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EFFECTS OF THE AUTOMATION ON WORK CONTENT – SELECTED ISSUES

WPŁYW AUTOMATYZACJI NA TREŚĆ PRACY – WYBRANE ASPEKTY

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Summary: Modern work processes are conditioned by many factors, among which technical progress seems to be a key determinant. In that respect, automation and its implementation within business processes as the result of technical progress, changes the content of the work of production and office processes, modifies job requirements for employees as well as the demand for many professions, and also generates completely new areas of human activity. The paper presents the social effects of automation from the perspective of changes in the content of work caused by the technical progress of work processes. As part of the defined intention, three phenomena describing the impact of technical progress on the content of the work were identified, i.e. no-skill-biased technical change, skill-biased technical change and talent-biased technical change. Referring to representative scientific research, the potential scope of automation was also presented. In particular, there was pointed out that activities most susceptible to automation include physical activities in highly structured and predictable environments, as well as data collection and processing.

Keywords: automation, technical progress, content of work.

Streszczenie: Współczesne procesy pracy uwarunkowane są wieloma czynnikami, wśród których kluczowy jest postęp techniczny. W takim znaczeniu automatyzacja procesów biznesowych, jako skutek postępu technicznego, zmienia treść pracy w ramach procesów produkcyjnych i biurowych, modyfikuje wymagania stawiane pracownikom w procesach pracy, a także zmienia zapotrzebowanie na wiele zawodów, w tym generuje nowe obszary ludzkiej aktywności. W opracowaniu przedstawiono społeczne skutki automatyzacji z punktu widzenia zmian w treści pracy spowodowanych postępem technicznym procesów pracy. W ramach tak określonego zamierzenia dokonano identyfikacji zjawisk opisujących wpływ postępu technicznego na treść pracy. Odnosząc się do reprezentatywnych badań naukowych, przedstawiono również potencjalny zakres automatyzacji. Wskazano, że działania najbardziej podatne na automatyzację obejmują aktywności fizyczne w wysoce ustrukturyzowanych i przewidywalnych środowiskach, a także gromadzenie i przetwarzanie danych.

Słowa kluczowe: automatyzacja, postęp techniczny, treść pracy.

1. Introduction

Today's work processes are conditioned by many factors, including technological innovations, the development of the digital economy (mobile devices, 3D printing, Internet of Things, BigData), changes in the global division of labor, including offshoring, changes in the organization of companies and market institutions, demographic changes, and changes in consumption models [OECD 2017a, p. 12]. However the key determinant of changes in the business environment is technological progress that affects: socio-economic processes, the development of knowledge-based economy sectors [Godin 2006], product and process innovations, as well as business processes and models [Blaschke et al. 2017] and corporate structures [Snow et al. 2017].

The result of the technological progress of work processes is the automation of the production of goods and services, which in a general sense refers to the replacement of human work by machines and devices [Autor 2015], in particular the substitution of manual activities of conducting (directing, controlling) technological processes with automatic activities (without human participation) [Brzeziński 2002]. This substitution may relate to certain activities or groups of human activities fulfilling the functions of the workplace and/or the production phase of goods and services. In this sense, automation corresponds with other concepts that relate to the technological progress of work processes, in particular the concepts of mechanization and robotization. Thus mechanization means the introduction of machines into production of goods and services that replace human strength, including manual labor or the tractive force of animals [*Słownik…*], robotization, on the other hand, means replacing human labor with robots. In this sense, automation can be interpreted as the stage following mechanization. Thus, mechanization occurs when machines are used to reduce the workload of the worker, while automation when the machine completely takes over the tasks performed by the employee [Richard 2005]. Therefore robotization means full automation, i.e. the automated execution of specific tasks and processes while mechanization refers to instrumentalisation enabling the implementation of certain executive and mental (heuristic) activities in work processes. The literature on the subject sometimes distinguishes between the concepts of automation and robotization, but it seems that this is only to emphasize the importance of robots in the automation of work processes.

The aim of the study is to present the effects of automation from the perspective of changes in the content of work caused by the technical progress of work processes. Based on literature studies on the subject, three phenomena describing the impact of technical progress on the content of the work were identified. Referring to representative scientific research, the potential scope of automation was also presented.

2. Technical progress and the content of work

Technological progress, including automation, changes the content of the work of production and office processes [Autor 2015; Martyniak ed. 1992; Mokyr 2002], modifies the demand for many professions, and also generates completely new areas of human activity [OECD 2017b].

There is a rich literature which identifies the impact of technological progress on the content of work and job requirements for employees. Based upon the scientific research, it has been discovered that from the beginning of the 19th century to the present day, three phenomena can be specified, i.e. no-skill-biased technical change, skill-biased technical change and talent-biased technical change. No-skill-biased technical change generally concerns the technical progress in the 19th century. The conducted study indicates that 19th century technological advancement resulted in the increased productivity of employees possessing relatively low skills – skilled craftsmen were replaced by lower-skilled workers [Autor et al. 2003]. The craft workshop was replaced with a factory, followed by exchangeable parts and an assembly line, and the products previously produced by skilled craftsmen were then produced in factories by employees with relatively small skills [Mokyr 2002]. However it is worth mentioning that no-skill-biased technical change can be identified today, when selected sectors are analyzed, particularly based upon lower-skilled employees [Esposto 2008], or when we analyze individual occupational groups. Skill-biased technical change has been confirmed in the U.S. industry since the beginning of 20th century. In particular, technological advancement connected with the transition from the production system of the late 19th-century to factory systems with electric motors allowed for the automation of operations, especially in the field of moving raw materials and semi-finished products (transport, production line), which was previously performed by unqualified workers [Goldin, Katz 1996]. As a result of the implementation in the industry of machines controlled by an employee with the sense of sight and hearing, there was an increase in the skills required by workplaces, a growing demand for maintenance skills that ensure failure-free machines and equipment, and an increasing demand for highly qualified engineers and technicians [O'Connor, Lunati 1999]. It was also discovered that skill-biased technical change is particularly accompanied by the development of information and communication technologies, which increases in the productivity of skilled workers performing functions based on abstract thinking, creativity, and problem solving [Autor, Acemoglu 2011].

Talent-biased technical change is related to the currently identified increase in demand for experts and talented employees, especially in the area of robots, artificial intelligence and information analysis [Brynjolfsson, McAfee 2014]. Advances in computer technology over the last few decades have provided employers with cheaper machines and software that can potentially replace people in many activities requiring medium skills such as accounting, office work and repetitive production tasks [OECD 2017b, p. 10]. Therefore the ongoing digitization related to the growing computing power of computers means that companies report and will report lower demand for some work done by people, especially on the basis of medium skills, which are increasingly implemented by computers, robots and other digital technologies [Brynjolfsson, McAfee 2014, p. 10]. Current technological progress allows for the automation of skills, including the understanding of human emotions, because artificial intelligence is beginning to achieve better results than humans. For example, recent tests have shown that computers exhibit 97% accuracy in lip-reading, while human performance in this area is estimated at around 52% [Manyika et al. 2017, p. 12]. Scientific research confirms that digital technologies, robotics and artificial intelligence permeate production processes in many countries [Acemoglu, Restrepo 2016].

3. Potential scope of automation

Contemporary literature on the subject contains methodologies for estimating the potential scope of automation [Autor et al. 2003] and the risk of automation of individual professions within sectors and economies [Frey, Osborne 2013].

The research shows that in the next two decades, 47% of all employees in the US economy will be in the high risk group associated with automation [Frey, Osborne 2013]. Similarly, for other economies this percentage is at a relatively high level, e.g. Finland – 35%, Norway – 33% [Pajarinen et al. 2015], Europe 54% [Bowles 2014], Singapore – 25% [Lee 2017]. For example, professions most vulnerable to automation are: telemarketers – 99%, accountants and auditors – 94%, retailers – 92%, real estate agents – 86%, word processors and typists – 81% and agricultural sector employees [Frey, Osborne 2013, pp. 68-72]. The lowest risk occurs in the case of legislators and senior officials as well as biological sciences' employees and health care professionals [Heyman 2016, p. 4].

Recent estimates based on the methodology of C.B. Frey and M.A. Osborne indicate that in the US economy up to 5% of all professions can be automated completely using current technologies, while about 60% of all jobs have at least 30% of tasks that are subject to automation. Activities most susceptible to automation include physical activities in highly structured and predictable environments, as well as data collection and processing. In the USA, this type of work represents 51% of work carried out in the economy [Manyika et al. 2017, p. 8]. For example, data collection (64% automation potential and 17% working time in the economy) and data processing (69% automation potential and 16% working time in the economy) concerns almost all sectors, and consist of: administration of personnel, payroll and transaction data , placing data in the forms of insurance, credit, banking and health institutions [Manyika et al. 2017, p. 44].

Based on the methodologies of C.B. Frey and M.A. Osborne, the risk of office processes automation is also estimated, with particular emphasis on the financial sector, including the so-called shared service centers. Until now the view was widespread that automation in this sector primarily eliminates simple work with information requiring low competences, but currently a decrease in employment among professionals in the financial sector is also noticeable. As a result of such tendencies, tasks requiring information assessment and inference are also subject to automation, such as identifying priority tasks in the organization, predicting process results, and designing business patterns. Automated processes, through integration with many applications, can perform various tasks, such as: opening e-mail attachments, filling out and reading electronic forms, and saving and modifying data [Schatsky et al. 2016]. In this sense, middle and back-office processes are subject to automation. There are also applications supporting the front office personnel, particularly such applications could monitor contact center agents and automatically generate connection notes [Schatsky et al. 2016]. For example, the number of bankers, stock traders and other employees on Wall Street working in front-office positions , in the period 2010-2014 decreased by 16%. In addition, KPMG's forecasts indicate that by 2026, 100 million of the so-called knowledge workers around the world will be replaced by automated processes [Rise of robots 2016, p. 14].

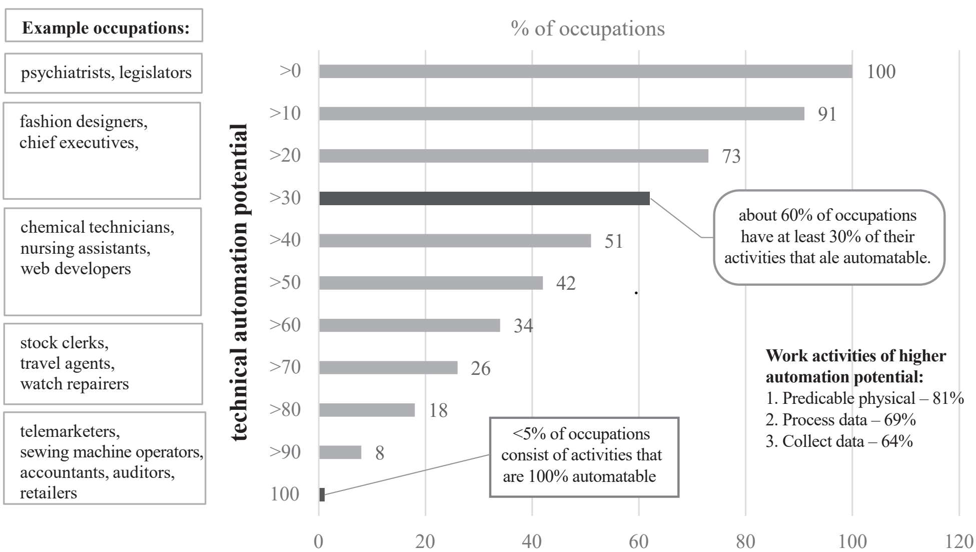

Fig. 1. Automation potential

Source: [Manyika et al. 2017].

The analyses show that automation is a threat to many professions in the financial sector, however, accountants are perceived as the most threatened by the progressive robotization of office processes. The analyses carried out by Deloitte allowed to identify positions in the field of the financial sector of low, medium and high risk of automation, and thus [Nagarajah 2016]:

- low probability of automation concerns jobs requiring higher skills, consisting of: strategic planning and consulting, financial analysis and controlling,

particularly including specialist positions in the field of business and financial project management, as well as directors and financial managers,
- medium probability of automation involves the positions such as purchasing managers and directors,
- high probability of automation refers to relatively simple work in the area of accounting like settlement of transactions, receivables and payments including jobs such as payroll managers, financial administrators, credit controllers, financial accounts managers, financial and accounting technicians, finance managers.

In light of the research, it turns out that in the face of progressive automation, accountants should strive to gradually increase their competences, especially to minimize the risk of recognizing their profession as possible to automate. In particular, accountants should be oriented towards fulfilling more strategic and analytical roles. Representative research results report that relatively simple work in the area of accounting, related to transaction settlement, receivables and payments will be increasingly subject to automation, but work requiring higher competences, related to strategic planning and consulting, analyses and financial controlling will still be carried out by people. For example, the team work of accountants consisting in advising top management in the field of cost optimization requires interpersonal skills that computers cannot cope with [Nagarajah 2016]. In general, the harder it is to automate work, the higher the level of perception and manipulation (objects and information), creativity and social intelligence is required in the workplace [Frey, Osborne 2013, p. 31].

4. Conclusions

Along with the progress of automation, human work has changed significantly. For example, initially man was responsible for the direct production of goods and services, later for operating machines and production equipment, and finally nowadays humans are increasingly becoming programmers of operating systems supervising the operation of machines and equipment. The engineer stopped working on machines and devices, but instead began to issue commands through programs and algorithms as to what parts a specific machine is to design and manufacture. The manager's work is less and less based on the direct supervision of production processes, including the work of human teams. Increasingly, it refers to working with information, i.e. numbers, reports, computer programs for making decisions regarding the supervised process. Due to the relatively high costs of downtime, the work of repair crews responsible for the maintenance of machinery and equipment have become crucial for the efficiency of the entire process.

Modern technologies, including information and communication, robotics and artificial intelligence penetrate the production processes in many countries, therefore it will be increasingly difficult for workers to compete with machines, and their salaries will be, as it is supposed, relatively lower [Oberfield, Raval 2014]. Advanced robotics, automation and their penetration in production processes can create surplus on manual and physical skills, while increasing the need for non-routine cognitive skills. The analyses show that tasks that are not subject to substitution by automation and robotization should be treated as complementary to automation, which should be associated with opportunities for the human factor of the organization. In particular, when technology "makes certain steps in the work process more reliable, cheaper or faster, it adds value to the remaining human links in the production chain." [Autor 2015, p. 6].

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