 pandemic has resulted in the expansion of digital solutions, including the introduction of online communication tools. A significant change was the introduction of IT solutions to increase centralization within the company network in response to the pandemic. More and more activities are moving to the online space, where there is less need for personal presence. In the product segment represented by the company, demand has not fallen, so the biggest problem has been maintaining day-to-day production, with a shortage of blue-collar workers. Decisions previously taken exclusively at local level were increasingly taken at the parent company, to solve the problems arising from COVID-19. This has been maintained after the pandemic. Following the pandemic, digital solutions have been maintained, and working from home two days a week has been preserved for certain white-collar jobs, and may even be increased where justified. In contrast to the other companies in the sample with the exception of company F, the number of employees has decreased over the past year due to reduced demand in the market segment served by the company.

At Company E, the COVID-19 pandemic has brought significant changes to the company's operations using digital solutions. During the COVID-19 period, the company created as much as possible the conditions for attendance, not only for blue-collar workers but also for white-collar workers. At the same time, the pandemic has accelerated the introduction of digital solutions. It has enabled some white-collar jobs to be made permanently through remote work. In addition, the company has moved from the previous form of on-site presence for both meetings and training courses to online solutions. During the pandemic, a number of IT solutions were introduced (such as mobile applications, information email and feedback email) and maintained, which not only replaced face-to-face communication but also contributed greatly to increasing the efficiency of the production line (in the case of blue-collar work).

In the case of Company F, during the COVID-19 pandemic, online meetings and remote work were introduced. At the same time, the interviewee reported a significant drop in production, as most of the workers are blue-collar and involved in production, and for them the introduction of digital solutions was not an alternative. The digital solutions that were introduced were maintained in the post-pandemic period. Digital supply chains were not built as production relies on fewer partners, thus no complex supply system is deployed. Furthermore, the relatively small size of the Hungarian plant does not require such solutions. At the same time, existing digital solutions were used to a greater extent than previously. In terms of inventory, up-to-date information was shared between the offshore plants, which, with the help of inter-plant logistics, solved the shortage of parts resulting from supply chain disruptions. The number of employees in this company has also decreased in the last two years, like in company D, due to a significant drop in demand and thus in sales in their market segment.

Overall, we found that digitalization and IT capability were key determinants of the crisis resilience of the firms in the sample (Sass et al., 2021). However, there were also differences according to the nature of production (advantages of higher added value), according to company size (advantages of larger companies) and according to the age of the company (new companies were more flexible). The follow-up indicated different behaviors in terms of keeping or abandoning digital tools. We shall examine the fate of the different digital solutions one by one.

All interviewed companies introduced online training courses during the pandemic and after three years they all still carry out their trainings online. Three years later, these programs remained fully digital, yielding significant savings in both cost and time. This continuity underscores the economic advantages of remote learning solutions. Employees and managers alike cited increased accessibility and flexibility as key benefits. The shift to online training also enabled companies to standardize content delivery across geographically dispersed teams. Similarly, online meetings are now common in the sample, as one interviewee (Company C) put it: "*We are holding Teams meetings, the company has a culture of this by now, the company even introduce rules for "conference working."*

Another long-term solution is remote work or working from home, which was introduced during the pandemic by all six companies in the sample. Five companies maintained flexible remote work arrangements, ranging from two days per month to two days per week. (The sixth company offers remote work on a case-by-case basis in special circumstances only and for one working day per month.). The survival of the "home office" practice is a multifactorial issue. The nature of the job is crucial. In positions closely tied to physical production, remote work practices have declined in the surveyed companies. On the other hand, it is easier to maintain home office practices in jobs such as research and development or various administrative functions, which are not bound to a specific location and often involve international teams. This has led to a situation where where two-days-a week and two-days-a-month remote work practices can be observed within the same company. Furthermore, the direct manager's consent

is also required. Therefore, a situation may arise where a worker will not be permitted to work from home, despite the fact that the company practice and the position allow it. As an additional factor, company culture is another significant factor. Company culture also played a critical role, with flexible and employee-centric companies more likely to sustain remote work options. Furthermore, companies that perceived remote work as a threat to team cohesion reduced its prevalence, while those emphasizing employee well-being integrated remote work into their standard policies. This divergence highlights the interplay between corporate priorities and external pressures in shaping post-pandemic practices. The interviewee from Company C also emphasized that the current state of the labour market plays a significant role in corporate decisions. The excess demand of labour has been favorable for the survival of remote work practices after COVID-19, as home office has proven to be attractive for workers. However, the change in market conditions has also been accompanied by a decrease in company flexibility, which has also impacted the development of home office practices since these practices are important mainly for the employees (and not for the company), as it could be seen from the interviews.

As a third solution, digital supply chains/networks (digital development; synchronized planning; smart supply; smart factory; dynamic performance; connected customer) were used during the pandemic by four of the six firms, and all six had adopted these practices by the study's conclusion. The firms that introduced this solution later indicated that the business environment – all of their partners apply these solutions – and not the pandemic induced them to implement these digital tools. Thus, these advancements have been driven by broader industry trends rather than the pandemic alone. Companies reported increased efficiency, reduced lead times, and enhanced collaboration with suppliers, which is confirmed by their performance indicators.

A uniform during-pandemic development that has remained in place in all firms in the sample is within-company communication, which has been mainly transferred online, except for those companies where production processes need personal communication. Higher efficiency, cost savings, and advantages related to traceability are the results of the enhanced use of this tool. On the other hand, given the importance of internal communication in maintaining or even enhancing employee loyalty (Sinitsyna et al., 2024), keeping this digital tool is an indicator of companies' strategic commitment to sustaining employee engagement and cohesion, even in hybrid or remote work settings, thereby reinforcing organizational culture and long-term workforce stability. As one interviewee (Company F) put it: *"the retention of staff is very important, helped by small organization, where personal relationships dominate and corporate culture; it is very important to have little movement among the employees…"*

Furthermore, the increase in online communication has enabled a higher level of centralization in decision-making, which meant in the case of two of the six companies in the sample a higher level of coordination and involvement in subsidiary-level decisions from the headquarters. This shift suggests that the pandemic-induced transition to digital communication has not only improved operational efficiency but also facilitated tighter organizational control and integration. As a result, firms have been able to strengthen corporate governance and align subsidiary actions more closely with headquarters' strategic objectives, indicating possibly a long-term structural change in multinational management practices. However, this finding cannot be generalized and requires further investigation due to the low number of firms in the sample.

Other retained innovations included online production data tracking, supplier portal enhancements, and critical queue notification systems. These solutions reflected both pandemic-specific adaptations and pre-existing innovation trajectories. Companies emphasized the importance of tailoring digital tools to their operational needs, ensuring alignment with production processes and strategic goals. All these solutions have been kept after the pandemic. These depend to a great extent on the nature of the actual production activities.

However, challenges persisted, particularly for firms with legacy systems. Transitioning to digital supply chains required significant investment in infrastructure and employee training. Firms that successfully navigated these challenges leveraged partnerships with technology providers and government-supported digitalization programs. Furthermore, as one interviewee (Company A) emphasized, problems with the Hungarian education systems represent one of the major challenges from the point of view of digitalization: *"…tackling the education crisis would be key for Hungary's development, schools are passing on less and less knowledge and attitudes to children, both secondary and higher education are almost unambitious, and dual training is not efficient."*

Regarding these practices, some of them (solutions for remote access) were introduced due to COVID-19, while others that were not a priority before the pandemic were given higher importance or implemented more quickly than they might have been otherwise. In many cases, however, we can see advancements that would have happened even without the pandemic. Companies need to keep up with the adoption of digital solutions. Thus, the pandemic acted as a catalyst for the introduction and practical application of these digital tools. Regardless of the reason, the managers interviewed considered all technical progress and development beneficial.

Discussion

The findings of this study reveal that the COVID-19 pandemic served as a significant catalyst for digital transformation among the examined firms in Hungary. Despite differences in company size, sector, market positioning, and the nature of their products and operations also highlighted in the literature (Apedo-Amah et al., 2020; Kim, 2020), a high degree of convergence can be observed in the adoption and retention of digital solutions.

The findings underscore the dual role of crises as accelerators and disruptors of technological innovations and their adoption. While the pandemic expedited the adoption of digital solutions, the sustainability of these practices depended on organizational readiness and various internal and external factors. Companies with robust digital infrastructures and proactive leadership were better positioned to capitalize on the opportunities presented by the pandemic.

The transition to online internal communication, which is often mentioned in the literature (Obrenovic et al., 2020; Andrews et al., 2021; Foss, 2021; Khan et al., 2023), was one of the most uniform developments, with all firms–regardless of size or structure–maintaining this practice even in the post-pandemic years. The strategic commitment to digital communication not only enhanced efficiency and cost-effectiveness but also contributed to stronger organizational cohesion and employee engagement. In certain cases, it also enabled greater centralization of decision-making, signaling a possible shift in corporate governance practices toward tighter headquarters control.

In line with previous research (Foss, 2021; Zou et al., 2020; Sass et al., 2021) remote work emerged as another widely adopted solution, though its extent varied. Five out of six companies retained some form of remote work, shaped by job characteristics, managerial discretion, and corporate culture. The variations within firms suggest that while remote work has become more accepted, its implementation remains context-dependent, reflecting a nuanced approach to flexibility and control. The digitalization of training programs was unanimously retained, underscoring the clear cost, accessibility, and standardization benefits of online learning. Similarly, digital production monitoring tools and supply chain solutions–though not initially driven solely by the pandemic–became integral to company operations. Their adoption was accelerated either by pandemic-induced needs or broader industry developments, with firms reporting performance improvements as a result.

Our results show that not only company-level attitudes, such as whether companies perceive the crisis as an opportunity or a threat (Zou et al., 2020; Santos et al., 2021), or how they think about employee loyalty (Foss, 2021), but also individual attitudes are decisive. Local managers use the room for maneuver provided by subsidiaries according to their own beliefs, for example by allowing more or less remote work for employees under their control. We also highlighted the role of situational factors, such as the current state of the labour market, which may influence the use of remote work.

The persistence of digital practices also highlights the interplay between employee preferences and organizational objectives. For instance, the continuity of remote work reflected a balancing act between productivity concerns and workforce satisfaction. Similarly, the widespread retention of online training underscored its dual benefits of cost efficiency and skill development (Castillo & Shah, 2020).

However, our study revealed disparities in digital adoption across firms. Smaller companies and those with limited pre-pandemic digital capabilities faced greater challenges in sustaining innovations. These findings align with existing literature on the digital divide, emphasizing the need for targeted support to bridge gaps in infrastructure and skills (Vo et al., 2022). Furthermore, in spite of the small sample, our results stress the importance of the nature of the activity itself in the company as a factor in the inclination to adopt and retain digital solutions.

It is important to note that while some of the innovations were direct responses to the crisis, others reflected broader strategic trajectories, in line with the findings of other articles (Cardoso et al., 2025). The pandemic often acted as an accelerator rather than an originator of digital adoption. The continuation of these practices suggests a deeper transformation in operational models, with long term implications for competitiveness, employee management, and global coordination in multinational firms.

Conclusion

Overall, our results indicate that the COVID-19 pandemic acted as a catalyst for the acceleration of digitalization processes in Hungary–a mid-developed country where the necessary infrastructure and skills were largely in place, yet the widespread adoption of digital solutions had not fully materialized prior to the crisis. Our findings confirm that digital practices offering clear and measurable benefits to companies–such as online training, digital communication tools, and supply chain digitalization–were more likely to persist over time. These practices were retained due to their efficiency, cost-saving potential, and positive impact on collaboration, especially in geographically dispersed and international company environments.

However, not all digital solutions experienced the same level of continuity. Practices more oriented toward employee convenience and work-life balance–most notably remote work–showed greater variability and were more contingent upon organizational culture, job characteristics, managerial attitudes and external factors (tightness of the labour market). This suggests a tension between organizational efficiency and employee-centered flexibility in the post-pandemic era, especially in sectors where physical presence and on-site coordination remain critical.

The results also highlight the unevenness of digital transformation across firms, with differences emerging not only based on sectoral characteristics but also firm size, digital maturity, and corporate culture. While some of these differences align with established findings in the digital divide literature, our research may point to the particular role of path dependency and prior innovation orientation as key determinants of whether crisis-induced solutions became permanent. Firms with a history of innovation and openness to change were more likely to embed new digital practices into their routines, turning crisis responses into long-term organizational assets – an area, which deserves further investigations due to the limitations of our study.

Furthermore, we observe that digitalization in the context of crisis management is not only a technical or infrastructural issue but also a strategic and cultural challenge. Organizational willingness to invest in employee training, adapt management practices, take into account work-life balance and redesign workflows plays a vital role in determining whether digital tools will be sustainably integrated. In this sense, the pandemic has served not only as a technological inflection point but also as a test of organizational learning and adaptability.

An important limitation of our study is the low number of analysed firms and their specific characteristics: in our sample, there are only foreign-owned subsidiaries operating in the automotive and electronics industries. The study focuses primarily on firms operating in a particular industry context, and practices may differ substantially across sectors. Furthermore, our research is rooted in a single-country setting, whereby regulatory aspects, cultural factors, differences in digital infrastructure and digital readiness may affect the results. Due to the convenience sampling method, selection bias may also be present. Thus our conclusions cannot be generalized and transferred directly to other industries or economies. Furthermore, we could not analyse certain information, e.g. the link between whether the company received government support and if it kept the digital solutions introduced during the pandemic. At the same time, we had information about the companies in the sample at two points in time, which was helpful for tracking developments over time. Thus, still, we think, our results based on a longitudinal analysis, serve as a good basis for further works in the area.

Looking ahead, the continuity of digital solutions will depend on how firms can balance the pressures of global competitiveness, cost efficiency, and employee satisfaction. Policymakers and industry stakeholders should take note of the specific barriers faced by small and medium-sized firms in sustaining digital innovations, particularly in the areas of infrastructure investment and digital skills development. Targeted support mechanisms, such as training subsidies, IT infrastructure programs, and knowledge-sharing platforms, could enhance resilience and digital maturity across the business sector.

Finally, future research areas can be determined based on the limits of the methodology applied. Thus, future research should explore the long-term organizational consequences of digitalization beyond efficiency metrics. Questions related to employee well-being, employee loyalty, organizational identity, workplace cohesion, attractiveness of the workplace and managerial control merit deeper investigation. Broader comparative studies across industries and national contexts could also shed light on the global dynamics of post-crisis digital transformation. Especially important would be to conduct comparative country case studies in the Central and Eastern European region, given the similarities in context, heritage, development path and level of development of the market economies. As crises may be becoming more frequent and interconnected, understanding how firms internalize and institutionalize change will be crucial for shaping resilient, adaptable, and inclusive economic systems. Furthermore, based on our research results, future research should delve deeper into the organizational determinants of digital continuity, as our study highlighted substantial variation in the persistence of digital solutions across firms, even within the same industry. For instance, while digital communication platforms and online training were widely retained due to their measurable benefits, remote work practices remained inconsistent and appeared strongly shaped by organizational culture, managerial attitudes, and the production-related nature of job roles. Comparative case studies that explicitly examine these cultural and managerial dimensions–both across firms and between home and host country headquarters–could offer richer insight into the micro-level factors influencing digital path-dependency. Additionally, our findings suggest that digital maturity before the crisis played a key role in whether firms could embed new tools as long-term practices. Thus, future studies might explore how pre-pandemic innovation orientation, IT infrastructure, and HR practices affected the speed and depth of digital adaptation. Investigating whether companies with prior investment in digital skills or workflows experienced more successful or more lasting transformations would enhance understanding of digital absorptive capacity. Another promising research direction concerns the role of subsidiary–HQ relations in shaping digital continuity. Our results hint at an increasing trend toward centralized decision-making in digital matters during and after the pandemic, which raises questions about the autonomy of subsidiaries in shaping their own digital practices. Longitudinal research could trace how this centralization evolves and what impact it has on subsidiary initiative, performance, and employee engagement. Furthermore, our article pointed to sector-specific constraints, such as the physical presence required in manufacturing, which limited the applicability of remote work. Future research should therefore compare digital transformation processes in production-intensive versus knowledge-intensive firms, helping to determine where hybrid models are feasible and sustainable. Finally, given the observed concerns about skills shortages and the education system's inability to keep pace, further research should examine how external constraints–such as labour market readiness, vocational training, and policy interventions–either enable or inhibit firm-level digital transitions. This is particularly important for Central and Eastern European countries where structural challenges in education and training may undermine digital progress.

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