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Fostering digital business transformation and digital skill development for economic growth and social inclusion in Poland: a preliminary study

The rate of economic growth, measured as the increase in GDP per capita, and the development of the knowledge economy are now strongly determined by the ability of enterprises to function, innovate and compete under the conditions of the fourth industrial revolution. The latter is characterised by the development of technology-enabled platforms that combine both supply and demand to disrupt the existing industry structures, such as those within the “sharing” or “on-demand” economy (Schwab, 2016). The social perspective of this technological change demonstrates that technical innovations are likely to have a positive effect on the diffusion of social innovation, development of the information society, and vice versa (Morrar et al., 2017, p. 18). The creation of digital opportunities (e.g. access to a broadband Internet connection, distance learning, public e-services) within all sectors is therefore essential for the socio-economic development of a country and plays a significant role in eradicating poverty and creating and accessing new economic opportunities, which are key for success in the new economic reality (Hameed, 2007).

At the microeconomic level, the scope and the dynamics of the changes following global access to the Internet and the development of mobile applications mean that enterprises are forced to adapt to turbulent economic conditions, including consumer expectations. This requires enterprises to go through a process of digital transformation.

The digital transformation of an enterprise is an extremely broad issue, which encompasses changes to traditional business models and processes thanks to the use

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of Information and Communication Technology (ICT) based solutions. Innovative applications, like SMAC (social, mobile, analytics, and cloud), create new ways of producing and distributing goods, and also affect how services are provided, including better interaction with the client through real-time communication and online chatbots (Berman, 2012). Therefore, digital transformation, as a very vital issue in terms of the contribution made by ICT to economic growth and the reduction of social inequalities, occupies a crucial place in socio-economic development strategies, e.g. *A Digital Single Market Strategy for Europe* (European Commission, 2015). It is also becoming an important element in business development strategies (Hess et al., 2015; Bełz et al., 2019).

In an economy increasingly based on virtual, augmented reality, artificial intelligence, and global data flows, the development of adequate skills by society, particularly by the workforce, presents one of the most critical issues facing the higher education system. Appropriately competent managerial staff and employees are an essential element in the effective implementation of a digital strategy for an enterprise. The skill gap, understood as a lack of organisational knowledge, skills, and experience significant with respect to achieving the strategic goals, is the main reason for not undertaking or failing to carry out a digital transformation. The importance of this problem is reflected in numerous empirical studies (i.e. Śledziwska et al., 2015; Goerzig, Bauernhansl, 2018), reports of international organizations (e.g. World Bank, 2016; OECD, 2019; UNCTAD, 2019) as well as reports of the world's largest consulting companies (including PwC, 2018; EY, 2019).

In relation to the issues mentioned above, the purpose of this paper is to outline the problem of reducing the digital skill gap, which is vital in terms of achieving an effective digital transformation, and to present selected solutions concerning systemic support for the improvement of digital skills in Polish enterprises.

Since the study is fairly exploratory and presents preliminary findings, and precedes the main empirical stage, a desk-type research method was adopted, including a critical analysis of the literature, reports of public institutions and consulting companies, as well as using press information. The author also carried out a review of the Eurostat databases based on a set of several dozen indicators, including DESI (Digital Economy and Society Index) in the timeframe 2015–2020, i.e. since the announcement of *A Digital Single Market Strategy for Europe* (European Commission, 2015).

The paper attempts to answer three research questions:

- What factors determine the digital maturity of an enterprise?
- What are the relationships between the digital skill gap, digital divide and social inequalities?
- What is the role of the system support for the digital transformation and development of digital skills, recognised as a driving force for economic growth and the process of social inclusion?

The first part of the article outlines the essence of digital transformation and provides the definition of digital maturity for enterprises. The second part focuses on analysing the problems related to the digital skill gap for enterprises, which is a result of the digital divide at the macroeconomic level and concerns the issue of social inequalities. The third part concisely presents initiatives in the field of systemic support, provided in the framework of cooperation based on the concept of the triple helix and including coordinated actions for the development of digital skills, undertaken jointly by the enterprise sector, the science sector, and the state administration. The final part is a summary of the research limitations and the main findings of the analysis, as well as directions for future empirical research.

TOWARDS THE DIGITAL MATURITY OF AN ENTERPRISE

The digital transformation process consists in transferring business processes from the analog to the digital sphere. It is a long-term and complicated process that requires, first of all, a strategic vision responding to three basic questions: in which direction, when, and how should the enterprise evolve as a result of the introduced changes, so as to ensure long-lasting growth under the conditions of the digital economy (Matt et al., 2015)?

In the first decade of the 21st century, the digital transformation mainly took place in large companies operating on foreign markets. In the case of SMEs, enterprises in advanced technological industries, due to their specialisation, were particularly involved in digital development. For most SMEs in the world, digital transformation remained an optional solution, enabling them to enter a new market arena in the future and increase the chances of rapid growth. On the threshold of the third decade, business practice demonstrates that digital development is becoming a *sine qua non* condition for SMEs to ensure their further existence in the market.

In recent years, there has been an increase in awareness among entrepreneurs and managerial staff of the essence of digital transformation and its importance in gaining a competitive advantage in the market. However, the problem is that despite relatively high awareness among entrepreneurs of digital change, only a small percentage of SMEs are becoming engaged in this process. The reason is mainly a lack of appropriate resources, including digital and general competences (i.e. communication and analytical competences), as well as competences in the field of strategic management. An additional barrier is a lack of sufficient financial resources to cover the costs of this process.

Contemporary enterprises face various challenges that require them to make several strategic decisions. These comprise the extraordinary growth of data, and the associated need to manage big data, including the provision of storage space (servers vs. cloud computing), the ability to share data with other entities in the market and data sales. Cybersecurity and the issue of protecting the processes of data transfer

and storage are becoming extremely difficult and costly tasks for business, yet they are very important given the growing data flows on a global scale and new legal regulations regarding the protection of personal data (Kaplan et al., 2015).

The digital development of the company also brings significant benefits, among which are internal improvements in the business processes due to the adaptation of ICT solutions, as well as the possibility of distance cooperation with foreign partners, resulting in reduced transport costs and easier access to geographically distant markets due to the digital goods and services available.

Digital transformation is closely related to the issue of the ex-ante digital maturity of the enterprise, defined as the readiness of the organisation to implement this process. Ex-post digital maturity, in turn, is defined as the level of digital proficiency of the company, as a result of the changes.

The degree of digital maturity of an enterprise is determined through various models based on selected indicators, which consider numerous variables that can be categorised into three groups:

- quality of human capital in terms of the presented digital skills (human resources capable of adapting ICT solutions),
- scope of digitisation of business processes,
- technological preparation in terms of an adequate ICT infrastructure.

In the literature, digital maturity is identified by the enterprise's results in specific areas, which includes: digital culture, technology transfer, digitally-driven operations and processes, digital strategy and leadership, digital skills, digital innovation, digital governance, digital ecosystem, digital compliance and cybersecurity, digital products, and the e-business model (Teichert, 2019, p. 1681).

The digital development of the company can be narrowed down to five stages (Ra-mantoko et al., 2018, p. 216):

- stage 1: the company operates and is visible only in physical space. This is the zero level digital maturity;
- stage 2: the company is visible in the digital space, via a website for example, but does not use more advanced digital solutions;
- stage 3: the company uses ICT in the process of data collection, analysis, and processing;
- stage 4: digital solutions are introduced in functional areas of the company's operations;
- stage 5: the current business model has been redefined to achieve comprehensive integration of the digital solutions in all areas of the company's operations. This is the level of full digital maturity.

Research on the digital development of enterprises carried out in EU countries prove that enterprises from the countries of Central and Eastern Europe are in a transition period, i.e. they are undertaking activities in the field of digital transformation, but these are fragmentary and relate only to specific areas of the enterprise's activity. However, the approaches enterprises are taking to the issue of

digital transformation are evolving. Until now, domestic enterprises, particularly those from the SME sector, have been considering whether they should undergo a digital change. Currently, they are heading towards an approach based on seeking answers to the questions of how and in what time frame the process should be carried out. However, the greatest problem on the way to full digital transformation is still the competence gap in the form of a lack of, or insufficiently developed, digital skills to allow maximum use of the potential that the use of ICT solutions in operational activities entails.

DIGITAL SKILL GAP, DIGITAL DIVIDE, AND SOCIAL INEQUALITIES

The gap in the digital skills of an enterprise is closely related to the occurrence of a digital divide at the macroeconomic level, which is one of the important forms of social inequality in the 21st century (Hargittai, Hsieh, 2013). It contradicts the egalitarianism assumption of the fourth industrial revolution (Hudson, 2003), in which all market players have equal access to the global Internet network and therefore can develop their digital skills without any problems.

In the field of social science, the complexity of the digital divide problem concerns many theoretical views and thoughts that are based on economic, sociological, political and administrative theories and sciences. Some aspects are also reflected in the nomenclature used in the analysis of this subject, which contains such terms as ‘digital inequality’, ‘digital divide’, ‘digital gap’ and ‘digital exclusion’.

Along with the implementation of the Internet on a global scale in 1996, the issue of the digital divide was defined as inequality of access by the population to the Internet in different countries of the world (Compaine, 2001; Castells, 2002). The current discourse emphasizes that the digital divide can occur on three levels (Ragnedda, Kreitem, 2018, pp. 9–13), associated with the dynamic development of new technologies.

The first level of the digital divide is the Internet access gap – which refers to the inequality of access by people to the network. The divide can be quickly bridged thanks to public investments in the development of a national ICT infrastructure. The second level of the digital divide comprises digital skills and digital capabilities, which refers to social stratification with respect to the level of digital skills possessed by individuals; competences determine how and for what purposes Internet users can benefit from access to the network (Robinson et al., 2015, p. 569). The digital skill gap is closely related to socio-economic status (Witte, Mannon, 2010), which results in the division of society into digitally rich and poor citizens (van Dijk, 2006, p. 166), and also has an impact on the supply of a highly skilled workforce. A higher social and economic status of the population is associated with the possibility of incurring the cost of purchasing the latest generation equipment and access to paid content, including online education. This

results in a more productive application of ICT in the daily use of the Internet and automatically strengthens the digital skills of a given group of Internet users.

People with a higher socio-economic status use their Internet access primarily for professional and educational purposes, which, in turn, makes it easier for them to find employment as specialists. Unlike them, those with a lower socio-economic status focus, during online activities, primarily on consumption purposes, including the use of social media and platforms offering entertainment media content.

In addition to social inequalities in digital skills due to differences in economic status, the research also showed a diversity in digital skills based on gender (Ono, Zavodny, 2009), age (Friemel, 2016), race, and ethnicity (Mesch, Talmud, 2011). Therefore, to effectively identify barriers in the development of the digital skills of a given population, a broader context of the economic environment should be taken into account, e.g. GDP per capita (labour market structure, R&D expenditure, technology advancement of enterprises), social aspects (life expectancy, number of university graduates, including in the fields of STEM (Science, Technology, Engineering, Mathematics), middle income, geographical distribution of the population), and cultural aspects (national innovation culture, creativity, entrepreneurship, and lifelong learning).

The third level of the digital divide – tangible benefits of using the Internet – is defined as a gap in the development of the digital economy, which consists of digitisation through the use of electronic platforms in the most important areas of the functioning of the state (e-administration), business and commerce (e-business and e-commerce) and teaching (e-education) (Hidalgo et al., 2020).

The socio-economic reality of the second decade of the 21st century indicates that economic entities continue to struggle with the problem of the digital divide. The most developed EU-15 countries, including Germany, Britain, and the Scandinavian countries, exhibit a high degree of digital maturity of enterprises and are widely recognised as global digital leaders. Their economic structure is characterised by the dynamic development of industry 4.0 and the ICT labour market with a relative balance of supply and demand in terms of highly qualified workforce. These economies are separated by the digital divide from the Central and Eastern Europe (CEE) states that joined the EU in 2004 and later. The CEE countries, after years of economic and political transformation, and the preceding period of Soviet Union influence, are still largely characterised by a technological lag and still face the problem of the digital divide. This is observable in statistics on innovation and the development of the digital economy and the information society in EU member states. A PwC analysis conducted at the beginning of the second decade of the 21st century revealed that an increase by 10% in a country's digitisation score fueled 0.75% growth in its GDP per capita. Additionally, the economic effect of digitisation accelerated as the countries moved to more advanced stages of digitisation. Digitally poor economies received the least benefit, largely because they had not yet established an ICT ecosystem that could capitalise on the benefits of digitisation (PwC, 2013, p. 7).

The analysis at the microeconomic level shows that there are significant differences between the digital proficiency of enterprises from the EU-15 countries and those from Central and Eastern Europe. The differences can be measured using a DESI 2019 index regarding the integration of digital technologies. It consists of two components: business digitisation (60% weighted average of the normalised ratio) and e-commerce (40% weighted average). For an in-depth analysis of the digital gap at the microeconomic level, other indicators from the Eurostat database can be included. The Digital Intensity Index (DII) 2019 measures the enterprise's digital development, which is defined by 12 different digital technologies:

- more than 50% of the persons employed use computers with access;
- use of at least 3 ICT security measures;
- maximum contracted download speed of the fastest internet connection of at least 30 Mb/s;
- more than 20% of the employees provided with a portable device that allows Internet connection via mobile telephone networks for business purposes;
- employees made aware of their obligations in ICT security-related issues;
- electronic orders (web or EDI) received from customers from other EU countries;
- use of any social media;
- ERP software package used to share information between different functional areas;
- use of CRM;
- social media used for at least two purposes;
- any computer networks used for sales (at least 1%);
- web sales of more than 1% of the total turnover and B2C web sales of more than 10% of the web sales.

In enterprises of Central and Eastern European countries, the absorption and diffusion of advanced digital technologies is a challenge due to the average level of development of the social macrostructure in these countries and the brain-drain by Western economies, which results in a low level of business digital maturity and an insufficient supply of highly qualified employees.

The low level of digital maturity is primarily noticeable in the SME sector, which, excluding companies in the high-tech industry, is facing difficulties in adopting ICT. Due to high costs, SMEs limit their expenditure on training personnel in the field of digital skills. Enterprises may pay for external IT services, however, despite IT outsourcing, employees in other departments need to understand the concept of digitisation processes and be able to use ICT tools in their jobs (Arendt, 2008).

In the analysis of the digital skill gap at the microeconomic level, attention is paid to the complementarity of individual types of competences. To be effectively digitally transformed, an enterprise must combine general digital skills, i.e. those that are associated with the use of basic ICT solutions in current operational activities, along with specific competences, i.e. those which are based on programming skills, data science, and the use of highly advanced specialised programs necessary for the production of goods and services based on the use of artificial intelligence.

The fields of business activities that require digital skills include (Śledziewska, Włoch, 2015):

- communication within the organisation through digital tools;
- collection, analysis and processing of data sets, including big data;
- creation of virtual teams;
- digitisation of enterprise management processes and customer relations using ERP and CRM platforms.

In the second decade of the 21st century, the OECD carried out an analysis of digital skills (OECD, 2016, pp. 14–15). The analysis allowed a strategic framework to be created for strengthening digital social competences to ensure an appropriate pace of economic growth and social inclusion. This strategy is based on three pillars: 1. educational activities aimed at strengthening digital skills, 2. activities to increase the supply of qualified employees in the area of digital solutions use, and 3. activities stimulating an increase in enterprise demand for digitally skilled workforce. This should allow the enterprise to reach market equilibrium.

In this context, the role of educational government programs should be emphasized, which support society financially and institutionally, as well as the role of enterprises themselves in strengthening digital skills. One should also remember other competencies that are needed in the digital transformation of enterprises, namely skills in the field of critical thinking, problem-solving, and behavioural ones, including communication, leadership, project, and teamwork, which together constitute a set of features essential for digital transformation (Hoidn, Karrkainen, 2014, p. 7).

Therefore, activities for the development of digital skills in line with the idea of lifelong learning, undertaken as part of public-private partnerships, are extremely important. They include cooperation between enterprises and universities in the development of new educational programs and work practices in enterprises. Besides, the non-governmental sector and public institutions, particularly such business environment institutions as business incubators, accelerators, technology transfer – centres and Science and Technology Parks (STPs), play a significant role in the digital transformation process. The improvement in the availability of financial instruments that enable entrepreneurs to finance specialist employee training and purchase advanced ICT solutions also have a significant impact on further digital development.

SYSTEMIC SUPPORT FOR THE DIGITAL TRANSFORMATION OF POLISH ENTERPRISES

In 2018, Poland joined the group of twenty-five developed countries that form the global FTSE Russell classification of equity markets. It is also the first country in the former Eastern Bloc to meet the strict criteria to be recognised as a developed country, such as a correspondingly high economic growth rate and macroeconomic stability. Paradoxically, in 2014–2019, in terms of digital technology integration in

enterprises, Poland was one of the last of all EU countries, including the countries of the Eastern Bloc. In 2017, it was ranked in 25th place among 28 member countries. In 2018–2019, Poland dropped by one place, to 26th place.

The biggest differences in digital development are between SMEs and large enterprises. According to DESI 2019, only 12% of SMEs in Poland sell on the internet, while the EU average is 17% of total sales by SMEs. The turnover from online sales is also low, accounting for 7% of SME turnover in Poland.

The findings of the analysis of the digital skills potential in Poland compared to the developed EU countries have shown that the problem lies primarily in the inadequate system approach to the needs of the modern digital economy. This is particularly visible in the organisation of digital education at high school and university levels. The shortage in this area has been fully revealed by the education situation in March 2020 related to the COVID-19 pandemic, which forced the Polish education system to switch to remote teaching. The difficulties of some teachers, students, and their parents in using web applications such as Microsoft Teams, Zoom, Moodle, or Yammer showed a lack of preparation for functioning in the digital reality of the 21st century. A similar situation occurred with SMEs, which, accordingly, conducted their core business without the aid of digital technologies. As a consequence of the coronavirus pandemic and the announcement of the national quarantine, a significant proportion of SMEs faced the threat of bankruptcy due to the forced shutdown or limitation of their core business activity, while e-commerce SMEs reported an increase in sales volume at the same time (Business Insider Polska, 2020).

In the era of digital technology revolutions, including 5G technology, IoT (Internet of Things), AR (augmented reality), AI (artificial intelligence), Blockchain and Big Data, system support should be focused on developing more advanced digital skills. In Poland, the workforce, especially for the 18–50 year age group, has basic digital skills in the use of electronic office equipment and information retrieval. The competency gap in this age group relates primarily to the use of more advanced computer programs such as Excel, ERM (Enterprise Risk Management), and ERP (Enterprise Resource Planning) systems. Other competencies such as communication competencies, including communication in a foreign language, teamwork and project work are also insufficient to ensure an appropriately high level of competitiveness of Polish enterprises.

In the third decade of the 21st century, the demand for advanced specialists in the field of ICT will also increase, which requires a redefinition of the education system in Poland, following global standards in higher education. The implementation in the Polish higher education system of Act 2.0 is tasked with modernising educational and scientific activities and reducing barriers like the bureaucracy of the grant system and the poor financing for the development of academic staff and scientists. Universities have become outdated with insufficient ICT equipment, which means that the process of educating the future staff of

enterprises cannot be carried out to an adequate level, based on access to virtual tools, simulations and global databases.

In enterprises, especially SMEs, one barrier to the development of digital skills is the bureaucracy required to obtain finance from EU funds and, as entrepreneurs claim, an unfavourable regulatory environment, particularly the tax system, as well as an inflexible labour code. Entrepreneurs emphasise difficulties in obtaining finance and institutional support as the biggest obstacle in the digital transformation. The managerial staff of Polish enterprises are aware of the need for digital development, and this is inscribed in the company's long-term strategy, but it faces two types of problems. There is a shortage of employees with appropriate digital skills in the labour market, while entrepreneurs often cannot afford to develop these competencies as part of the training of their employees. Large companies, especially transnational corporations, are ready to accept employees who lack a high level of digital skills but show intellectual potential and can therefore be easily and quickly provided with appropriate digital skills training. SMEs in this area focus on acquiring digital skills from the market and employing the human capital already in possession of the digital skills required by entrepreneurs.

Considering the reduction of the competence gap as a barrier to the digital transformation of enterprises in Poland, further actions are necessary to shape a friendly institutional environment that supports business. The task for the coming years is to increase the efficiency of the digital ecosystem, based on the triple helix model (Etzkowitz, Leydesdorff, 2000), i.e. cooperation between science, enterprises, and administration (public authority). The ecosystem should cover its operations at the macroeconomic level (education and higher education systems) and the mesoeconomic level (regional innovation centers, technology transfer centers, academic incubators, digital hubs). At the microeconomic level, further support is needed in the form of financing the cooperation between enterprises and scientific staff, practices in enterprises, mentoring programs, and other initiatives based on the principle of public-private partnership.

The key to strengthening the digital economy in Poland is institutional support in shaping digital skills for a competitive and innovative labour market, which at the macroeconomic level should translate into joint programs implemented under the cooperation of the Ministry of Digitisation, the Ministry of National Education, the Ministry of Science and Higher Education, and the Ministry of Development. International partnership is also gaining importance. The Polish government has already made the first steps in this respect, which is joining the EU PRACE project. In 2019–2023 its task is to develop international research cooperation in the field of advanced computer technologies. Another initiative is the strategic partnership signed in April 2020 connecting the National Cloud Operator and Microsoft. Part of this initiative is the creation of the first data processing region in Central and Eastern Europe. The main goal of the partnership is to accelerate the digital transformation of enterprises, education, and public institutions. This is the second strategic partnership

after the agreement with Google signed in September 2019, under which the Google Cloud region is being built, i.e. a hub of technical infrastructure and software for clients from Poland and the region of Central and Eastern Europe. It should be noted that there are extensive actions planned to develop advanced digital skills, including training, workshops, e-learning programs in cloud computing, the use of artificial intelligence and machine learning technologies, and advanced data analytics and the Internet of Things under both partnerships.

On the other hand, strengthening the support at the regional level as part of the support provided by Polish STPs remains a key issue. Out of twenty-two STPs, only three have an organised technology transfer centre (Mażewska, Tórz, 2019, pp. 55–58). Over two-thirds of STPs possess access to specialised ICT laboratories; however, in-depth interviews conducted by the author showed that the management teams had mainly listed servers and 3D printers as specialised ICT equipment. A significant number of the STPs also do not offer specialised training on digital transformation for their tenants, nor other forms of support (e.g. in matching partners on the university-business line; loan funds, etc.) that could help enterprises, especially SMEs, in digital development. There is also a lack of technical and engineering resources for creating Industry 4.0 solutions in the field of the Internet of Things, autonomous robots, simulations, augmented reality, artificial intelligence, and cybersecurity. Changing this state of affairs should, therefore, be a priority in shaping the development strategies for STPs, taking into account the fact that STPs are envisaged as institutions of innovation that support policy and therefore should respond to the strategic current needs of their tenants.

CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

Digital transformation is a serious challenge for Polish enterprises, particularly in the SME sector, considering the barriers in the form of financial and competence gaps. Although SMEs often claim financial barriers are a reason for not undertaking digital transformation, it is possible to overcome them with the help of instruments of financial support from the EU and national funds for innovation and digitisation of business.

That is why the study focuses on the analysis of one of the key barriers to the digital transformation process: the digital skill gap. The statistics related to digital technology integration in European business show that Poland suffers from a lack of properly trained staff who can use ICT solutions in the current operations of an enterprise. As a consequence, this is the prime factor that hinders Polish enterprises from achieving a higher level of digital development and full digital maturity, which is reflected in the dynamics of economic growth and the development of information society.

The problem of enterprises having gaps in both general and specific digital skills should be linked with the issue of the digital divide at the macroeconomic level. Along with technological development, the nature of the digital divide is changing. It currently refers primarily to the phenomenon of social inequalities in the field of digital skills, and no longer just access to the network.

Government programs, the activities of business environment institutions and public-private partnerships have a crucial impact on overcoming the digital gap.

This paper aims to analyse the occurrence and character of this research problem. An undoubted limitation of the analysis is the reliance on secondary data, which does not fully explain the conditions for the development of digital skills in transforming economies. This is a particularly important issue in the context of the dynamic changes that are taking place in enterprises at the threshold of the third decade of the 21st century in the countries of Central and Eastern Europe, as they attempt to bridge the gap between them and those in Western European countries.

Therefore, a justified direction for further research is an empirical analysis of the scope, dimensions, and limitations of support for the digital transformation of enterprises, provided by Polish business environment institutions, principally STPs, which are an instrument of pro-development and pro-innovation policy.

Since there are many studies on digital transformation focused on the application of quantitative methods, there is now a need for qualitative research (a case study of selected Polish STPs and their tenants) based on the use of the triangulation method (in-depth interviews, direct observation, and analysis of internal documentation and artifacts). The assumption of the research is to be of an applied nature and to serve Polish managers of STPs by the provision of more effective support to their tenants in the field of digital transformation.

BIBLIOGRAPHY

- Arendt, L. (2008). Barriers to ICT adoption in SMEs: how to bridge the digital divide? *Journal of Systems and Information Technology*, 10(2), 93–108. DOI: 10.1108/13287260810897738.
- Belz, G., Wawrzyniak, Ł., Wąsowicz, M. (2019). Network Potential of Innovation in Digital Transformation Projects. *Transformations in Business & Economics*, 18(2B (47B)), 694–708.
- Berman, S. (2012). Digital transformation: opportunities to create new business models. *Strategy & Leadership*, 40(2), 16–24. DOI: 10.1108/10878571211209314.
- Business Insider Polska. (2020). Epidemia testuje rynek online. Oto co zamawiamy przez Internet w czasach korona wirusa. Retrieved from: <https://businessinsider.com.pl/finanse/handel/koronawirus-wplywa-na-rynek-online-sklepy-notuja-wieksze-obroty/30g4gsx> (2020.04.15).
- Castells, M. (2002). *The Internet Galaxy: Reflections on the Internet, Business, and Society*. Oxford: Oxford University Press. DOI: 10.1093/acprof:oso/9780199255771.001.0001

- Compaine, B. M. (2001). *The digital divide: facing a crisis or creating a myth*. MIT Press. DOI: 10.1016/S0740-8188(02)00114-7.
- Etzkowitz, H., Leydesdorff, L. (2000). The dynamics of innovation: From national systems and 'Mode 2' to a triple helix of university – industry – government relations. *Research Policy*, 29(2), 109–123.
- European Commission (2015). *A Digital Single Market Strategy for Europe*. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM/2015/0192 final. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex-%3A52015DC0192> (2019.01.04).
- EY. (2019). Redesigning for the digital economy. A study of SMEs in Southeast Asia. Retrieved from: [https://www.ey.com/Publication/vwLUAssets/EY-smes-in-southeast-asia-redesigning-for-the-digital-economy/\\$FILE/EY-smes-in-southeast-asia-redesigning-for-the-digital-economy.pdf](https://www.ey.com/Publication/vwLUAssets/EY-smes-in-southeast-asia-redesigning-for-the-digital-economy/$FILE/EY-smes-in-southeast-asia-redesigning-for-the-digital-economy.pdf) (2019.10.15).
- Friemel, T.N. (2016). The digital divide has grown old: Determinants of a digital divide among seniors. *New Media & Society*, 18(2), 313–331. DOI: 10.1177/1461444814538648.
- Goerzig, D., Bauernhansl, T. (2018). Enterprise architectures for the digital transformation in small and medium-sized enterprises. *Procedia CIRP*, 67, 540–545. DOI: 10.1016/j.procir.2017.12.257.
- Hameed, T. (2007). ICT as an enabler of Socio-Economic Development. Retrieved from: https://www.researchgate.net/profile/Tahir_Hameed4/publication/228618930_ICT_as_an_enabler_of_socioeconomic_development/links/5488d98d0cf268d28f09001b/ICT-as-an-enabler-of-socio-economic-development.pdf (2019.10.20).
- Hargittai, E., Hsieh, Y. P. (2013). Digital Inequality. In: W. H. Dutton (Ed.), *The Oxford Handbook of Internet Studies* (pp. 129–150). Oxford: Oxford University Press. DOI: 10.1093/oxfordhb/9780199589074.013.0007.
- Hess, T., Matt, C., Benlian, A. (2015). Digital Transformation Strategies. *Business & Information Systems Engineering*, 57(5), 339–343. DOI: 10.1007/s12599-015-0401-5.
- Hidalgo, A., Gabaly, S., Morales-Alonso, G., Uruena, A. (2020). The digital divide in light of sustainable development: An approach through advanced machine learning techniques. *Technological Forecasting and Social Change*, 150, 1–7. DOI: 10.1016/j.techfore.2019.119754.
- Hoidn, S., Kärkkäinen, K. (2014). Promoting Skills for Innovation in Higher Education: A Literature Review on the Effectiveness of Problem-based Learning and of Teaching Behaviours. *OECD Education Working Papers, No. 100*. Paris: OECD Publishing. DOI: 10.1787/5k3tsj671226-en.
- Hudson, J. (2003). EGalitarianism? The Information Society and New Labour's Repositioning of Welfare. *Acoustics, Speech, and Signal Processing Newsletter, IEEE*, 23(2), 268–290. DOI: 10.1177/0261018303023002008.
- Kaplan, J. M., Bailey, T., O'Halloran, D., Marcus, A., Rezek, Ch. (2015). *Beyond Cybersecurity: Protecting Your Digital Business*. Hoboken: John Wiley & Son.
- Matt, C., Hess, T., Benlian, A. (2015). Digital Transformation Strategies. *Business and Information Systems Engineering*, 57(5), 339–343. DOI: 10.1007/s12599-015-0401-5.

- Mażewska, M., Tórz, A. (2019). *Raport z badania Parków Technologicznych 2019*. Poznań/Warszawa: Stowarzyszenie Organizatorów Ośrodków Innowacji i Przedsiębiorczości w Polsce.
- Mesch, G., Talmud, I. (2011). Ethnic Differences in Internet access. *Information Communication and Society Communication & Society*, 4, 445–471. DOI: 10.1080/1369118X.2011.562218.
- Morrar, R., Arman, H., Mousa, S. (2017). The Fourth Industrial Revolution (Industry 4.0): A Social Innovation Perspective. *Technology Innovation Management Review*, 7 (11), 12–20. DOI: 10.22215/timreview/1117.
- OECD (2016). Skills for a Digital World. *Working Party on Measurement and Analysis of the Digital Economy*, Committee on Digital Economy Policy, DSTI/ICCP/IIS(2015)10/FINAL. Retrieved from: <https://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf> (2019.10.19).
- OECD. (2019). *Measuring the Digital Transformation. A Roadmap for the Future*. Paris: OECD Publishing. DOI: 10.1787/9789264311992-en.
- Ono, H., Zavodny, M. (2009). Gender and the Internet. *Social Science Quarterly*, 84(1), 111–121. DOI: 10.1111/1540-6237.t01-1-8401007.
- PwC. (2013). *Digitization for economic growth and job creation. Regional and Industry perspective*. Retrieved from: <https://www.strategyand.pwc.com/m1/en/reports/digitization-for-economic-growth-and-job-creation.pdf> (2019.10.20).
- PwC. (2018). *Europe Monitor – Innovation and Digital Transformation: How do European SMEs perform?* Retrieved from: <https://www.pwc.nl/nl/assets/documents/pwc-europe-monitor-innovation-sme.pdf> (2019.10.21).
- Ragnedda, M., Kreitem, H. (2018). The three levels of digital divide in East EU countries. *World of Media. Journal of Russian Media and Journalism Studies*, 1(4), 5–26. DOI: 10.30547/worldofmedia.4.2018.1
- Ramantoko, G., Fatimah, L. V., Pratiwi, S. Ch., Kinasih, K. (2018). Measuring Digital Capability Maturity: Case of Small-Medium Kampong-Digital Companies in Bandung. *Pertanika Journal of Social Science & Humanities*, 26(T), 215–230.
- Robinson, L., Cotten, S. R., Ono, H., Quan-Haase, A., Mesch, G., Chen W., Schulz J., Hale, T. M., Stern, M. J. (2015). Digital inequalities and why they matter. *Information, Communication and Society*, 18(5), 569–582. DOI: 10.1080/1369118X.2015.1012532.
- Schwab, K. (2016). *The Fourth Industrial Revolution: what it means, how to respond*. Geneva: World Economic Forum.
- Śledziewska, K., Włoch, R. (2015). *(Un)Digital Poland: The Gap in the Digital Skills of Human Capital*. In: Proceedings of the ENTRENOVA – ENTERprise REsearch INNOVATION Conference, (pp. 415–421). Kotor, Montenegro, 10–11 September 2015. Zagreb: IRENET – Society for Advancing Innovation and Research in Economy.
- Teichert, R. (2019). Digital Transformation Maturity: a Systemic Review of Literature. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 67(6), 1673–1687. DOI: 10.11118/actaun201967061673.
- van Dijk, J. (2006). Digital divide research, achievements and shortcomings. *Poetics*, 34, 221–235. DOI: 10.1016/j.poetic.2006.05.004.

- Witte, J. C., Mannon, S. E. (2010). *The Internet and Social Inequalities*. New York: Routledge.
- World Bank (2016). *Digital Dividends*, World Development Report 2016. Retrieved from: <http://documents.worldbank.org/curated/en/896971468194972881/pdf/102725-PUB-Replacement-PUBLIC.pdf> (2019.10.25).
- UNCTAD. (2019). *Digital Economy Report 2019 – Value Creation and Capture: Implications for Developing Countries*. Geneva: United Nations Conference on Trade and Development.

Summary

The digital transformation of an enterprise is an extremely complex issue, which involves modification of the traditional model and business processes through the use of ICT solutions. The transfer of operational activities from the analog to the digital sphere enables new production and distribution methods, better interactions with the customer and the production of digital goods and services. Therefore, digital transformation, as a key issue for enterprises, should play a central role in their development strategy.

In the world of artificial intelligence, based on self-learning algorithms and global data flows, appropriate workforce skills are necessary for the effective implementation of a digital strategy. The skill gap, resulting from a lack of proper vision, knowledge, skills and experience, is the main reason for the lack of success in the process of the digital transformation of SMEs. It is also significant with respect to ensuring faster economic growth and the process of social inclusion.

The purpose of the study is to outline the importance of the issue of reducing the digital gap, which is one of the important competence gaps for conducting effective digital business transformation at the threshold of the third decade of the 21st century, and to present solutions of systemic support for the development of digital skills in Polish enterprises.

The findings of the analysis are as follows: in order to reduce the gap in digital skills, it is necessary to strengthen extensive cooperation within the triple helix, to include public-private partnerships based on coordinated actions undertaken jointly by enterprises, science, and public administration. Science and technology parks (STPs) should play a special role in this respect. However, for this assistance to be effective, it is necessary to prepare the managerial staff for the construction and, above all, implementation of an appropriate support strategy related to STPs for the digital transformation of their tenants.

Keywords: digital divide, digital maturity, digital skills, digital transformation.

Wsparcie cyfrowej transformacji biznesu i rozwoju cyfrowych kompetencji na rzecz wzrostu gospodarczego i społecznej inkluzji w Polsce: badania wstępne

Streszczenie

Cyfrowa transformacja przedsiębiorstwa jest zagadnieniem niezwykle szerokim, obejmującym zmiany tradycyjnego modelu i procesów biznesowych przy wykorzystaniu rozwiązań ICT. Przeniesienie działań operacyjnych ze sfery analogowej do cyfrowej, umożliwi nowe sposoby produkcji oraz dystrybucji, pozwala na lepszą interakcję z klientem oraz produkcję cyfrowych dóbr i usług. Cyfrowa transformacja zatem, jako bardzo aktualna i bardzo ważna kwestia, powinna zajmować istotne miejsce w strategii rozwoju przedsiębiorstw.

W świecie sztucznej inteligencji, opartej na samouczących się algorytmach i globalnych przepływach danych, coraz większego znaczenia nabiera kwestia odpowiednich kompetencji kadry, które potrzebne są do efektywnej implementacji strategii cyfrowego rozwoju. Luka kompetencyjna, rozumiana jako brak istotnych z punktu widzenia celów organizacji, wiedzy, umiejętności i doświadczenia, stanowi główną przyczynę niepodjęcia bądź nieudanego procesu cyfrowej transformacji przedsiębiorstw, w tym zwłaszcza MSP. Prezentuje ona również kluczowe znaczenie z punktu widzenia zapewnienia szybszego tempa wzrostu gospodarczego i procesu społecznej inkluzji.

Celem opracowania jest syntetyczne nakreślenie znaczenia kwestii redukcji luki kompetencji cyfrowych, która stanowi jedną z istotnych luk kompetencyjnych dla przeprowadzenia efektywnej cyfrowej transformacji biznesu u progu trzeciej dekady XXI wieku, oraz prezentacja rozwiązań systemowego wsparcia rozwoju kompetencji cyfrowych w polskich przedsiębiorstwach.

Wnioski płynące z przeprowadzonej analizy są następujące: w celu zmniejszenia luki w kompetencjach cyfrowych potrzebne jest wzmocnienie szeroko zakrojonej współpracy w ramach potrójnej helisy, która będzie obejmować partnerstwo publiczno-prywatne, w tym skoordynowane działania, podejmowane wspólnie przez sektor przedsiębiorstw i nauki oraz administrację państwową. Szczególną rolę w tym zakresie mają do odegrania parki naukowe i technologiczne. Aby jednak pomoc ta była efektywna, konieczne jest przygotowanie kadry menedżerskiej do budowy i przede wszystkim implementacji odpowiedniej strategii parku w zakresie wsparcia cyfrowej transformacji jego lokatorów.

Słowa kluczowe: luka cyfrowa, cyfrowa dojrzałość, cyfrowe kompetencje, cyfrowa transformacja.

JEL: O32, O33.