

## Introduction

The development of a modern economy and social relations is determined by a number of factors. Among them, the most important one, which creates opportunities for gaining competitive advantage, is the popularization of the implementation of the latest technologies and innovations bringing us closer to the dominance of Industry 4.0.<sup>28</sup> The changes and trends taking place have a decisive impact on all areas of social life including in particular, the current labour market and education system, as well as on the entire area of social communication. Technological development implies a key impact on the employment situation by, *inter alia*, changing the production capacity of modern enterprises, the shape of modern consumption trends, and changing factors determining a company's competitiveness. One of the most significant factors currently affecting technological development and the dynamics of its implementation is the COVID-19 pandemic and its consequences related to the need for social isolation.

This volume is a collection of texts resulting from the research of individual authors, showing the relationship between the COVID-19 pandemic and technological innovations embedded in the concept of Economy 4.0. The book is divided into three parts.

The articles in the first part focus mainly on attempts to answer the question: does the COVID-19 pandemic affect the acceleration of the implementation of innovative solutions within Industry 4.0? They also diagnose the situation in which entrepreneurs find themselves at this time and describe the challenges they face to maintain growth. Particular attention is paid to start-ups and the dynamically developing renewable energy industry.

A group of articles in the second part analyzes changes in labour relations and the organization of the educational process, with a particular focus on the impact of

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<sup>28</sup> The concept of "Industry 4.0" was born in Germany in 2011 during the Hannover trade fair. It was created as a strategy to limit foreign competition and differentiate German and European industry globally by promoting the computerization of production processes. It is based on the concept of the smart factory, which is based on the communication of devices on the principles of social media functioning, through which the devices organize production and optimize it to the maximum extent; after: N. Szozda (2017), *Industry 4.0 and its impact on the functioning of supply chains*, "Scientific Journal of Logistics" 13(4), p. 402. The concept of "Industry 4.0" has been recognized as the right direction of development also by other industrial countries. However, in the United States the concept of the "connected enterprise" is more commonly used, and in the United Kingdom it is the "fourth industrial revolution" concept; after: R. Morrar, H. Arman, S. Mousa (2017), *The Fourth Industrial Revolution (Industry 4.0): A Social Innovation Perspective*, "Technology Innovation Management Review", vol. 7, i. 11, pp. 13–14.

the COVID-19 pandemic on the implementation of technological innovations in the field. Most attention was paid to the use of distance learning, particularly in higher education. The impact of the pandemic on the process of combining work and family life (work life balance) was also analyzed.

The third part of the book contains articles on innovative forms of social communication which are subject to change under the influence of the COVID-19 pandemic. The texts contained in this part go beyond the framework of the Economy 4.0, as they partly concern a broader understanding of the State 4.0. The authors addressed and analyzed, *inter alia*, the impact of research on democratic processes, such as elections, and changes in the forms and language of media messages or changes in consumer behaviour in the light of uncertainty and fear.

## **Part One**

# **Acceleration of Economic Innovation as One of the Effects of COVID-19 Pandemic**

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## Innovation and the Development of Industry 4.0 in Poland in the Light of the COVID-19 Pandemic

**Abstract:** The article focuses on the correlation between the COVID-19 pandemic and the implementation of technological innovations as an instrument for the development of industry 4.0. This paper discusses sequentially selected determinants of the development of economy 4.0 worldwide, in order to focus further on the analysis of the impact of COVID-19 on changes taking place in the economy, in particular on the labor market. In conclusion, it was established that the pandemic implied the acceleration of the digital transformation trend.

Economic development is determined by a variety of factors, both those that are directly related to the situation of enterprises and macroeconomic factors that determine the impact of the microeconomic environment. Nowadays, innovation is a very important condition for gaining competitive advantages on the market. It affects investment attractiveness particularly, in terms of the potential to attract investors implementing solutions using modern technologies. In order to accelerate the development of investments, expenditures on Industry 4.0 solutions should be increased, but also by intensifying the development of cooperation with universities, scientific units, research and development centers, and public administration. Therefore, it is necessary to increase the dynamics of the development of scientific and research potential and the level of commercialization of scientific research results.

According to the results, studies, and rankings, the Polish economy is still not very innovative compared to other OECD countries, which is confirmed, for example, by the Regional Competitiveness Index (Mundschenk, Stierle, Stierle von Schütz, Traistarau, 2006, pp. 3–6) (abbreviated as RCI) and the European Innovation Scoreboard. The second list shows that Poland belongs to the group of countries considered as moderate innovators, at the value of the innovation index at the level of 56.1 compared to the value for the whole EU in 2018 at the level of 100.<sup>2</sup> The

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<sup>2</sup> To determine the summary innovation index, aspects such as the quality of human resources, research systems, the innovative environment, investments of companies in the area of R&D, innovation of enterprises, innovative connections, intellectual assets, and the share of innovation in sales are taken into account. Source: *European Innovation Scoreboard 2019. Poland*, <https://ec.europa.eu/docsroom/documents/35907>, access: 01.02.2021.

level of investment in research and development in Poland, amounts to 1% of the GDP and is two times lower than the average in the EU (2.1% of GDP). Among the Visegrad Group countries, the Czech Republic spends 1.8% of its GDP on research and development, Hungary spends 1.4% of GDP, and only Slovakia is slightly lower than Poland – 0.9% of GDP (*Wydatki...*, 2021, p. 26). The article aims to assess the preparation of the Polish economy to implement solutions within the framework of the economy 4.0 and current changes and needs in this area in the light of the COVID-19 pandemic.

Currently, the economy is subject to global competition. In order to achieve systematic economic growth, it is necessary to gain a competitive advantage not only on a national and European scale, but also in many industries on a global scale. In defining competitive advantage, M. Porter stated that the goal of achieving it is the attractiveness of the target industry. He stressed that it is determined by the result of „five competitive forces”: direct competitors, suppliers, buyers, substitutes, and new companies appearing on the market. These forces determine the prices, the cost of manufacturing products, and the necessary capital investments in a given industry. Moreover, Porter paid particular attention to the impact of technology on supply chain relationships, competitive advantage, and the structure of the industry (market of destination). He also claimed that this concept should be considered not only at the level of the enterprise, but also at the national level. In 1990, he formulated a theory of local and national competitiveness in the global economy. It is particularly this theory that seems to be very important from the perspective of creating development policy at the regional level. M. Porter formulated the so-called diamond of competitive advantages (also known as the diamond of competitiveness), which consists of the strategy of companies and the state of competition in the industry, supply conditions (availability and quality of factors of production), demand conditions, and related and supporting industries (Porter, 1985).

Currently, the theory of international exchange is dominated by an approach indicating that the development similarities of individual countries are conducive to an increase in the level of exchange and the benefits of international trade (Cieřlik, 2000). Similarly, Burenstam-Linder’s theory of a unified structure of demand suggests that the dynamics of the increase in turnover in international trade in industrial goods increases with a higher degree of similarity in the level and structure of demand of both countries. In the case of the development of Industry 4.0, it should be assumed that the compliment of production structures and methods and to a much lesser extent, cost differences, will be decisive for the development of cooperation and international exchange.

The differing attitude to the influence of fourth-generation industry on international trade relations is included in the theory of competitive advantage. It indicates that entrepreneurs who want to effectively compete on foreign markets should have certain advantages, and on the other hand, that active functioning

on foreign markets allows to increase the existing advantages (Światowicz-Szczeptańska, 2012). The benefits resulting from the combination of unique resources and other own assets with the market position imply obtaining the advantage of cooperation, possible only thanks to the joint investments of cooperating entities (Dyer, Sigh, 1998). It seems that due to social changes related to globalization, the impact of the internet, and the emergence of markets for new sectors and industries, it is now almost unattainable to gain a long-term, stable competitive advantage (Kozielski, 2012). The competitive advantage of most Polish enterprises has so far been based on such factors as cheap labour and subsequently, a correspondingly low price, high quality, professional customer service, well-developed logistics, and a good brand. In the light of the Industry 4.0 development, it seems necessary to apply a new paradigm based on the business model of new opportunities, i.e., the so-called “four-leaf clover”, to compete effectively. Its implementation requires the company to work on the concept and business model, operational efficiency, organizational culture and leaders, and the so-called window of new business opportunities. All these elements determine the preparation for the implementation of solutions within the fourth-generation industry (Götz, Gracel, 2017, p. 221).

These concepts should be the starting point for carrying out the necessary research.

Nowadays, in many highly developed countries, changes in industrial policy are taking into account the need to implement solutions as part of the development of the fourth generation of industry. It is to lead to maintaining a high level of employment and even creating additional new jobs thanks to the improvement in the competitiveness of enterprises achieved in this way. Proponents of the view that Industry 4.0 is a real revolution even formulate beliefs that suggest „life 4.0” or „society 4.0” is emerging. It means that Industry 4.0 will affect our social and economic reality because the ongoing technological changes affect not only industrial production, but also the way of the “functioning of public administration, health care, the labour market, and thus, such issues as: commuting, working time, organization of workplaces, training, etc.” (Ibidem, p. 223). The thesis can be confirmed by the way most workplaces operate during the COVID-19 pandemic. The fourth industrial revolution is not only an attempt to increase the efficiency, productivity, and competitiveness of industry. It also refers to the application of the possibility resulting from technological development, e.g., for civic participation in political life through e-administration and digital society education, increasing people’s well-being and quality of life, sustainable development, increasing the universality of using renewable energy sources, and raising the level of health care (Ferreira, Lopes, Silva, Putnik, Cruz-Cunha, Silva Avila, 2018, p. 207). It is worth emphasizing that the processes of globalization, accelerated by technological innovations, also have negative effects. Constant competition and the pursuit of profit and faster economic growth, despite innovation, lead to a deepening degradation of the natural environment al-