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Digitalization along with 5G and 6G Networks – Determinants and Consequences

Abstract

Digitalization is a process which enters all areas of human, business, and social activity. It is a significant megatrend in business transformation. It serves as a source of innovation, a tool for value creation, and an infrastructure facilitating access to the Internet. It is a necessity when living in the network society, as it allows for greater flexibility in reacting to the changing environment. Digitalization involves communication, distribution, products, and services. It brings specific benefits to organizations operating in the network society. It is the major source of innovation, as well as the essence of technological development of the industry, therefore, further development of digital business might be expected. 5G and 6G networks are a requisite condition for Polish enterprises to join global production and service networks. Furthermore, these networks create opportunities for development in the field of economy and in the social sphere. The development of digitalization along with 5G and 6G networks raises both hope and concern, hence entailing an urgent need to raise public awareness in this respect as well.

The aim of the article is to illustrate the role, importance, determinants, and consequences of digitalization for organizational management in the network society. In the face of a rapidly changing environment full of hazards and uncertainty, digitalization emerges as a way of conducting business, which enables companies

to reach a greater number of customers and improve operational efficiency. The article also refers to the determinants and consequences of 5G and 6G networks. The applied research methods include an extensive analysis of the existing literature and inference based on the data available.

Introduction

The 21st century is the era of economy based on knowledge, information, and communication technologies. To an increasing extent, work processes are being computerized and oriented towards digitalization and the creation of cyber-physical processes. Knowledge workers and IT-savvy employees are growing in importance (Drucker, 2002). Scientific and technical progress, particularly dynamic in the field of IT solutions, has a bearing on the changes in processes related to organization and management. Moreover, the use of IT systems in the provision of many traditional and new services significantly improved customer access and reduced the average handle time (Wilkowski, 2013). Digitalization is the process of transforming a signal from the analogue domain to the digital domain. Digitalization is also a set of activities aimed at replacing devices applying analogue technology in technical systems with digital ones. Digitalization means the conversion of a record for further storage, processing, and transmission of data in a written, printed audio form or in the form of analogue recording into a digital format (Pisarek, 2006, p. 32). The impact of digitalization on business activity is particularly important in the Information Age and the network economy, as reflected in the improved organizational efficiency, reduced operating costs, and enhanced quality of customer service (Paliszkiewicz, 2020, pp. 7–10). Digitalization is a process influencing almost every sphere of human and societal activity (Buła & Nogalski, 2020). Even though digitalization is being widely applied at the stage of project development and project assumptions in almost every field, several barriers remain at the conceptual and technological stages, inhibiting the identification of the most effective ways of implementing the process of digital transformation. The aim of the article is to indicate the role, importance, determinants, and consequences of digitalization for organizational management in the network society. In the face of a rapidly changing environment full of hazards and uncertainty, digitalization emerges as a way of conducting business, which enables companies to reach a greater number of customers and improve operational efficiency. Moreover, the work endeavours to present the subject, significance and evolution of the 1G to 6G networks. The advantages and threats related to 5G and 6G networks are referred to as well. The applied research methods include an extensive analysis of the existing literature and inference based on the data available.

Digitalization in management and its importance in the contemporary world

The analyses presented by McKinsey indicate that digitalization ought to be understood as "a way of doing things", simultaneously depicting how managers describe digitalization, namely (Dorner & Edelman, 2015): equating digitalization with technology, digitalization as a way of reaching customers, digitalization as a new way of doing business. Moreover, referring to digitalization in relation to enterprises, Dorner and Edelman emphasize that digitalization enables the creation of values in new business realities, creates value in the processes which endeavour to apply the concept of customer experience management (CEM) and creates the basis for building fundamental capabilities that can support the entire structure of an enterprise (Pluciński, 2015).

Digitalization in management is associated with the increasing adoption of digital technologies to achieve business objectives. Digitalization creates a new perspective for business associated with the possibility of opening onto diverse, more efficient ways of conducting business activities (Pluciński, 2015). The intensified rate of development in the field of digitalization processes entails the need for new, current knowledge and specific competences, along with distinct, more modern working methods. Digitalization processes necessitate the acquisition of new skills which translate into a search for effective ways of acquiring knowledge. Determination and adequate resources are essential in the processes (Laskowska-Rutkowska, 2020).

At present, it is required that business entities are able to quickly analyse the current situation, respond adequately to changes in their environment, and adapt to them. New applications based on information systems and technology prove helpful in this regard (Gajewski, Paprocki, & Pieriegud (Eds.), 2016).

The extensive use of information technologies in all areas of human, business and social activity entails changes in the approach to management as well (Ross, 2011). These changes relate to time management, managing the future, and self-management. The developments in digitalization apply to all areas of activity and management.

Digitalization encompasses all areas of life and business activity, including human resource management in the organization. These processes will further intensify. The analyses conducted by numerous research centres show that I.A. HR analytics will be widely applied by the year 2025, which in turn will affect performance and decision-making processes at the strategic and operational level of the organization (van den Heuvel & Bondarouk, 2017). Therefore, the education system, including vocational training and university education, ought to be changed as well to prepare young people to work in new conditions and in modern organizations. It is particularly important in the face of a volatile environment filled with uncertainty, risk, chaos, and lack of business continuity.

Digital resources applied within the organization play a significant role in the digitalization process, frequently taking the form of a data warehouse and comprising data from various sources, saved in a uniform structured electronically readable

format, which may be accessed by various user groups through standard interfaces. The digital asset management system, its elements, and their relationships are presented in Table 1.

Table 1. Digital asset management system

Digital asset management system				
		Metadata		Administrator
Documents	Digitalization	Digital assets		Functions: – user registration – defining passwords – defining processes – granting access – *ad hoc* printouts – export/import
Multimedia (audio, animation, video, virtual reality, graphics)	Digital processing		– viewing – sharing – conversion to a new format	– persons/groups – companies – e-office – virtual societies
Electronic documents	Electronic Data Interchange (EDI)		archiving	Information system incident reporting: – incident archiving – document processing – document history – accessing the incident history
Group work	Cooperation			
Corporate databases	Data extraction			

Source: (Drążek & Komorowski, 2015).

Table 2 compares the characteristics of the information society and the digital society.

This comparison was made with reference to resources, economy, people, education, and prevailing technologies.

Table 2. Digitalization of the information society

Element or area	Information society	Digital society
Relevant resource	Information, knowledge	Any digital content
Economy	ICT sector	Using the potential of ICT in all areas of the economy
Human	Expert	Network cooperation of professionals and "non-professionals"
Education	Informatics	Application of techniques and technologies in every area of education
Technique/technology	Information technologies, computers	Teleinformation technologies and the so-called e-devices or smart devices

Source: (*Polska 2030. Trzecia fala nowoczesności. Długookresowa strategia rozwoju kraju*, 2011).

Developments in the field of digitalization bring specific benefits which relate to the features of quality related to IT-enabled services (see Table 3).

Table 3. Features of quality related to IT-enabled services

Feature of service	Features of quality associated with IT-enabled services
Responsibility	– service punctuality – immediate provision of service – service time
Reliability	– provision of services with due diligence – abiding by service agreements – availability of service – service reliability
Credibility	– service solves customer problems – relevance
Personnel competencies	– ability to answer customer questions – quick problem solving – politeness – attentive and friendly customer service staff
Availability	– telephone availability – accessible organizational entities and units – website accessibility – communication accessibility
Personalization	– service oriented towards meeting customer needs and tastes
Security	– confidentiality of processed and transmitted information – respect for privacy and data protection policy
Appealing device design	– visually appealing website – eye-catching graphics – proper layout
Simple to use IT system	– easy navigation – effective navigation – functionality – adequate distribution of information – facilitated website navigation – minimum requirements concerning customer information
Flexibility of the information system	– compatibility with other systems – possibility to choose how the service is provided, e.g. information retrieval
Quality of information	– adequacy of information – accuracy of information – usefulness – up-to-date – timeliness

Source: (Dobrowolski & Dobrowolska, 2015, p. 54).

As can be seen from the information provided in Table 3, the characteristics that characterise service quality are multiple, and they affect the quality of IT-assisted services provided.

The biggest challenge of digitalization is to create a positive workplace culture and management competence. Although technology and finance are relevant, it is the human capital that is the most important factor driving the digitalization process. Digitalization is a significant megatrend in the transformation of enterprises,

it is a digital form of reality. One might observe a change in the approach to the management of manufacturing processes in accordance with new principles and paradigms such as agile resilience and risk minimization. Despite the many years of the digitalization process, it is difficult to clearly define it, as it is used in many contexts. According to the Ministry of Digitalization, the Digital Poland Programme identifies three relevant areas (Nowak, 2019):

- the first area includes broadband infrastructure enabling access to high-speed Internet,
- the second area refers to undertakings which increase the number and scope of publicly available services accessible by electronic means,
- the third area covers projects encouraging people to use the Internet and improving their digital skills.

Digitalization is a strategy aimed at using the best solutions to take advantage of the potential behind digital resources. Given the complexity of digitalization, it is also one of the most important stages in the development of an organization, entailing such complex processes as, e.g., the introduction of digital document workflows.

Digitalization emerges as a kind of evolution in the computerization of a company since it allows all its components to merge into one functioning mechanism. Every form of digitalization is certainly a unique and unrepeatable journey, also known as *transformation*. Therefore, the notion cannot be contained within nor limited to a single product or service. Even though digitalization is being widely applied at the stage of project development and assumption in almost every field, several barriers remain at the conceptual and technological stages, inhibiting the identification of the most effective ways of implementing the process of digital transformation. The greatest extent of digital transformation in Poland was observed in the financial sector.

Based on the literature available, it may be indicated that digitalization has various facets and applications (Table 4).

Table 4. Aspects of digitalization

Digitalization	Ways of understanding digitalization
Megatrend	Megatrend in business transformation
Form of reality	Digital reality
Source of innovation	Interface for generating innovation in the organization
Digitalization	Change from analogue to digital
A value creation tool	An instrument enabling value creation in a new business reality, as well as value creation in processes
A reactive tool	An instrument helpful in reaction to the changing immediate and distant environment
A prospect for changing ways of working	An opportunity to introduce more modern and efficient ways of working
Infrastructure	Broadband infrastructure enables access to high-speed Internet
The essence of technology	The core of industrial development
Strategy	Enabling the application of the best IT solutions in the e-organization

Digitalization	Ways of understanding digitalization
Mode of action	A new way of doing business in the network society
Development stage of the organization	An important stage in the development of the organization is enabling the application of the latest IT developments
Evolution	A shift towards increased use of computerization in the enterprise
Necessity	Digitalization creates opportunities for skilful adaptation to the changing environment of the network society

Source: Author's own elaboration.

A review of the terms of digitalization included in Table 4 proves the different approaches to understanding this problem. There is still a lack of unambiguous definition of this term in the literature and in the practical activities of enterprises.

Two waves may be distinguished in the development of digitalization. The first wave occurred at the turn of the 20th and 21st centuries when websites were developed, and Internet access was popularized. The second wave is associated with the emergence of new technologies and a change in customer behaviour reflected in the increased use of technology, the growing interest in social media, and service provider – customer interactions shifting from the real to the virtual world. The following trends were distinguished within the second wave of digitalization development (vor dem Esche & Hennig-Thurau, 2014, pp. 10–11):

– digitalization of information – which is related to the digital storage and processing of information in terms of understanding consumer behaviour,
– digitalization of communication – focused on different types of digital communication,
– digitalization of distribution – related procurement processes and product delivery with the use of digital technologies,
– digitalization of products and services – related to the use of digital technologies in production processes.

When referring to digitalization, it is important to pay attention to other important terms such as:

– digital revolution, because the processes are happening extremely fast,
– digital transformation, changing structures, processes ways of digitalization,
– digital readiness, being ready for a new world, it is more of an attitude, openness, readiness, and willingness rather than having skills, it is a willingness to work with technology and to adapt quickly to changes.

Digitalization of an organization are specific technological solutions that help companies adapt to the changing economic environment. Nowadays, digitalization is a must for every company. Today's world needs such competencies as the need to learn and develop (learnability), agility, and curiosity – openness to change.

Digitalization will have an increasing impact on organizational development solutions and creating new jobs. There are already senior management positions such as (Rickards, Smaje, & Sohoni, 2015):

– CEO (Chief Executive Officer),

  - CTO (Chief Technology Officer),
  - CDO (Chief Digital Officer) as Member of the Board responsible for the digitalization processes.

Advantages of digitalization in the network society

"Digitalization" and "computerization" are terms frequently encountered in the network society. The network society functions within the information society for which information is the primary material and where technology has an all-encompassing influence, network logic dominates and technological convergence occurs (Castells, 2007, pp. 79–80). The presence of network communication technologies, the distribution of information and knowledge, as well as the proliferation and institutionalization of these practices influence the creation of the network society. Consequently, on the economic level, the network society is based on the transfer of information, human experience is not limited by time nor space, whereas network access and information flow control enable people to yield and exercise power (Skrzypek, 2020, pp. 15–16).

Information technology has an impact on (Olszak & Ziemba, 2007, p. 32):
  - creating new ways of designing organizations and new organizational structures, especially network ones,
  - creating new relationships between the company and stakeholders due to network communication,
  - the development of e-commerce which reduces costs and delivery time as well as facilitates supplier – customer communication,
  - efficiency improvement concerning production and service provision,
  - changes in industry structure and competition,
  - developing mechanisms for knowledge acquisition and work coordination in smart organizations,
  - the development of efficient knowledge workers,
  - unfettered communication between managers via computer networks,
  - the possibility of launching and operating a business in the global economy.

For some, digitalization means the installation of a computer in a company, while for others it refers to the use of a wide spectrum of different devices combined in various structures and achieving objectives. These may relate to either smartphones or tablets, as well as complex server infrastructures and cloud-based technologies, or numerous sensors which continuously monitor company operation parameters (Rojek, 2016).

Furthermore, the question arises as to what aspects should be considered for the digital transformation to succeed (Rojek, 2016). The goal of digitalization is not to implement information technologies, but rather to properly apply them. Business analysts often refer to digitalization in the context of changing the company's business model to take advantage of new revenue generating opportunities, e.g., the possibility

of entering new markets or reaching new customers. Another relevant issue concerns measuring the aforementioned success. In this regard, return-on-investment (ROI) is still one of the most substantial indicators. At the same time, the digital transformation very often fundamentally changes business activity. Therefore, other aspects should also be considered when assessing its effectiveness, e.g., the creation of new distribution channels or the impact of team work on company performance. What is more, choosing the right solution architecture plays an essential role in the digital transformation as well. The most effective strategies assume that company activities should always be customer-oriented with focus placed on customer engagement, satisfaction, and loyalty.

Digitalization ought not to be associated only with technological developments applied in enterprises. Modern businesses should treat digitalization as a necessity, a facilitator of effective adaptation to the rapidly changing environment. This approach may take two forms:

- passive: related to the transformation of the management system,
- active: focused on the adoption of technologies aimed at improving operational activities.

Progressive digitalization triggers an increase in the use of social media platforms, data analytics, cloud computing, and intelligent production systems (Kijek, Angowski, & Skrzypek, 2020, pp. 9–17).

It is a fact that in management you calculate whatever may be computed or estimated. Thus, one might ask whether it is possible to measure the extent to which digitalization affects an organization. The Digital Economy and Society Index (DESI) serves as an example of how to traditionally measure the degree of digitalization and digital performance of the society. With reference to a given country, it is calculated as follows (Kulisiewicz, 2015):

Connectivity x 0.25 + Human capital x 0.25 + Use of Internet services x 0.15 +
+ Integration of digital technology x 0.2 + Digital public services x 0.15

The impact of digitalization on an enterprise may be measured in a similar manner. Based on the conducted research, McKinsey measured the degree of digitalization in 150 companies around the world, which evaluated 18 practices in digital strategy, capabilities, and culture. As a result, the digital maturity assessment metric was developed, also known as the Digital Quotient, or DQ. The study points to the need to create a clear digitalization strategy, adapt organizational structures and processes, and develop a distinct organizational culture (Catlin, Scanlan, & Willmott, 2015).

When referring to digitalization, it is impossible not to refer to digital transformation, which is a cultural change, a change in the way we operate, and provide value to customers. It is an inevitable process in a digital environment. Digital transformation cannot be equated with digitization. It should be a fundamental component of the strategy of any company that wants to stay on the market. The need to incorporate technology into the strategy is becoming a necessity. There is a need to rethink the

structure and the role the company wants to play in the business, to articulate the strategy and to gain support and backing.

Digital transformation is a specific change in an organization, which results in the penetration of digital technologies in all aspects of the organization's operation, and its results are the integration of digital technologies and business processes leading to a new model of functioning of the organization, which has digital technology at its core. It is the integration of digital technology into all areas of a company's functioning, which makes it possible to use the collected data to create innovative services and expand the existing offerings. Digital transformation forms the basis for the creation of new concepts of economy functioning (Pieriegud, 2016, pp. 11–14) such as Industry 4.0, Automotive 4.0, Logistics 4.0, Quality 4.0, Customer 4.0 (Gawrysiak, 2008, pp. 7–16). Digital transformation as an element of the fourth industrial revolution, is defined as a digital integration of biological and physical systems, which includes organizational and technological changes. Digital transformation is a process of change, with the ability to cross boundaries, and the involvement of business partners (Sutter & Ballard, n.d.).

Digital transformation has a significant impact on the way organizations are managed. Entrepreneurs managers need to rethink existing operating models, experiment with digital solutions, respond quickly to customer expectations, and adapt to major solutions despite financial challenges and lack of competencies. Digital transformation involves the introduction of innovation, a new culture, new business models that include the digitization of resources, and the increased use of technologies that improve the comfort of stakeholders. It is necessary to support human intellectual capacity, which is the essence of the digital breakthrough (digital transformation) and computer software is the necessary instrument of digitization, the role of information management is growing. The degree of development of technology directly affects the ability of people to process information.

It is necessary to solve problems related to budgeting and lack of qualified staff, to include new solutions in business processes, it is necessary to realize that digital transformation is not an alternative but a condition for the survival and development of a company.

In this transformation, it is important to integrate digital technologies and business processes and not to solve single business problems with digital technologies. The results of digital transformation are new types of organizations, new business models based on digital resources rather than physical ones (digital information is a production potential).

Digital transformation is a change, it is a human problem involving trust. True digital transformation is accompanied by risk. It can lead a company into an era of good work, better quality of life, but it also carries the risk of skill gaps, growing inequality, and polarisation in the world of work. In addition, a comprehensive workforce change and innovation strategy is needed. Digital transformation puts the onus on the company to learn, improve, and adapt (Swanson, 2018).

The essence and scope of the 5G network – myths and reality

For decades, digitalization has been the driver of over 60% of all innovations, since it constitutes the basis of the technological development of the industry. It provides a technical means for commercialization of developments in the field of artificial intelligence. One might expect further development of digital business in the coming years. As far as digitalization of manufacturing is concerned, it ought to be based on networking and the use of artificial intelligence algorithms facilitating the transition to Industry 4.0 business models. Since Polish companies must join global production and service networks, it will be difficult to develop Industry 4.0 without access to the 5G network. Access to the newest technologies, including 5G, enables meeting expectations in the field of economy and in the social sphere (ways of working) due to the provision of electronic communication services which cannot otherwise be implemented using the capacity and capabilities of the existing networks. It is estimated that 5G will have a greater impact on the modern world than the combined impact of the steam engine, the electric motor, and the computer.

Due to the growing fears and concern related to 5G, it is necessary to raise people's awareness concerning the significance and impact of 5G on their lives, society, and economy (Twaróg & Mieczkowski, 2019, pp. 1–42). Only through gaining knowledge about the 4.0 field, globalization, Customer 4.0, Quality 4.0, Standardization 4.0, 5G networks, and Society 5.0 can one comprehend these phenomena. Thus, it is crucial to spread this knowledge and reach a wider audience.

5G (where "G" stands for "generation") is the latest mobile network standard, the fifth generation of mobile technology replacing 4G/LTE. The 5G network is a way to modernize and expand what we already have, i.e. optical fibres, transmission towers, poles, and technical solutions in the field of teletechnical sewage systems. This is a complex new technology but based on the already applied physical layer fundamental principles. 5G in comparison with 4G allows for higher speed and more stable connections with lower latencies, which are down to 4 milliseconds, whereas in 4G it is 50 milliseconds. 5G refers to non-ionizing radiation, lower frequency and longer wavelength than ionizing radiation (X-rays, gamma rays, and ultraviolet light). 5G networks are designed to minimize transmitter power and not to affect the body temperature of living organisms, including humans. 5G will be able to support a greater number of devices, up to 1 million devices per 1 square kilometre. It is estimated that in 2020, approximately 5.5 billion people with 50 billion devices will use mobile networks worldwide. 5G network solutions are costly, however, there is a growing conviction that the 5G network and optical fibres are the backbone, the circulatory system of the modern economy. According to specialists, 5G should lead to an increase in work efficiency, free people from tedious and time-consuming activities, reduce the costs of goods and services, improve security, quality, and comfort of life (Twaróg & Mieczkowski, 2019, pp. 1–42).

5G is a promise of tremendous changes which will facilitate further development of Internet of Things (IoT), smart homes, augmented reality (AR), virtual reality (VR), or connected cars (Ignar, 2019). 5G is the generation of mobile telecommunications networks. It is the fifth-generation mobile network. The technology has been developed for several decades – currently we are using the 4G network. The use of the 5G network is conditioned upon having a device to meet specific capability requirements and standards. 5G compatible smartphones and modems are already available on the market. There is already a 5G network in Poland launched by Plus, available in seven cities: Warsaw, Gdańsk, Katowice, Łódź, Poznań, Szczecin and Wrocław. It interconnects over 900,000 citizens (Jaroszewski, 2020). The four biggest Polish mobile network operators are already moving towards the technology, implementing 5G networks. The 5G technology may be applicable to the IoT, automotive industry, transport, and entertainment.

According to the report *The State of 5G Deployments* prepared by Viavi Solutions, residents of 378 cities in 34 countries, including Poland, have access to 5G communications (Grendys, 2020). The 5G network will allow for millions of additional devices to be connected to the Internet, including the IoT, which, in turn, will foster the development of intelligent industries, smart cities, and intelligent transport. The main applications of 5G networks include mass connectivity between devices, connectivity with barely any network latency, and wireless broadband technologies. Reduced latency and delays in the transmission of information will also make it possible to automate the medical and transport sectors.

The document published by the Ministry of Digitalization entitled *5G Strategy for Poland* presupposes research on the impact of exposure to electromagnetic radiation emitted from telecommunications stations on human health. Thus far, the WHO has not confirmed any causal link between disease occurrence and the use of wireless technologies.

The International Telecommunication Union (ITU), in accordance with the IMT 2020 specification, indicated the following 5G features:
− peak data rate of 20 Gb/s for download and up to 10 Gb/s for upload,
− the latency is up to 4 milliseconds and possibly down to 1 millisecond,
− connection density – up to 1 million devices per 1 square kilometre,
− reliability – providing satisfactory service to users travelling at a speed up to 500 km/h.

5G networks operate in conjunction with 4G but will gradually replace them. 5G will give access to lightning-fast transfer speeds of ever-increasing amount of data, generate new ideas for development, and contribute to revolutionizing many industry sectors as well as daily life. 5G will change the approach to device management, introducing flexibility in network design and expansion, prevention activities, and smart logistics optimizing supply chain processes. The new generation of networks will affect business operations and customer behaviour, as well as foster service innovation. According to a report by 5G Americas in the US, the number of active

connections in the first quarter of 2020 increased by 300% compared to the last quarter of 2019, despite the COVID-19 pandemic.

The level of radiation exposure from 5G antennas will be lower due to the higher density of 5G power transmitter deployment when compared to the 4G antennas, reducing the latency from 30 milliseconds to 1–4 milliseconds. This will provide for real-time interactivity and data communication. In 2024, there may be over 4 billion interconnected devices supported by the network around the world (Stój, 2020). The situation sparks hope, at the same time raising concern.

1G to 6G network development (*4G, LTE, 3G…*, 2017)

The 1G network, the first generation of wireless cellular technology, was introduced in the early 1980s. It was based on analogue technology, no longer used by mobile network operators.

The 2G network is the world's first fully digital mobile network, launched in 1991. This infrastructure is used on this day (enabling, e.g., the sending of text messages, or SMS).

The 3G network resulted in a revolution in mobile technology, with the first network launched in Japan in the year 2001. It supports transmission speeds of up to 14 Mb/s. The 3G network in Poland encompasses 90% of the country's territory with nearly 99% population coverage.

The 4G network was first used in 2009 in Scandinavia, facilitating the transmission of data at the speed up to 300 Mb/s. 4G technology is often referred to as LTE, since "Long Term Evolution" is the name of the transmission standard used by 4G networks. 4G – LTE is a technology undergoing constant development.

Rapid development of the 5G network began in 2017, when Talia, Ericsson and Intel launched the first real-time 5G network in Estonia and Sweden. The first tests of the commercial services were launched in Tallinn and Stockholm. The 5G network is a natural evolution and extension of the 4G. According to the EU, the introduction of 5G technology is likely to create over 2 million jobs across the EU (Krawczyk, 2019a).

Furthermore, scientists are currently working on the 6G technology which will reshape the world at the end of the 21st century (Krawczyk, 2019a). It is predicted that thanks to the 6G network, holograms and cross-real and digital twin technologies will be deployed, creating a new standard of offered services (Grendys, 2020). 6G will be based on XR technology, which needs 500 Mb/s, and will enable the display of three-dimensional holograms of objects and people complete with body language and facial expressions presented in real time. It is important to consider the importance of the digital twin technology, as it will allow users to work with projects and devices without direct contact. It will also foster the development of telecommunications services, e.g., streaming of high-quality video. Ultra-reliable low-latency communication (URLLC) might play an integral role in ensuring safe

human–machine cooperation. Such development could enable mass data transfer between devices in high-density networks, across IIoT (Industrial Internet of Things) and IoT. 6G technology intends to implement AI in its network, which, in turn, should facilitate access to infrastructure and build long-term trust in digital technology.

Other studies suggest that 6G will offer data transfer rates expressed in terabits per second (Tb/s), where 1 terabit equals 1,000 gigabits (Persona, 2019). Data transmission latency will be reduced to 0.1 ms, the frequency will be raised from 100 GHz to 3 THz, leading to a post-smartphone era. Marcus Weldon predicts that 6G will merge reality and the digital world mixing physical, biological, and artificial intelligence systems (Krawczyk, 2019b).

In Poland, an enterprise Polskie 5G is to be established, with the State Treasury or a state-owned company as the dominant shareholder. A memorandum on the analysis of the business model of Polskie 5G was already signed at the Ministry of Digitalization headquarters. The goal is to grant access to 5G services to all users in Poland. Relevant agreements were concluded by the Polish Development Fund, the state-owned telecommunications operator EXATEL, and commercial operators, including Orange, T-Mobile, and Polkomtel on 28 October 2019. Further developments in the field have been continuously under way since then.

Conclusions

The concept of digital society implies the influence of digital technologies and network communication processes on all spheres and levels of social, economic, and cultural life, which due to technological changes, gain a digital dimension. Therefore, the evolution of the digital society has a significant impact on the development potential and creates opportunities for improving organizational maturity (Skrzypek, 2019). The inevitable progress of digitalization and the emergence of more advanced information and communication technologies means that society ought to continuously adapt to the rapidly changing environment. The use of digital technology has caused the advent and increased adoption of social media platforms, data analytics, cloud computing, and intelligent production systems. Digitalization against the backdrop of the network economy era means that the process of education, human development, and e-skills, i.e. the set of digital competences acquired through the adoption of the newest advancements in information technology, will constitute an investment which could enhance the strategic potential and improve efficiency. Children born after 2010 will work in the Economy 4.0. One should not be misled into thinking that machines might one day replace people, for machines are not and will never be people. However, one should rather assume that machines may relieve people by doing work for them. Machine learning and artificial intelligence are considered as a form of knowledge construction which may provide guidance in informed decision-making. This knowledge, based on information and data, should lay the foundation for making good business

decisions (Jain & Jain, 2020, pp. 644–652). Artificial intelligence as a science and technology allows for programming machines in such a way that they behave like humans do. Intelligent machines can perform many tasks, automate processes, and can learn systematically and control various processes (Yano, 2012, pp. 42–47). It should be expected that the digital business will undergo further development in the coming years. The essence of production digitalization ought to lie in the networking and the application of artificial intelligence algorithms aimed at transformation towards Industry 4.0 business models. Since the 5G network drives the development of Industry 4.0, it would be difficult for Polish companies to join global production and service networks without it. According to the forecasts prepared by Samsung experts along with the scientific and technical work done by Japanese and Chinese specialists, it is estimated that the next generation, or the 6G network, will be launched in 2028. Intensive research conducted facilitates the transformation process, the transition from 3G to 4G lasted 15 years, whereas the shift from 4G to 5G took only 8 years.

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