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THE IMPACT OF DIGITAL TRANSFORMATION ON CHANGES IN BUSINESS MODELS. WILL COVID-19 ACCELERATE CHANGE?

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Purpose: Technological changes determined by the development of Industry 4.0 significantly change the business models of modern organizations. The Covid-19 pandemic is also influencing changing organizational systems and dynamic progress in technological transformation. The main purpose of the paper is to present the impact of digital transformation on changes in business models and to answer the question if Covid-19 will accelerate change.
Design/methodology/approach: The paper contains the literature review on business model concept, Industry 4.0, Digital Transformation and Covid-19. In this paper the empirical study is also presented. The main research problem was to determine the impact of the digital transformation (technological progress) following the Covid-19 pandemic on changes in the business models of Polish enterprises and public sector institutions.
Findings: A research confirmed that the digital transformation (processes connected with digitization, automation, robotization and artificial intelligence) resulting from the Covid-19 pandemic has had an impact on the business models of both Polish enterprises and public sector institutions. The research also confirmed a discrepancy between the opinions of experts and management when it came to assessing the impact of technological progress associated with Covid-19 on the business models of the surveyed organizations.
Originality/value: The presented work is an important contribution when it comes to the post-pandemic economic reality. Paper assesses the impact of technological progress induced by Covid-19 on changes in the functioning of individual processes, which can be an important guide for management practitioners, helpful in implementing modern technological solutions in organizations.

Keywords: digital transformation, management, pandemic, managerial change.

Category of the paper: Research paper.

1. Introduction

The unprecedented pace of technological change (Liu &Vasarhelyi, 2014), progressing digitalization and "datafication" (Lycett, 2013) in the business world, the confluence and fusing of digital and physical technologies (Baheti & Gill, 2011; Poovendran, 2010; Schwab, 2016) and the growing interconnectivity of tools and machines (Lee, Bagheri &Kao, 2015; Strange & Zucchella, 2017) that shape the present business landscape have created a broad range of challenges and opportunities that are transforming firms, business processes and the very nature of competition (Kagermann, Wahlster & Helbig, 2013; McKinsey, 2015). The scale, scope, depth and pace of changes are viewed as revolutionary (Schwab, 2016) and have been labeled 'the fourth industrial revolution', or Industry 4.0.

Nowadays, innovations, especially those related to digitization, automation and robotization, are becoming the main driving force of economies and enterprises. According to A.G. Lafley and R. Charan: "The best way to be successful in the current business environment is innovation" (Lafley, Charan 2008, p. 13). Its fruit is "a sustainable and profitable increase in revenues from core activities" (Lafley, Charan 2008, p. 13). Enterprises implementing innovations are often presented as market leaders, while enterprises that fail to implement innovations are treated as market laggers.

In recent years, digital transformation and process automation have accelerated at a tremendous rate, and leading companies are rapidly innovating. Research by McKinsey & Company shows that 80 percent of companies believe their business models should be digitized to remain economically viable" (McKinsey & Company 2020).

These processes are of particular importance during the current Covid-19 pandemic. According to a report from the United Nations Industrial Development Organization (UNIDO), "Covid-19 is a catalyst for digital transformation. Covid-19 is becoming the unexpected accelerator of the digital transformation. The disruptions caused by the crisis are having a profound impact on the world's mindset, which is nowadays more open to embracing change so as to curtail the effects of the pandemic and to return to normality. In fact, due to these disruptions, the world has arguably experienced the most astonishing digital transformation in a few months that we have seen in the last decade" (UNIDO 2020).

The above-mentioned factors prompted us to study the impact of Covid-19 on changes in an organization's business models. We noticed that a research gap exists in this area as well as in relation to the impact of the Covid-19 pandemic on technological progress resulting from digitization, automation and robotization. We conducted research aimed at determining the effects of the Covid-19-related digital transformation on the business models of Polish enterprises and public sector institutions. In particular, we analyzed processes connected with the use of digitization, automation, robotization and artificial intelligence, the basis of which is, inter alia, software and the use of the Internet. We examined the impact of these processes on

the business models of the surveyed organizations by conducting quantitative research of the opinions of representatives of enterprises holding managerial positions and experts employed in public administration.

2. Literature review

2.1. Business model concept

Research on business models in the management sciences is conducted from three perspectives - the perspective of choices, the perspective of the activities undertaken by an organization, and the normative perspective. Each of these perspectives imposes a specific understanding of a business model and its components. From the perspective of choices, a business model is the logic underlying an enterprise's operation and the way it operates; from the perspective of an action system, a business model is a system of activities heavily focused on creating value; from the normative perspective, a business model is a general pattern or guideline, and its main function is to enable description and classification (Grzywa, 2015). The term business model first appeared in the academic literature in the late 1950s. However, it was not until the massive diffusion of the Internet that it gained wide recognition in managerial literature and among business professionals. Since then, it has been conceived of and conceptualized at different levels of abstraction, from various perspectives and often for the idiosyncratic purposes of individual studies (Zott, Amit & Massa, 2011). A business model has been referred to as a kind of architecture, a design, pattern, plan, method, assumption, a statement (Morris, Schindehutte & Allen, 2005), a tool (Baden-Fuller & Haefliger, 2013, Chesbrough & Rosenbloom, 2002; Magretta, 2002) and a managerial philosophy (DaSilva & Trkman, 2014). Despite the popularity of the term, there is no consensus on its meaning (Falencikowski, 2013). Put simply, business models are stories which describe how firms work (Magretta, 2002). Another interpretation is that they function as abstract representations of businesses (Al-Debei and Avison, 2010). For Timmers (1998), a business model is the architecture of a product, service and information flow, encompassing various business actors and their roles, and a description of revenue sources and potential benefits for individual business actors.

The business model is a simplified picture of the most important elements of a company's operations and their mutual relations. The type of approach and the underlying theory of economic activity determine which elements are important for describing the reality of an enterprise and in what relation to reciprocity they remain. It is important to distinguish between static and dynamic approaches to business models. In static logic, a business model is "considered at an abstract and conceptual level – it is a general pattern, even a guide, and its

main function is to enable description and classification. Thus, it is understood as a simplified image of creating and capturing values" (Grzywa, 2015, p. 25). This trend does not "consider the interactions between individual elements of the business model, but rather focuses on their observation". In the dynamic trend, the understanding of the business model is based on the links between the choices and their consequences, between individual elements. In this article, we assume that a business model is a simplified, synthetic presentation of the business logic of a specific company, a description of how the company operates on the market. This description can be made via many different elements defining what the company offers to its clients, how it reaches them, how it maintains contact with them, and with what resources, activities and partners it does so, etc. Johnson, C.M. Christensen and H. Kagermann (2009) proposed a business model diagram consisting of the following four elements:

- a value proposition for the client – defining the target audience and determining how the organization creates value for them,
- a profit formula – defining how an organization creates value for itself and includes such components as a revenue model, a cost structure, a margin model and the rate of consumption of resources, – key resources – an asset that creates value for both the buyer and the organization.
- key processes – activities, including the rules, measures and standards of the organization that are key to creating value for the recipient and the organization.

There is an extensive scholarly literature dealing with the search for a model that perfectly reflects the real parameters of a business. The elements that are used to describe and characterize it are most often treated as equal driving factors, which have the same power of impact on the company's success and universal (i.e., independent of the type of organization, industry or development phase) application. In practice, however, we encounter a huge variety of business models, and these differences "occur not only between various sectors, but also between individual companies within the same industry" (Afauh, Tucci, 2003, p. 87).

The above considerations regarding business models allow us to make the following comments:

- the business model is an attractive concept for both practitioners and scientists, as it is a business story (Magretta, 2002),
- it should be noted that this concept is widely used by managers of both organizations operating for profit and those not operating for profit. Therefore, the understanding of a business model should be extended to cover a broad range of organizations,
- despite great interest in issues connected with business models, the amount of in-depth empirical research relating to business models is limited, which in turn restricts the cognitive aspect. This applies in particular to the issue of changes in business models as a result of digitization, automation and robotization.

The rapidly increasing focus on business models in recent years (Foss & Saebi, 2017) may have been spurred by strategic discontinuities and intense global competition (Doz & Kosonen, 2010). Johnson et al. (2008) link the growing need for business models with a shifting competition base, Voelpel, Leibold & Tekie (2004, p. 264) point to "major and unpredictable changes in the business environment" and their accelerated pace. Finally, a number of scholars (Pateli & Giaglis, 2005) find key antecedents of the business model in new opportunities brought about by advances in information and communication technologies. The advent of the era of Industry 4.0 can thus be expected to generate further interest in the topic.

2.2. Industry 4.0 and business models

Over the last few years, the concept of Industry 4.0, also known as the fourth industrial revolution, has attracted the growing attention of scholars, practitioners and politicians (Jarosz et al., 2020). Despite its popularity, however, no generally accepted definition of the term exists (Hofmann & Rüsch, 2017). Working definitions comprise a variety of technologies, applications, and processes. The term itself appeared for the first time at the Hannover Fair in 2011 in the context of the German government's new high-tech strategy aimed at promoting the automation and computerization of industry (Karabegovi, 2018).

In the nine years that have passed since the definition of the main assumptions, numerous interpretations and guidelines for industry 4.0 have appeared. The core idea is reflected in a passage from the 2013 publication "Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0" (H. Kagermann, W. Wahlster and J. Helbig), namely: "In the future, companies will establish global networks of machinery, storage systems and production facilities in the form of cyber-physical systems. In a production environment, such systems will include intelligent machines, storage systems and production equipment capable of autonomously exchanging information, triggering actions and controlling each other…".

Industry 4.0 is presented in the literature as the fourth consecutive industrial revolution, preceded by (Drath & Horch, 2014; Schwab, 2016):

- the introduction of water and steam-powered mechanical manufacturing,
- the development of electrically powered mass production technologies and the introduction of the division of labor,
- the use of computers to support further automation of manufacturing.

The vision behind Industry 4.0 consists of smart manufacturing, smart logistics, smart grids and smart products, and the increasing use of the Internet of Things in manufacturing. These processes are inevitably leading to changes in business models and the emergence of new business models (Kagermann, Wahlster & Helbig, 2013). Advancing digital and physical technologies and their coalescing into new CPSs enable a wealth of technology ecosystems, where multiple applications communicate with each other as a network (Desmet, Maerkedahl & Shi, 2017). Thus, digital technologies extend, complement and optimize physical operations. Schwab (2016) notes that the "fusion" of previously separate technologies has led to

a confluence of emerging technology breakthroughs. The process covers such fields as artificial intelligence, robotics, IoT, autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing. These technologies can grow out of each other and feed each other, thereby mutually amplifying their impact.

It can therefore be concluded that the transition to an industry 4.0-compliant enterprise model adds significant value to new and existing products, business models and processes.

2.3. Covid-19 vs Digital Transformation

Covid-19 is a disease caused by a new coronavirus called "SARS-CoV-2" (Prescott and Wiersinga, 2020). The World Health Organization first learned of this new virus on December 31, 2019. Covid-19 has had the most significant impact of any disease in the twenty-first century in terms of the population infected, number of deaths, and socio- economic consequences. The virus has evolved to easily infect humans, spread between them and survive.

Virus affected every side of our lives, also many organizations and industries (Szeiner et al., 2021). In the era of Covid-19, the challenges were exposed, and it is fundamental to accelerate the pace of digital transformation, i.e., the adoption of digital technology to transform services or businesses by replacing non-digital or manual processes with digital processes or replacing older digital technology with newer digital technology involving the entire organization and stakeholders in this process. Digital solutions may enable – besides greater efficiency via automation – new types of innovation and creativity, rather than simply enhancing and supporting traditional methods. What is more important organizations had to adapt to these conditions regardless of their previous positioning and experience in digital transformation processes (Almeida, Durante Santos & Augusto Monteiro, 2020).

Almost overnight, the Covid-19 crisis has widened the productivity gap between large-scale technology innovators and those that have long resisted digitization. In the new reality, in order not only to survive, but also to expand their business, companies cannot simply reduce costs and limit investments. This is the best time to increase the pace of digitization to meet the new expectations of customers and adapt to the challenges posed by the "new normality". Many companies see the pandemic as a major accelerator of digital transformation, opening up new opportunities for many industries. In contrast to pre-pandemic digitization, digitization of enterprises must nowadays take into account new challenges. These include, for example, the implementation of remote services and remote management in every process, where possible, as well as securing the company against unexpected circumstances, increasing efficiency, and ensuring sustainable development.

The changes occurring in business models as a result of digitization were confirmed by the aforementioned research conducted by McKinsey's team of experts (McKinsey & Company, 2020). These studies suggest that companies will now invest in the development of new on-line products and services. This applies to both small and local businesses as well as market tycoons. In fact, every market participant is currently wondering how to join this accelerated digital

revolution. Companies with the simplest business models are trying to adapt quickly to the new conditions. For companies with more complex business models, the existence of which depends on many factors, McKinsey's experts suggested navigating within five action horizons that may ensure a business a safe landing in the era of coronavirus:

- The first horizon of operations involves defining the scale, pace and depth of actions that need to be taken.
- The second horizon involves solving cash flow problems in the short term and trying to ensure the company's financial stability.
- The third horizon is virus recovery. Here, too, everything is based on a good plan that the company should outline in order to quickly get back to running a large-scale business.

Taking into account the actions indicated by the McKinsey experts, the key issues appear to boil down to decision-making processes and planning.

To sum up, the Covid-19 pandemic and the resulting crises, regardless of their nature, have resulted in major changes in both company strategies and business models, and this requires some reflection. During the epidemic, companies from many different branches of industry realized that in order to survive, they had to digitize and adapt so as to be able to provide services remotely, treating online platforms as an alternative to traditional services. In the next stage, changes await practically every industry. Companies will start looking for new solutions not only in order to adapt to the existing reality, but also so as to create new development strategies that will take into account changes on the market.

3. Research methodology

The main research problem was to determine the impact of the digital transformation (technological progress) following the Covid-19 pandemic on changes in the business models of Polish enterprises and public sector institutions. The research problem thus formulated implies the main goal of the research, which is to assess the degree to which the digital transformation has changed the business models of the surveyed organizations. This study takes into account the results of quantitative research based on the opinions of public administration experts and representatives of enterprises holding managerial positions. Our research also aimed (as a sub-objective) to verify the assessments made by the expert management team and to identify gaps in these assessments.

To perform a linear regression, we adopted two directional hypotheses:

H1. *Processes related to the use of digitization, automation, robotization and artificial intelligence result in changes in the business models of Polish enterprises and public sector institutions.*

H2. *There is a discrepancy (gap) between the opinions of experts and management regarding their assessment of the impact of the digital transformation on the business models of the surveyed organizations.*

Because we believe that the impact of Covid-19 is a contextual variable, we also assume that the digital transformation (technological progress) following the Covid-19 pandemic will lead to changes in the business models of Polish enterprises and public sector institutions. In our research, we equate technological progress with digital transformation and understand it as processes connected with digitization, automation, robotization and artificial intelligence, which in turn are based on, inter alia, software and the Internet. It involves gathering information and transforming it using modern technologies. To carry out our research, we conducted two surveys:

1. a questionnaire addressed to enterprise and public administration representatives holding managerial positions. We 230 responses;
2. a survey of experts employed in Polish universities, incl. academic teachers and representatives of universities responsible for cooperation with business. In this case, the study sample comprised 150 experts. The purpose of both surveys was to determine the role of the pandemic in triggering technological changes in Polish companies and public administration. The study focused both on identifying best practices implemented in response to the current pandemic, as well as on identifying challenges arising from digital transformation. We used a linear regression model to develop the survey results. The general linear regression model can be written as follows:

$$Y = \beta_0 + \beta_1 X + \beta_2 \cdot sex + \beta_3 \cdot seniority + \beta_4 \cdot position + \varepsilon,$$

where:

Y – is an assessment of changes in the functioning of the analyzed industry or process.

X – is the implementation of a given form of progress, or all forms together.

β_1 – parameter showing the influence of X on Y.

β_2 , β_3 and β_4 – parameters constituting the control variables.

Y is coded on a scale of 0-4, where:

- for managers: 0 = small impact; 1 = medium impact, 2 = difficult to say, 3 = significant impact, 4 = very significant impact,
- experts: 0 = no impact; 1 = minor impact, 2 = don't know, 3 = major impact, 4 = very significant impact.

X for a given form of progress is coded with one zero (the answer "not applicable" was coded as 0, and the remaining answers as 1). X is the sum of the codes for 14 forms of technological progress: X1 – Automation, X2 – Robotization, X3 – Digitization, X4 – Artificial Intelligence, X5 – Big data, X6 – Social networks, X7 – Mobile Internet/Applications, X8 – Broadband access to The Internet, X9 – Cloud for storage, X10 – Internet of Things,

X11 – Online store, X12 – Remote maintenance/monitoring, X13 – Virtual reality, X14 – Augmented Reality.

This is a number in the range 0-14, which tells us how many of these 14 forms of technological progress the expert / manager considers to be candidates for implementation.

4. Results

4.1. The impact of digital transformation induced by Covid-19 on the functioning of individual industries

First, we examined the extent to which changes are expected in the way companies operate/ in the business model following the end of the Covid-19 pandemic in the indicated industries. In this case, we determined the impact of technological progress (including all forms x1-x14) on business models in different branches of industry. We studied 15 industries: agriculture, mining, industrial processing, municipal services, construction, wholesale and retail trade, transport and warehousing, accommodation and catering, telecommunications, finance and insurance, real estate services, professional, scientific and technical activities, and education. The results of the research are presented in Table 1. We have presented a summary of the research results for managers and experts.

Table 1.
The impact of Covid-19-induced technological advances on business models by industry

Industry	β_1	
	Managers	**Experts**
Agriculture	-0,176 *	0,009
Mining	-0,187 *	0,018
Industrial processing	-0,031	0,296 *
Utility	-0,132 *	0
Construction	-0,059	0,123
Wholesale and retail trade	-0,066	0,53 *
Transport / storage	0,184 *	0,073
Accommodation and gastronomy	0,061	-0,101
Telecommunication	0,11 *	0,104
Finance and Insurance	0,038	0,071
Real estate market services	-0,011	0,065
Professional, scientific and technical activity	-0,234 *	0,028
Education	-0,123 *	0,104
Administration	0,115 *	-0,014
Healthcare and social assistance	-0,054 *	-0,27 *

* - statistically significant relationship ($p < 0,05$).

Source: own study.

An analysis of Table 1 shows that, according to the managers, individual forms of technological progress will have an impact on the functioning of business models in 9 industries (Agriculture, Mining, Municipal Services, Transport and Storage, Telecommunications, Professional, Scientific, Technical Activities, Education, Administration, Healthcare. and Social Welfare). In 6 (Agriculture, Mining, Municipal Services, Education, Healthcare and Social Welfare) of these industries, this impact will be negative. In turn, according to the experts, the impact will be visible only in 3 sectors, and negative in only one (Health Care and Social Assistance). Only in the case of one industry, i.e., Healthcare and Social Services, did the experts and managers agree on the impact of (negative) technological change on the business model. The managers predicted that this impact will be most pronounced in Professional, Scientific, and Technical Activities, while experts saw the most significant changes occurring in Wholesale and Retail Trade.

4.2. The impact of technological progress induced by Covid-19 on changes in the functioning of individual processes

Next, we examined the extent to which Covid-19 will affect particular functional areas in a company's operations in the post-pandemic world. Thus, we examined the impact of technological progress (including all forms x1- x14) on particular processes. We analyzed the following areas: Research and Development, Purchasing, Logistics, Production, Marketing, Finance and Accounting, and Administration. The results of the research are presented in Table 2.

Table 2.
Impact of Covid-19-induced technological advances on changes in business models by process

Process	β_1	
	Managers	**Experts**
Research and Development	-0,113 *	-0,11
Purchasing	0,073 *	0,102
Logistics	0,215 *	0,011
Production	0,195 *	0,191 *
Marketing	0,251 *	0,32 *
Financial and accounting	0,071	0,788 *
Administration	0,244 *	0,033

* - statistically significant relationship ($p < 0,05$).

Source: own study.

According to the managers, the technological progress triggered by the Covid-19 pandemic will influence business models in 6 out of 7 of the analyzed processes. The study showed that such changes will not be limited solely to financial and accounting processes. Only in one case (R&D) will this impact be negative. In turn, according to the experts, such an impact (always positive) will be visible only in 3 processes (Production, Marketing, Finance and Accounting). In only two cases (Production, Marketing), did the experts and managers agree on the (positive) impact of technological changes on business models in certain processes as a result of

Covid-19. Managers expect these changes to be most pronounced in Marketing, while experts predict the biggest impact will take place in Finance and accounting processes.

4.3. Assessment of implementations in both groups

Table 3 provides a comparison of the assessments given by the managers and experts. An analysis of Table 3 shows significant differences in the responses of managers and experts. As a consequence, there are considerable disparities in opinions between the two groups. This results from the fact that the experts only rarely gave the answer "not applicable". They assume the existence of an impact, and as such the variable X in this group is almost always 1 (and when all forms of technological progress are analyzed, it is almost always 14 in total). The correlations are less significant in the case of the experts, due to the fact that almost all the experts believe that such an impact will occur (11 out of the 14 analyzed cases).

Table 3.
Assessment of the impact of technological advances induced by Covid-19 in both groups

Form of technological progress induced by Covid-19	% of answers other than "Not applicable"	
	Managers	Experts
Work/process automation	100,00%	100,00%
Robotization	98,26%	100,00%
Digitization	99,13%	100,00%
Artificial intelligence	98,26%	100,00%
Big data	96,52%	100,00%
Social networks	100,00%	100,00%
Mobile Internet/Applications	99,13%	100,00%
Broadband Internet access	90,43%	100,00%
Cloud storage	89,13%	89,12%
Internet of Things	92,17%	100,00%
Online shops	100,00%	100,00%
Remote maintenance/monitoring	92,61%	100,00%
Virtual reality	67,39%	86,39%
Augmented Reality	61,74%	76,19%

Source: own study.

An analysis of Table 3 shows that in some situations involving Covid-19-induced technological changes (11 cases among the experts and 3 cases among the managers) the response rate was 100% other than "Not Applicable". This means that in these situations assessing the impact of a given form of technological progress on other variables is impossible. As a consequence, these cases were omitted from further analyses of the impact of Covid-19-induced technological changes on business models.

4.4. The impact of various forms of Covid-19-induced technological progress on business models

Table 4 shows the results of research on the impact of various forms of technological progress under the influence of Covid-19 o business models. The results below take into account the opinions of the managers and experts.

Table 4.
The impact of various forms of technological progress induced by Covid-19 on changes in business models

A form of technological progress induced Covid-19	β_1	
	Managers	**Experts**
Robotization	-0,393	---
Digitization	3,314 *	---
Big data	-0,075	---
Broadband Internet access	-1,128 *	---
Cloud storage	0,929 *	-0,046
Internet of Things	-0,861	---
Remote maintenance/monitoring	-0,795	---
Virtual reality	0,31 *	-0,156
Augmented Reality	0,369 *	0,898 *

* - statistically significant relationship ($p < 0,05$).

Source: own study.

According to the managers, the functioning of companies will be influenced by such factors as digitization, cloud, VR and augmented reality (positive impact) as well as broadband Internet (negative impact). In turn, according to the experts, only augmented reality will have such an impact (positive).

Table 5 shows the combined impact of specific forms of technological progress induced by Covid-19 on business models. Only the experts envisage a positive impact. An analysis of managers' opinions showed that this relationship is statistically insignificant.

Table 5.
The impact of Covid-19-induced technological changes on business models

A form of technological progress induced Covid-19	β_1	
	Managers	**Experts**
All together	0,048	0,34 *

* - statistically significant relationship ($p < 0,05$).

Source: own study.

5. Results

Our research confirmed our hypothesis that the digital transformation (processes connected with digitization, automation, robotization and artificial intelligence) resulting from the Covid-19 pandemic has had an impact on the business models of both Polish enterprises and public sector institutions. We examined the impact of Covid-19-induced technological progress on business models both by industry (Table 1) and by process (Table 2). With regard to variable Z1 – industries, our research revealed this impact in the 15 analyzed industries:

- according to the managers, it will have an impact on 9 industries, and negatively in 4 of these;
- according to the experts, it will have an impact on only 3 industries, and negatively in only one. When it came to specific industries, the managers and experts agreed on only one sector: Healthcare and Social Services. According to the managers, technological progress will have its biggest impact on Professional, Scientific, and Technical Activities, while the experts pointed to Wholesale and Retail Trade in this respect. The technological consequences of the pandemic are also visible in the case of variable Z2 – processes;
- according to the managers, 6 of the 7 examined processes will be impacted (negatively in the case of Research and Development);
- according to the experts, such an impact (always positive) will only be visible in the following processes: Production, Marketing, and Finance and Accounting. The managers and experts expressed similar opinions in the case of Production and Marketing processes. We also analyzed the impact of various forms of technological progress associated with Covid-19 on business models. We examined the effects of each form separately (Table 4) as well as the effects of all forms taken together (Table 5). Our research has confirmed this impact in the following areas;
- according to the managers: Robotization, Digitization, Big data, Broadband Internet Access, Cloud Storage, Internet of Things, Remote Maintenance / Monitoring, Virtual reality, Augmented reality;
- according to the experts: Cloud Storage, Virtual Reality, Augmented Reality.

However, in certain areas the impact will be negative. For example:

- according to the managers: Robotization, Broadband Internet Access, the Internet of Things, Remote Maintenance/Monitoring,
- according to experts: Cloud storage, Virtual reality.

The analysis of all forms together (Table 5) showed that only the experts envisaged a positive impact.

Our research also confirmed a discrepancy (gap) between the opinions of experts and management when it came to assessing the impact of technological progress associated with Covid-19 on the business models of the surveyed organizations. The responses of both the managers and the experts indicate their awareness of technological advances. A comparison of the managers' and experts' assessments indicates a gap (a significant difference) in their responses. Most of the experts believed there had been such impact (100% in 11 cases). A slightly lower percentage of managers shared this opinion.

Our research leads to the following conclusions:

- the existing situation (including the restrictions introduced by governments) is forcing companies to change their business models. We are currently witnessing a period of intense re-evaluation regarding the needs and expectations of consumers in many industries. According to both managers and experts, most industries will begin operating on new principles;
- The crisis triggered by the Covid-19 pandemic will affect most of the ongoing processes. It will mainly result in greater differentiation in terms of products and services, customer service, as well as in the levels and types of quality of products and services offered;
- we will witness the development of many, hitherto unknown business models, and enterprises will develop radically new ways of meeting needs, some of which are already widely recognized.

We believe that while Covid-19 will not change the foundations of doing business, it will bring to the fore the need for flexibility and adaptation. In an economy under pressure, there is a need for greater awareness, efficiency and sustainability. To build these foundations, not only will companies and partnerships need to be more resilient, but they will also require widespread digitization. In addition, we argue that extensive automation of production processes and robotization will enable companies to continue operating during the most severe restrictions introduced to combat the pandemic.

We are aware that it is impossible to assess in any adequate way how current events will affect our future, be it at the microeconomic or the mesoeconomic level, i.e., what will happen in particular industries, and how business models will change. However, our conclusions have also been confirmed by other researches. For example, the recent Dell Digital Transformation Index studies show that more and more companies operating in Poland are embracing digital transformation. Poland was the third highest ranking country in the report in terms of digital maturity. Data for the 2020 report was collected after the outbreak of the coronavirus pandemic and based on a survey sent to approximately 4,300 people – directors and managers representing companies from 13 industries and 18 countries, including Poland. Globally, 80% of the respondents replied that their organizations had managed to implement digital transformation plans at least partially this year – most often by strengthening the security of their ICT infrastructure and extending remote work opportunities.

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