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Wojciech Giza, Barbara Sztokfisz

## Revolution 4.0 as a Factor of Change in the Labour Market

### Abstract

*Objectives:* The aim of the deliberations is to show how the exogenous factors, in this case the subsequent Industrial Revolutions, affected the structural changes of the labour market and how they were perceived by the economists.

*Research Design & Methods:* The research area is limited to the theory that explains the functions of the labour market in the historical perspective. The study is a theoretical study that combines the elements of analysis in the field of economic history and the development of economic thought. The justification of the presented theses was made using the induction method and the comparative method, both of which enable the presentation of the labour market evolution process in a relatively long-time horizon.

*Findings:* The structure of the study reflects the changes that have taken place in the economic theory under the influence of the Industrial Revolutions. The last of them, the Revolution 4.0, is a reference point to form the key questions regarding the automation and redistribution of income that the contemporary labour market researchers are concerned with.

*Implications / Recommendations:* In the theoretical dimension, the attention was drawn to the usefulness of the comparative analysis method for understanding the profound changes in the labour market. The practical aspect of the research is to identify the potential threats that arose as a consequence of the Revolution 4.0. Understanding them makes it possible to take action in the field of social, economic, and educational policies that aim at reducing social tensions resulting from dynamic changes taking place in the labour market.

*Contribution / Value Added:* The technological progress is most often treated as a key factor that affects the supply side of the economy. It enables an increase of the productive potential of highly developed societies. The presented considerations reveal the analogies that arise in connection with the functioning of the labour market in the context of subsequent technological revolutions. Particular attention was paid to the influence of technological progress on the demand side of the economy and the consequences related to the distribution of income. The article is an attempt to supplement the reflection on the impact of the latest advancements in information technology with the context of historical changes that have taken place in the labour market.

*Article classification:* theoretical article, conceptual article

*Keywords:* Revolution 4.0, labour market, technological progress, classical political economy, neoclassical economics

*JEL classification:* O31, O33, B30, J31

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## Introduction

Every revolution is associated with deep transformations that cause the discontinuation of the existing processes. In response to the transformations taking place in the socioeconomic sphere, the economic theory usually develops bold proposals for the conceptualisation of such processes. According to T. S. Kuhn (1962), they can be defined as a search for a new scientific paradigm. That was the case with the classical political economy, which developed in the period of the First Industrial Revolution of the second half of the 18th century. Another paradigm – neoclassical economics – developed in late 19th century, when the giant corporations were created and the free market capitalism became monopolistic.

The Third Industrial Revolution of the 1960s was overshadowed by the development of information technologies. The economists focused their attention on the significance of knowledge and information, and incorporated them in the economic theory. Currently, we are witnessing a revolution that has been named ‘the Revolution 4.0’. It is hard to answer the question about how this revolution will change the production methods and also how it will affect the directions of the economic theory development. One can only assume that this time there will also be attempts to thoroughly reorient the economic theory, as was the case in the past.

Although the considerations presented in this research paper are placed in the broad context of the Revolution 4.0, they mainly focus on analysing the labour market modernisation process. The essence of every revolution, either social or industrial<sup>1</sup>, is a dynamic process of changes that

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<sup>1</sup> The ‘social revolution’ term can be applied, e.g., to the French Revolution of 1789–1799 or the Russian Revolution of 1917. When it comes to Industrial revolutions, one can speak of: (1) the First Industrial Revolution of the mid-18th century; (2) the Second Industrial revolution of the turn of the 19th and 20th centuries; (3) the Third Revolution of the 1960s; and (4) the Fourth Revolution that started in the first decade of the 21st century. Although the exact dates remain disputable, these periods roughly cover the time of the most important technological inventions

redefines institutional conditions, both formal and informal. The main research questions formulated in this study are:

1. How did the First Industrial Revolution shape the relations on the labour market, where work was the basic production factor and its remuneration determined the distribution of income in the society?
2. What new challenges has the Revolution 4.0 created to understand the ways of the functioning of the labour market?

This article is an attempt to supplement the reflection on the impact of the latest advancements in information technology with the context of historical changes that have taken place in the labour market. The authors believe that the profound changes in the socio-economic dimension can be explained through adaptation processes related to the implementation of new technologies.

## The subject of research and the research method

The subject of this research is the process of labour market evolution resulting from the technological changes caused by the successive Industrial Revolutions. The study also takes into account the way of conceptualising these changes on the basis of economic theory.

In this research article, a descriptive method has been applied. It allows one to capture the essence of changes taking place in the labour market over a long period of time (defined by A. Marshall as “secular” (1920, p. 379)). This method refers to the evolutionary approach proposed by T. B. Veblen (1898) and is currently used by some representatives of institutional economics. It enables the reconstruction of the process of the development of economic theory, taking into account the socioeconomic factors that had a significant impact on the directions of its

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that led in subsequent years to an economic growth and the development of complementary industries that made use of the innovations.

evolution. The proposed research approach combines the elements of economic history with an analysis of the development of economic theory understood retrospectively.

### **The labour market in the classical view of political economy**

The development of economic thought is inherently linked to the major socioeconomic transformations that not only changed the existing dominant means of production, but also redefined social relations. When British economic historian Arnold Toynbee (1884, pp. 27–32) used the term ‘Industrial Revolution’ for the first time, he meant the period from 1760 to 1840. In 1760, in the Scottish town of Carron, when the first metallurgical furnaces were lit, new perspectives for the metallurgical industry opened. The inventions applied in the weaving industry increased productivity. As an example of increased productivity in the British weaving industry, Gregory Clark (2014) quoted data on the labour required to transform a pound of cotton into cloth. In the 1760, the process took 18 person-hours, while one hundred years later this was done in just 1.5 person-hours. The process would not have been possible without implementing in the production process inventions such as: John Kay’s flying shuttle (1733), James Hargreaves’ spinning jenny (1769), Samuel Crompton’s enhanced spinning mule (1779), or Richard Roberts’ self-acting mule (1830) (Clark, 2014, p. 255). James Watt’s steam engine became a new source of energy that replaced the human and animal muscle power. Privately, Watt knew Adam Smith, who is recognised as the father of modern economics. All these inventions enabled rapid growth in production. They also permanently changed the picture of the society. Labour, along with capital and land, became the key factor of production and the permanent element of economic balance sheet. In the period before the Industrial Revolution, work had been done mostly by slaves, as was the case in Antiquity, or as feudal duty, as was the case in Medieval Europe.

A milestone that enabled the creation of the labour market was the process of enclosing communal pastures in England. Rural dwellers who had lost their source of income migrated to the suburbs of cities such as Manchester or Liverpool, and increased the numbers of the new wage-earner forces – the so-called proletariat. They found employment in manufactories that developed as a consequence of the Industrial Revolution. The process was accompanied by social resistance. The expression of the utopian thinker, Thomas Morus (Doyle, 2014, pp. 166–179) – ‘Sheep eat man’ – became the symbol of this phenomenon.

Together with the Industrial Revolution, the market economy institutions developed. Among them, the labour market gained special significance. In the first paragraph of his book titled *The Wealth of Nations*, Adam Smith wrote: “The annual labour of every nation is the fund that basically supplies it with all the necessities and conveniences of life it annually consumes” (1981 [1776], p. 10). Smith’s claim that labour creates value became the subject of numerous polemics and interpretations in the area of the economic theory of value.

Recognising labour as the fundamental factor of production also gained significance in the broader context of the social stratification mechanism. In the traditional societies of Antiquity and the Middle Ages, and even that of the 16th and the 17th centuries, the place of an individual in a society was determined by customs and traditions. The social position was inherited together with the social privileges associated with a given class. Traditional societies were hierarchical. Once the market was recognised as the basic mechanism defining social relations, any free citizen could climb the social ladder, provided they could gather the necessary material resources. Success in the economic dimension guaranteed advancement to a higher social rank. The economic factors, in particular the labour market regulations, became the subject of an extensive debate, which surpassed the limits of economic theory.

The labour theory of value propagated by A. Smith and his successors was not only an

attempt to explain how the market evaluated respective goods. It became more than that, namely a claim that led to the greatest polarisation in the 19th-century economy, which reached far beyond the academic discourse and stepped into the institutional dimension of the socioeconomic system of capitalism. On the one hand, the classicists of economy – A. Smith, D. Ricardo, J. B. Say, and, to some extent, J. S. Mill – advocated liberally-oriented market economy. On the other hand, K. Marx criticised it severely and prophesied its prompt end as a consequence of a contradiction that was deeply rooted in it. This dispute had a broader dimension; it concerned two major theoretical narratives: pro- and anti-market-oriented.

Paul James McNulty admitted that Adam Smith could be rightly called the first economist of the labour market who approached labourers with understanding and this way changed the attitude represented by his predecessors, i.e. by William Petty and mercantilists (McNulty, 1966, pp. 539–540). The classicists viewed labour as the basic factor of production, whose value was not determined in accordance with the contemporary standards of the demand–supply analysis based on A. Marshall’s views (1920). This resulted from the fact that the classical political economy was strongly inclined towards supply. However, it lacked the analytical tools to understand the idea of demand. Owing to the marginal revolution of the 1870s, the economists understood the importance of the demand factors in the process of the development of consumer goods’ prices, followed by production factors. However, before that happened in classical political economy, a crucial role in explaining the wages had been played by the wage-fund doctrine enriched with the Malthusian interpretation of population pressure. This concept can be described by means of a simple formula:

$$W = \frac{WF}{QL},$$

where:  $W$  – wage rate;  $WF$  – wage fund;  $QL$  – quantity of labourers.

According to the wage-fund doctrine, in a short period, the wage rates ( $W$ ) constitute the quotient of the wage fund ( $WF$ ) and the quantity of labourers (which is constant in a short period). The wage fund is part of the capital accumulated by owners. It is paid in advance to labourers so that it can cover the time gap between the input of production factors and the results achieved, i.e. the end product. Such schemes might be interpreted as some kind of a demand-supply approach. The demand for labour is communicated by employers, which is based on the wage fund ( $WF$ ). It resulted from the abstinence (capital owners’ resignation from the ongoing consumption). The supply of labour ( $QL$ ) is determined by the size of the population ready to begin employment. However, the representatives of the classical political economy were interested not only in the static approach. The most important question was how wage rates would change with the development of capitalist economy. At first, the empirical data was pessimistic. Despite the introduction of technological inventions that increased labour productivity, the wages remained on the subsistence level, understandably triggering defiance of the pauperised parts of societies<sup>2</sup>. F. W. Botham and E. H. Hunt, who analysed the dynamics of wages in the early period of the Industrial Revolution, demonstrated the fluctuation of the real wage index as well as its relatively limited growth in the years from 1751 to 1792, based on the example of the Staffordshire County (real wage index of general labourers in north Staffordshire). With the index value for the year 1790=100, in 1751 it amounted to 101.1, reached the peak in 1779=141.2, after which it dropped to 111.4 in the year 1792 (Botham & Hunt, 1987, p. 390). Some explanation for this phenomenon is offered in a study on the low rate of economic growth in the early period of the Industrial Revolution (Williamson, 1984).

<sup>2</sup> A broader interpretation of the wage-fund doctrine embedded in the historical context is provided in the study titled “The Wages Fund in Historical Context” (Phillips, 1967).



Having analysed the above facts, the classical-economy representatives finally matured in conviction that poverty and destitution were natural attributes of human existence. The fullest justification for this view was famously presented at the turn of the 19th century by Reverend Thomas Robert Malthus (1798). The principle of population presented in his essay allowed for a modification of the short-term doctrine of the wage fund in such a way that it justified the empirically-observed tendency of the wage rates to remain on the subsistence level. The logic behind it was simple: if, as a result of the development of market economy, the wage fund (WF) grows, it exerts pressure for wage rates (W) to grow. This is the place where Malthus' principle of population is implemented. According to it, an increase in wage rates (W) is followed by the population growth, which, in turn, increases labour force supply (QL). As a result, wages drop to the physical subsistence level. This line of thought provided justification for the thesis that – on the same basis that poverty and destitution are an insurmountable attribute of human life – also wages will remain on the subsistence level in the long term. Accordingly, no institutional solutions can change this state of affairs. This belief was abolished by empirical evidence which demonstrated that in the second half of the 19th century wage-earners also started benefitting from the technological advancement. The wage-fund doctrine came to be perceived not only as erroneous but also as harmful, as it justified a set of views that the capital owners benefitted from. As such, it fuelled the revolutionary moods among those who felt marginalised.

In response to the criticism presented by Marx in *Das Kapital. Kritik der politischen Oekonomie* (1867), the representatives of the marginal revolution formulated an alternative theory that explained both the formation of wages on the labour market and the principles determining the functional distribution of income in the society. This approach was reconstructed by G. J. Stigler (1994). The ambition of the supporters of the theory of marginal productivity of production factors

was to identify one universal principle to evaluate every single production factor. According to this theory, labour, land, and capital were to be remunerated in accordance with the value of their marginal product. Such an approach was supposed to ensure fair distribution which was postulated by American economist J. B. Clark. He claimed that in perfect competition, each factor would receive a reward adequate to its contribution to the product-creation process, which would make a fair solution (Clark, 1908, p. 7). The interpretation of this claim was accompanied by an academic dispute that concerned the exhaustion of a product, which, in fact, boiled down to formalised analyses of production functions. As a result, it was noted that a product gets exhausted only in the case of constant economies of scale. This means that once a factor of production is rewarded in accordance with the principle of the marginal product value, the whole product has been distributed between the owners of those factors. If there are increasing economies of scale, an extra product remains after the distribution and as such it should be distributed among the members of the society based on the distribution principles other than market forces.

The theory of distribution based on the marginal productivity of the factors of production has remained the nucleus of contemporary microeconomics to this day. However, it is of limited use in answering the questions arising in association with the Second Industrial Revolution of 1870–1914 (Mokyr & Strotz, 2000). In technical terms, the steam engine was replaced with the electrical engine and combustion engine, and the achievements of science were incorporated into the industrial production. The society became much more mobile owing to the air transport and popularity of the car. In order to absorb the technological achievements predominant in the 19th century, the enterprise of an individual owner was replaced by joint stock companies and limited liability companies. Monopolistic capitalism and mass production was born. This type of production is best embodied by the assembly line applied by

the car manufacturer, Henry Ford. The genius entrepreneur was very well aware of the fact that mass production required mass consumption. Accordingly, on 5 January, 1914, he offered to his employees a daily pay of 5 dollars, which was high by the standards of those times. For a large group of labourers, work in the car industry became the dream road to improve their financial status. On the hundredth anniversary of those events, Tom Mackaman quoted two opposite opinions that were published back then in the *New York Times* and *Wall Street Journal*, respectively. The first one said: “What marvels might not Mr. Ford’s example work if only other capitalists would do the same”. Meanwhile, the *Wall Street Journal* criticised him for what he had done, calling him the “class traitor” (Mackaman, 2014).

The First Industrial Revolution gave birth to the labour market founded on voluntary contracts between the demand party represented by employers and the supply party defining the employee behaviour. In the neoclassical economy analysis, there is a clear polarisation between the world of capital and the world of labour. The Second Industrial Revolution resulted in strong monopolisation processes. Those processes were also reflected in the labour market. They consisted in the growing importance of trade unions throughout the 19th century. The labourers who expressed their demands concerning the amount of wages and the conditions of production had less bargaining power when they were confronted with enterprise owners who gradually increased the scale of their operations and monopolised the market. The scattered British associations of farmers and craftsmen started consolidating under the Grand National Consolidated Trades Union, established by Robert Owen in 1834. The union was a country-wide association of British workers who decided to fight for fair working conditions and satisfactory wages. The origin, evolution, and significance of trade unions is presented in the classical study by Beatrice Webb and Sidney Webb (1920). The authors believed that the implementation of the socialist postulates had been a chance not only

to improve the financial situation of the labourers, but also to create a more just socioeconomic system in England. In order to implement the ideas they propagated, the Webbs, Graham Wallas, and George Bernard Shaw founded the London School of Economics and Political Science in 1895. When analysing the history of trade unions, one might think that they constituted an important element of industrial relations founded on mass production, which was mainly the consequence of the Second Industrial Revolution. Contemporary changes in the production process which resulted from the Fourth Industrial Revolution changed the functions that they were supposed to perform, and whose interests they should protect.

### **The Revolution 4.0 vs. contemporary development trends in the labour market**

The transformations of the late 20th and the early 21st centuries that we have been witnessing have a huge impact on the labour market. These transformations, mainly associated with fast technological development, are called the Fourth Industrial Revolution. Although this concept has not yet been uniformly defined in scientific research and it would be hard to find a consensus in such issues as, for example, the time frame of the Revolution or its precise characteristics, researchers and experts agree that no other period in the history of humanity saw such thorough socioeconomic changes. Schwab (2017, p. 3) lists three main characteristics of the Fourth Industrial Revolution: (1) *velocity* (the pace of the changes that we observe is exponential rather than linear); (2) *breadth and depth* (the complexity of – and relationships between – technologies change the entire economic, business, and social paradigm, and even who we are as individuals); (3) *systems impact* (involves the transformation of the entire system, both within and across entities). The progress triggers structural changes that enforce a modification of labour market institutions, understood in the context of both formal and less formal considerations. Even

though we are not able to predict the direction in which new technologies will develop, and their impact on the socioeconomic environment, we should observe and try to draw conclusions from the dominant trends. Noticing certain tendencies will enable, at least to some extent, a dialogue about the institutional environment, including the direction that the societies and economies should follow. To quote Daniel Susskind and Richard Susskind (2015, p. 155): “An unwillingness to try to determine overall interaction is akin to driving a car at night with no headlights. Making qualified predictions (...) is like having the headlights on”. Thus, we should accept the fact that we are not able to notice many issues. Moreover, the issues that can have the largest impact on the socioeconomic environment might not have been uncovered yet.

Undoubtedly, it should be emphasised that the dynamic spread of ICTs, also in the context of the above-mentioned growing role of machines, leads to an exclusion of a part of society from the labour market, mainly due to their lack of relevant skills and because of their problems with learning such skills or retraining. It should be noted, however, that this aspect has two sides: old jobs are being eliminated, while new jobs are being created (Kubiczek, 2006 p. 127). The research results suggest that in a race of the force associated with the creation of new jobs owing to technological progress and the destruction associated with their replacement by automation, the former tendency has always won. Moreover, throughout the 19th and the 20th centuries, it was accompanied by gradual reduction of working hours that contributed to improve the quality of life and leisure time (Freeman & Soete, 1997; Dachs, 2018). Nonetheless, the discussion associated with the “end of work” concept and shift to the post-industrial era (Rifkin, 1995, 2016) – as well as progressing automation that will, to a large extent, replace human labour (Brynjolfsson & McAfee, 2011; Frey & Osborne, 2013; Ford, 2015) – is still relevant. It should be noted that, long-term, the creation of jobs has indeed always surpassed the level of their liquidation. This kind of compensation was not and

is not an automatic, fast, or painless process for a large part of society. The need to adapt to the new reality as well as the time required to gain relevant skills means that, in the short run, new jobs do not compensate for the loss of the old ones (Kubiczek, 2006, p. 128), which poses a major challenge for the labour market institutions, understood both in the formal and the informal context. The negative impact of automation, associated with the progress in the field of artificial intelligence, is being extensively discussed in scholarly literature. C. Frey and M. Osborne (2013) analysed 702 different occupations in the American market and concluded that as many as 47% occupations are at risk of being entirely replaced by autonomous systems in the next 10 to 20 years. M. Ford (2015) highlights a very important and unprecedented contemporary phenomenon: machines not only increase productivity, but they also become workers themselves. What is also important is that the border between routine jobs (that are easy to replace by automation) and non-routine jobs is disappearing very fast, and the development of artificial intelligence algorithms can also affect workers with the highest skills. Accordingly, Ford proposes replacing the term ‘routine’ with ‘predictable’. All jobs that fall into this group will be very easily replaced by machines and robots. One of the main reasons why artificial intelligence affects the labour market lies in its nature. Namely, as it develops, artificial intelligence not only complements occupations, but it also entirely replaces them and substitutes human labour (the so-called *worker-replacing technological change*). It is worth noting, however, that the technological change might bring two competitive effects. The first one concerns relocation of workforce and is directly linked to the aforementioned substitution of labour. The second one leads to increased employment and capitalisation in industries that have developed the most as a result of the technological change. Historically, the latter effect was usually dominant (Frey & Osborne, 2013). Meanwhile, the changes that are taking place in the 21st century make one wonder which of the two effects will prevail

this time. The studies show that the innovations known from the history of the previous Industrial Revolutions mainly replaced routine jobs, but now, for the first time in history, we can see that artificial intelligence causes replacement of non-routine jobs, too (Brynjolfsson & McAfee, 2011). Accordingly, the consequences for the labour market as well as for the demand-and-supply structure associated with the labour market (discussed in detail in the subsequent section of this paper) might prove to be not only huge, but also unlike anything that we have known so far.

### **Interpretation of social inequalities in the context of the Revolution 4.0**

The method of income redistribution between the individuals who participate in the process of its generation has attracted the interest of economists ever since economics became a scientific discipline. The ongoing Fourth Industrial Revolution and the growing production automation in many areas both add numerous new issues that require analysis and put into question some of the theoretical assumptions of the neo-classical theory of income distribution and the marginal productivity theory. A question that is extremely vital for the contemporary social policy is – who should become the beneficiary of an economic system in which products will be, to a large extent, manufactured by automatic processes? Moreover, how will the demand side of the economies be affected by the decreasing share of the human capital in the production process? The concept of the distribution of income, dominant in the economic theory, has two aspects: functional and personal. The functional distribution of income (previously discussed in this paper) involves rewarding a certain group proportionally to its contribution to the production process (i.e. marginal productivity). In the concept called the theory of distribution, the factors that take part in the production process receive a reward proportional to the impact that the unit of a given factor has on the entire product (Leszczyńska,

2006). Thus, it seems that the owner of a factor that is of major importance in the process receives a relatively high reward. However, the theory of distribution was subject to some criticism, especially after Alfred Marshall had suggested that the organisation was the fourth factor of production (1920, pp. 240–249). It is impossible to analyse soft factors – such as the organisation, entrepreneurship, or knowledge – from the perspective of the contribution of each unit of those factors to the marginal product (Giza, 2007). The concept of the functional distribution of income seems, in the light of contemporary transformations, to be even more limited, as added value in production processes is, to a large extent, created by automatic processes. Thus, the classical theory of distribution no longer answers the question about how income should be distributed. In the context of the role of production factors in creating wealth and generating economic growth, it is also worth acknowledging Robert Solow’s milestone study titled “Technical Change and the Aggregate Production Function” (1957). Solow built a model to evaluate the share of production factors in the USA’s economic growth in 1909–1949. The results showed that as much as 85% of the growth could not be explained by the model, which means that the growth was not stimulated by the traditional production factors, such as labour, capital, or land. Along with Solow’s study, a very important term for the economic theory was coined, namely ‘the total factor productivity’, also referred to as the Solow ‘residual’. It became a measure of ignorance about economic growth (Warsh, 2012), and technological progress started to be associated with a crucial role in the process. The domain of each Industrial Revolution is to transform the old processes into new ones by improving and automating certain tasks. In the past, technology replaced certain tasks performed by humans. Although each innovation characteristic of the subsequent Industrial Revolutions took work away from a part of the labour force, it gave unimaginable possibilities for economic development and increasing prosperity. However,

the characteristic feature of the late 20th and the early 21st centuries is the polarisation of the labour market that leads to increasing inequalities (Autor & Dorn, 2013; Acemoglu & Autor, 2010). This trend involves growing employment rates in occupations that require both low and high skills, while the demand for middle-skill occupations is dropping. Acemoglu and Autor (2010) showed in their studies that the share of middle-skill occupations, i.e. sales, office and administration jobs, and production jobs in total employment dropped from 57.3% in 1979 to 48.6% in 2007 and 45.7% in 2009. This phenomenon is associated with the fact that automation mainly replaces routine and predictable work. The occupations that are in the highest demand are the ones that require creative problem-solving (information technologies are those complementary to such occupations (Autor, Levy, & Murnane, 2003)) as well as occupations that require manual labour (e.g. waiters, cleaning personnel, etc.), as these are very hard to replace by available technologies. In the light of the above deliberations – associated with income distribution challenges in the era of digital revolution and growing social inequalities – there emerge public policy reactions that are worth mentioning. One of the concepts is universal basic income, which has been broadly discussed in the social policy discourse in the recent years, including the possible consequences of this solution for the economy. Undoubtedly, it is an interesting research problem that introduces questions of not only economic but also social and behavioural nature, associated even with the philosophical approach to the concept of a human being and their role in the society. Harrop and Tait (2017) identified five prerequisites that lead to an increased interest in the basic income concept. The prerequisites include: more insecure work, stagnant payment, skills and job dislocation, rising inequality, and insufficient work. Even though the introduction of basic income might solve some of the contemporary problems, it should be noted that this is only a tool to distribute income, not to generate it,

and, in the long term, it might lead to economic stagnation. The experiments show that basic income, intended to meet the basic human needs, might yield positive results in poorer communities (e.g. the Madhya Pradesh Unconditional Cash Transfers Project implemented in 20 Indian villages in 2010 (Bharat, 2014)). Another initiative that responds to the growing automation and that is supposed to reduce inequalities is the robot tax. According to research conducted by Joao, Rebelo and Teles (2017) based on the American economy data, further decrease of production automation costs will deepen income-related inequalities unless the current tax system changes. In order to keep their jobs, workers are required to be constantly reducing their wage expectations. Although a robot tax can become a major contribution to the state budget, offering additional funds for income redistribution, if such solutions are introduced only in a limited number of countries, those countries will lose their competitiveness compared to the countries that decide not to implement this solution. Another important kind of initiatives aimed at adapting societies to the requirements of the contemporary labour market includes all kinds of training programmes that teach the skills that are currently wanted on the labour market (e.g. knowledge of programming languages). They are supposed to increase the adaptive abilities of a society in the era of rapid digital changes. On the one hand, they promote further technological development. On the other hand, they stimulate active social participation in the process. To sum up, continual economic growth creates the need for fair distribution of income, which poses numerous challenges in the era of the Fourth Industrial Revolution. The neoclassical theory of distribution seems to have become irrelevant, which is proven by the new government initiatives based on the personal approach and focused on increasing the quality of life of the society, removing inequalities and adapting to the changing labour market.

## Concluding remarks

To summarise the considerations, it is worth paying attention to the socio-economic consequences caused by successive industrial revolutions. They are listed in Table 1.

When answering the first research question formulated in the introduction, it can be stated that the labour market, understood as a network of relations that determines the way of using the production factor, namely labour, is the consequence of the First Industrial Revolution. On the one hand, the classicists of economics emphasised the value-creating role of work. On the other hand, they presented the unjustified scepticism about the possibility of an increase in wage rates in the long term.

The increase in wages in the second half of the 19th century not only ensured an increase in the welfare of employees, but also opened the path of social advancement for them. The Second Industrial Revolution gave birth to monopolistic tendencies. Their effect on the labour market came in the form of the emergence and inclusion of Trade Unions in the process of shaping modern institutions of the capitalist economy.

When the potential effects of the Revolution 4.0 are analysed, the possible threats to employees who can be replaced by machines and the positive effects in terms of increasing the production capacity of modern economies are frequently noticed. This appears to be nothing new, as this issue had been viewed in a similar way during the First Industrial Revolution. The key question

Table 1. Economic and social consequences of the Industrial Revolutions

| Industrial Revolutions   | The changes in the labour market and their social consequences  |
|--|---|
| The First Industrial Revolution (mainly related to inventions in the weaving and metallurgical industries and the consequences of the invention of the steam engine).  | <ul style="list-style-type: none"> <li>• the creation of the labour market;</li> <li>• market based on allocation of work resources;</li> <li>• noticing the so-called social question;</li> <li>• the beginning of legislation which regulated the employee–employer relationship.</li> </ul>  |
| The Second Industrial Revolution (related to the chemical industry, the usage of electricity, internal combustion engine, and mass production after the introduction of a production line).  | <ul style="list-style-type: none"> <li>• the rise of monopoly capitalism;</li> <li>• monopolisation of the product market and the labour market (the growing role of Trade Unions in the process of wage negotiations);</li> <li>• the development of techniques for influencing consumer preferences and unifying their behaviour through advertising.</li> </ul>  |
| The Third Industrial Revolution (related to the invention of computers, the Internet, and the rapid increase in the possibility of storing information).   | <ul style="list-style-type: none"> <li>• strengthening the supply side of economies by applying more efficient technologies;</li> <li>• the growing importance of the middle class;</li> <li>• the increasing importance of knowledge and information (data) as production factors.</li> </ul>  |
| The Revolution 4.0 (related to the progress in the development of artificial intelligence, biotechnology, automation and robotics, and the transfer of an increasing part of everyday and professional life to the digital world). | <ul style="list-style-type: none"> <li>• profound changes in the production process causing concerns about an increase in income inequality and employment stability in occupations dominating among middle-class representatives;</li> <li>• progressive automation of activities requiring advanced analytical and comprehensive skills;</li> <li>• blurring the boundaries between the functioning of the real world and the digital world.</li> </ul> |

Source: own elaboration.

is – what institutional solutions in terms of income distribution and employee remuneration will be adopted in the world where a machine will be able to replace human labour?

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## The Opportunities and Threats Resulting from Robotic Process Automation in Public Service Development

### Abstract

*Objectives:* This study aims to identify the opportunities and threats of automation and robotisation process automation in the development of public services.

*Research Design & Methods:* In this study, the method of deduction was used as well as auxiliary methods and techniques such as logical analysis, analysis and study of literature, and classification and scientific description. The reasoning process was based on knowledge of management sciences and the existing findings with regard to digital transformation, in particular the robotic process automation of the public sector and services.

*Findings:* The study revealed opportunities and threats related to the automation and robotisation of public services concerning three entities/groups: citizens, administration employees, and public organisations.

*Implications:* The issues presented in the article might constitute the basis for practitioners, mainly public authorities and all other persons responsible for creating and implementing automated and robotic public services. Applications can be of particular interest to local government officials and management staff of various public institutions. Therefore, the robotisation and automation of services will gain in importance in the coming years, and many entities will be involved in their introduction and operation. This paper can also be useful for the economic and non-governmental sectors, whose recipients will be more aware of the opportunities and threats of service automation and robotisation.

*Contribution / Value Added:* As a result of the analysis, the synthesis of the theoretical findings on the processes of automation and the robotisation of public services as well as certain consequences of these processes for further development of these public services were identified. They were then classified as opportunities or threats to the further automation and robotisation of public services, which may serve as a basis for the establishment of subsequent empirical studies.

*Article classification:* theoretical/conceptual paper

*Keywords:* public sector, e-services, digital transformation, robotic process automation

*JEL classification:* M0, O3, H4

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## Introduction

While studying the scientific literature on digital technologies and digital transformation in contemporary organisations and management, including the public sector and its services, one can see that despite the growing interest in this issue, there is still a shortage of research and elaborate theorising in this area (Sobczak, 2013; Hess, Matt, Benlian, & Wiesböck, 2016; Adamczewski, 2017; Andersson & Mattsson, 2018; Filgueiras, Flávio, & Palotti, 2019; Larsson & Teigland, 2020). According to Hess et al. (2016), integrating and exploiting new digital technologies is one of the biggest contemporary challenges, and no sector or organisation is immune to the effects of digital transformation (p. 123).

The evolution of ICT has led to the spread of the next generation of ICT platforms, the so-called SMAC platforms (Social, Mobile, Analytics, Cloud). They create a specific ecosystem of IT solutions, allowing organisations to develop their activities with less financial expenditure and a maximum range of impact, thus creating new business models based on information generated by the economic environment (Adamczewski, 2017, p. 9). Andersson and Mattsson (2018) draw attention to the importance of the development and implementation of new business models supporting public service innovation led by digital transformation. According to the authors, digital transformation stimulates and enables public service innovation as a new way to create value. Innovation in the public context should be evaluated with reference to aspects of “common wellbeing” and focusing on the beneficiaries (Andersson & Mattsson, 2018, pp. 218–219).

Jarbandhan (2017) writes about principles for public sector management in the Fourth Industrial Revolution, which goes beyond the usual automation known from the Third Industrial Revolution towards cyber-physical systems (e.g. driverless cars, smart robotics, materials that are lighter and tougher, or a manufacturing process built around 3D). Houy et al. (2019) consider automation

as an important aspect in the context of digitising and modernising the public sector and its work processes. They describe the term ‘automation’ as the execution of a procedure by a technical artefact without the need of human activity or intervention. Automated systems in the public sector context can support people in working more efficiently and more effectively through performing work processes and solving problems (Houy, Hamberg, & Fettke, 2019, p. 62). However, some negative consequences of robotic process automation are also identified. As Gingrich (2019) notes, robots can replace old jobs faster than new jobs are created. Thus, those who benefit from automation (e.g. owners of capital, highly-skilled workers) and those who lose (e.g. displaced workers) are expressing different preferences over the fundamental features and the future shape of liberal democracy (Gingrich, 2019, p. 1).

Based on these findings, the conclusion is that we are faced with new challenges related to the development of the public sector and the need to rethink the direction of its innovation. In terms of the modernisation and development of public services, numerous positive modifications have already taken place, and several improvements have been introduced. However, Poland is currently only at the first stage in the implementation of modern, automated, and robotised public services. While public entities already provide digital services that do not require direct contact between the provider and the recipient, they are still equated with a form, application, or document that can be sent through the Internet. Based on these findings, the prospects for the development of modern public services that meet the needs of their beneficiaries and build a greater common good should be examined. Therefore, the study aims to identify the opportunities and threats of automation and robotisation for the development of public services.

After this introduction, the paper proceeds as follows. Section Two contains a review of previous work undertaken in the area of digital transformation and robot process automation regarding public services development. Then, the research method is

presented and explained in Section Three. Section Four contains the research results and achievements, where the summary of opportunities and threats related to the automation and robotisation of public services is presented. The results are discussed in Section Five in the context of the wider changes and innovation of the public sector and related opportunities for further research. Section Six contains some concluding thoughts and suggestions for future research.

## Literature review

The bigger part of the world has been dominated by information technology, which applies to almost every field of human activity. While using modern IT solutions on a daily basis, the public expects that similar standards and solutions will be offered to them by public administration. It is even widely believed that public institutions should not merely take into account these expectations, but even exceed them (Dąbrowski, 2012). Well-designed and implemented electronic public services, properly tailored to the needs of citizens, are extremely important, as they guarantee the efficient and effective organisation of the state in the provision of public goods, which constitutes the basis of a modern information society (Kachniarz, 2012, p. 18). The use of modern electronic solutions in public administration provides an exchange of information while providing favourable conditions for cooperation between citizens, businesses, and various organisations with public entities, based on new communication models. Completely new relations and new conditions for cooperation are being developed between offices and stakeholders. Offices more and more often take the form of an e-office (e-administration) and the services provided so far in the system of direct contacts are becoming e-services (Pieczarka, 2017, pp. 113–114).

The dynamic development of the Internet has contributed to the emergence of modern categories of the so-called e-services. They are created, *inter alia*, as a model of traditional services, where the information carriers between the provider

and the recipient use electronic channels (e.g. e-PUAP platforms). At the same time, e-services are increasingly catering to the needs of new customers (citizens), often unconscious, but posing other conditions to meet the needs of the new technological possibilities (e.g. the PIT e-service). It can be observed on an increasing scale that electronic services are either complementary to traditional services or even substitute them. Public administration also implements many IT projects aimed primarily at improving the work of offices and customer service. The use of modern IT solutions contributes to the simplification of procedures and quick customer service, as well as the improvement of the organisation of the work of offices and better coordination of processes. It seems necessary to determine how the automation and robotisation processes will affect the development of public services.

Dąbrowska et al. (2009) defined e-services as

[a] new formula for providing a service and thus satisfying the needs using the Internet, from the moment the company contacts the client (individual or stationary) to present the offer, through ordering the service, its provision, and contact after the service. The virtual form of service provision allows for greater standardisation of services and may refer to full or fragmentary e-customer service as part of the service provision process appropriate for a given type of service. (p. 41)

In the literature, one can find many terms with supposedly the same meaning, e.g. electronic services, electronically-supplied services, e-services, on-line services, digital services, virtual services, or information society services. The vocabulary is used interchangeably to a greater or greater extent. There is a lot of chaos in defining the e-service offered by the public sector. It thus seems necessary to precisely define the public e-service and determine the factors influencing its development.

In this study, it was assumed that e-public services are understood as actions undertaken by public entities that rely on enabling citizens to implement

a particular obligation or powers, introduced using electronic means of communication at a distance without the simultaneous presence of the parties. The development and improvement(s) of public services are inherently related to automation and robotisation. The concepts of automation and robotisation are often used interchangeably, too. Although the difference is insignificant, it is worth emphasising. According to some researchers (Sobczak, 2019), automation is a more general concept than robotisation and as such means introducing the so-called automatic devices (Grzeszak et al., 2019, p. 8). Robotisation is a form or type of automation. Other researchers (Moreno & Jimenez, 2018, p. 224) believe that robotisation is a more comprehensive concept and includes computational processes, digitisation, automation, artificial intelligence, big data, and information and communication technologies (ICT). The common goal of automation and robotisation is to replace human labour. In the case of automation, human work is replaced by an IT system, while in robotisation replacing a human at work translates into a robot in the physical sense, or a type of software (Sobczak, 2019).

The literature distinguishes two types of robots: industrial and service. The difference between industrial and service robots concerns the area of their application and proximity to end-users (Prestes, Carbonera, Fiorini, Jorge, Abel, & Madhavan, 2014). Until recently, robotics was dominated by industrial robots. The Robotics Industries Association (RIA) defines an industrial robot as a reprogrammable, multi-functional manipulator designed to move materials, parts, or special devices through programmed movements to perform a variety of tasks (Keramas, 1999). Another approach is proposed by the International Organization for Standardization (ISO), which defines robot as “a machine with several degrees of freedom, often having the appearance of one or more wrist-ending arms capable of holding a tool, workpiece or control device” (Sirinterlikci, Zane, & Sirinterlikci, 2011, p. 158).

The number of robots used for professional and personal service applications is growing rapidly. In 2006, service robots accounted for 78.84% of the total robotic population, and industrial robots for 21.16% (Sirinterlikci, Zane, & Sirinterlikci, 2011, p. 158). Professional service applications are used in medicine, laboratories, forestry, mining, agriculture, rescue, defence, and security. Personal service applications are mainly used in education, housekeeping, and entertainment. Service robots are technical devices that perform tasks useful for the well-being of people in a partially or fully autonomous manner (International Federation of Robotics, 2015). The potential of automation and robotisation can be seen in the public sector, especially in medicine, geriatrics, care for people with disabilities or child therapy (surgical robots – classic surgical robots, surgical microrobots; diagnostic robots – classic diagnostic robots, microrobots, and diagnostic nanobots; rehabilitation robots – stationary, exoskeletons, telerehabilitation robots; care support robots – service robots in institutional care and auxiliary robots in-home care; others – therapeutic robots for adults and children, robots supporting learning or work, robotic rooms, integrated environments) (Mikołajewska & Mikołajewski, 2013, p. 109).

The authorities of some European countries emphasise the positive aspects of using robots in public services. In 2017, the British government published the report titled *Growing the Artificial Intelligence Industry in the UK* (Open Access Government, 2017). This report highlights that the use of artificial intelligence (AI) can bring the UK economic and social benefits. According to Paul Tomlinson, Director General of IEG4, there is still a tendency to think about AI primarily as a means of increasing productivity and saving money, but much less attention is paid to the potential of improving the citizen experience. The public sector can gain significant benefits owing to automation and robotisation (Open Access Government, 2017).

Exemplifying the use of robotics in public services is the Robotic Processing Automation (RPA) – the robotic automation of processes. They are software robots called ‘bots’ and designed to automate rule-based tasks by mimicking user interactions. Thus, a software robot is used to handle repetitive, multi-series activities. In this case, the robot is a computer-coded software, a programme that replaces people performing rule-based tasks, and a cross-functional and cross-application macro (computer algorithm), but not a walking, talking autobot, a physically existing machine, or a software that recognises voices and responses (Teuben & Vrieling, 2017).

The pace of changes in public services is limited, *inter alia*, by the presence of complex, costly, and often outdated IT systems. The RPA allows one to replace traditional processes with automated ones, thus making quick and effective improvements without a comprehensive system review (Teuben & Vrieling, 2017). The above examples clearly show the coexistence of robots and humans, which is also true in public services. This implies several positive and negative social changes that are worth taking a closer look at (Sasak, 2020).

## Methods

The choice of the research method was driven by the reference to two aspects of the issues raised: 1) the adequacy of the methods to the research objective and research problem, and 2) placing the issues in management considered as practical sciences, and precisely at the interface between service management, public management, and innovation management (Cyfert, Dyduch, Latusek-Jurczak, Niemczyk, & Sopińska, 2014; Lisiński, 2018). Given the identified lack of theoretical knowledge on the processes of digital transformation and robotic process automation of public services within these subdisciplines, theoretical research was undertaken, the results of which could be used in the development of future empirical research in this field.

Therefore, although the research was located within the framework of the practical management sciences, the method of deduction was used to solve the above-mentioned scientific problem, and its auxiliary methods and techniques were used, namely logical analysis, analysis and study of literature, classification, and scientific description. The research is based on the achievements of management sciences limited by the scope of the adopted goal and the research problem, as well as the existing knowledge about the robotic process automation of the public sector and services.

The basis of the deductive reasoning was a literature review carried out for this purpose, including management sciences knowledge and the existing findings on digital transformation (in particular on the robotic process automation of the public sector and services) related to the attempt to capture the specificity of development processes in the public sector. The aim of such a literature review was not so much an accurate description of the state of knowledge (as in the case of a systematic literature review) as to build a knowledge base sufficient to deduce conclusions about the opportunities and threats of automation and robotisation processes in the development of public services.

This type of literature review is based on a completely different, i.e. non-quantitative, logic/sequence of source selection and analysis. The process of literature review is path-leading, interactive, evolutionary, and based on coherence logic. Conclusions from a given cycle of reasoning become the basis for further search in the literature. This iterative process is interrupted when the results are relatively satisfactory; in fact, this process never ends (it is of an evolutionary nature, like a process of scientific cognition itself, which is to some extent a reflection of the evolutionary processes taking place in the studied social reality). This results directly from the nature of science and social reality, where we are looking not so much for a simple inference of conclusions from the premises based on formal logic, but for a relation of coherence between the premises justified in the studied literature

and the conclusions constituting new knowledge (which is not a simple statement or juxtaposition of facts previously known in the studied literature). In addition, there is an even broader context related to the ontological and epistemological status of premises and conclusions in science in general, and in social sciences in particular (e.g. verificationism vs. falsificationism), as well as its consequences for the cognitive and inquiry processes (Czakon, 2011; Dewey, 1991; Dubois & Gadde, 2002; Flach, 1996; Grobler, 2006; Lisiński, 2013, 2018; Shepherd & Sutcliffe, 2011; Schön, 1992), which, however, goes far beyond the scope of this paper. Such a reasoning process itself is difficult to reproduce precisely in the form of a linear procedure (like the one proposed by the systematic review), because it is simply not linear in the case of social sciences, which is entangled in a series of ambiguous relationships.

## Research results

Digital transformation is systematically changing the way in which different areas of society and economy function. As mentioned above, it also affects the public administration sector and the services it offers. Regarding the said literature review, three areas of digital transformation that shape public services can be identified: 1) the experience of stakeholders (understanding the needs of citizens, introducing multiple channels of communication with the clients, and implementing elements of self-service); 2) operational processes (internal processes of the organisation and work environment as well as mechanisms for monitoring the performance of individual tasks); and 3) business models (adjusting public services to the needs of citizens) (Westerman, Calmédjane, Bonnet, Ferraris, & McAfee, 2011).

Based on a report prepared by the Roland Berger consulting company on behalf of the German Bundesverband der Deutschen Industrie e.V. – BDI, four key elements of digital transformation have been identified: 1) digital data – capturing, processing, and analysing digital data allows

for better predictions and decisions to be made; 2) automation – combining traditional technologies with artificial intelligence is giving rise to systems that work autonomously and organise themselves, which reduces error rates, adds speed, and cuts operating costs; 3) connectivity – interconnecting the entire value chain via mobile or fixed-line high-bandwidth telecom networks synchronises supply chains and shortens both production lead times and innovation cycles; 4) digital customer access – mobile Internet gives new intermediaries direct access to customers with full transparency and new kinds of services (Berger, 2015, pp. 17–19). Automation processes that can be combined with the use of artificial intelligence in the processes of providing public services are particularly interesting for the further development of the public sector. Smart automation is not only about replacing people with machines, but also about increasing operational efficiency through the use of interactions between people and technology (Gajewski, Paprocki, & Pieriegud, 2016, p. 20).

According to Sobczak, the issue of digital transformation plays a particularly important role in the development processes of public organisations. Both citizens and businesses expect these organisations to provide public services through all possible channels at a similar level of quality as the private sector does (Sobczak, 2013, p. 280).

Poland is at the beginning of the process of automation and robotisation of public services. The next stage of development will take place when the proper public e-services will be provided at the middle-office level. Submitting an appropriate application form, regardless of whether it is a traditional or electronic form, should have the same consequences when it comes to digitally-transformed public services. The recipients should not be involved in the technical side of service delivery processes, but, rather, receive the public service results with specified qualities (Szczudlińska-Kanoś, 2020).

While studying the literature, one can find that the next stage of digital transformation of public

services is expected to be at the level of a specific set of organisational units connected with each other and functioning in the form of a network (Homburg & Bekkers, 2002; Möller & Svahn, 2003; Sobczak, 2013).

The last stage in the development of public e-services seems to be the moment when the services will be implemented at the back-office level and combined into the so-called “packages”. This will require service providers not only to engage in their duties and competences, as is the case

with the middle-office stage, but also to cooperate with other public, private, or third-sector entities. It would be advisable that one report in the case of a specific random event serve to settle many matters (Szczudlińska-Kanoś, 2020).

Based on the analysis of the literature, it was indicated that the opportunities and threats related to the automation and robotisation of public services concern three entities/groups: citizens, administration employees, and public organisations. As a result of the analysis of the theoretical findings

Table. 1. Opportunities and threats resulting from robotic process automation of public services

| Opportunities  | Threats   |
|--|---|
| Better matching of services to the needs of citizens/recipients  | Poor access to information technologies for some social groups (information exclusion)  |
| Modernisation of services and the processes of their provision   | Dependence on information systems (nothing can be done if there are technical problems)   |
| Lower service costs  | Some people employed in public services might lose their jobs   |
| Accelerating the development of digital competences in society   | Dehumanisation of services  |
| Greater transparency in spending money and achieving goals   | Negative effects of standardisation (less flexibility and no individual approach to clients/stakeholders)   |
| Increasing operational efficiency as a result of interactions between people   | No help from officials (instead – bots, helplines, etc.)  |
| Relieving public sector employees (robots will take over some of their repetitive activities) as well as better use of the creative potential of employees and their competences | Difficult access to public information for people who are less concerned with information technologies  |
| Relieving service users; robots will take over some of their repetitive activities   | A sense of alienation amongst both officials and recipients of public services (the system as something external, over which we have no influence and to which we must adapt)             |
| Transparent rules and better control of service delivery processes   | Lack of direct contact  |
| Easier access to public information  | Difficulties in dealing with atypical situations, in which human intuition and intelligence plays an essential role, which, in turn, might affect the quality of data processed by robots |
| Possibility to devote more time and attention to those citizens who need help (instead of fast standard service)   | Poor alignment of all parts of the system in a rapid process of change, e.g. between officials and citizens   |
| Trigger and acceleration of further changes in the public sector   | Low quality of received feedback (only standard and general information)  |
| Easier to get feedback from service users  | No exact explanation of the product   |
| Availability of services 7 days a week and 24 hours a day from anywhere with access to the Internet  | Extended feedback process in case of problems   |
| Faster data collection and analysis  |   |

Source: Own elaboration.

on the processes of automation and robotisation of public services, certain consequences of these processes for the further development of these public services were identified. They were then classified as opportunities of – or threats to – further automation and robotisation of public services (Table 1).

In the future, only those digital services will be useful and appreciated which will meet the expectations of more and more demanding citizens. On the one hand, it is necessary to automate and robotise the public services, while on the other hand it is essential to simplify them as much as possible, especially in times of a demographic crisis, when increasingly older communities should benefit from them. Therefore, when creating modern public services, it is inevitable to use methods and techniques of process management. An accurate process analysis of the service allows us to verify and evaluate subsequent component activities, and to improve them.

## Discussion and concluding remarks

The study investigates the possible ramification of the implementation of technological solutions, i.e. automation and robotisation, in the public sector. In the face of the ongoing technological changes, the question arises whether this transformation will be beneficial, and for whom. Two extreme visions emerge in this context: optimistic and pessimistic. In the optimistic one, the emphasis is put on development opportunities, saving time and energy, unleashing creativity. The pessimistic one points to depriving people of work, condemning many social groups to idleness, marginalisation, and, as a consequence, social unrest (Infuture Hatalaska Foresight Institute, 2019). This gives a black-or-white picture of what awaits us in the future with the changes that follow.

The results of the research presented in this study emphasise both positive and negative aspects of automation and robotisation of public services to citizens, administration employees, and organisations. Thus, as a result of the analysis,

a third rationalist vision emerged, emphasising both the benefits and threats of potential changes.

There is no doubt that changes in the area of public services will take place, and so the sense, purpose, form, and definition of public services will transform. Larsson and Teigland (2020) pose quite a fundamental question with regard to digital transformation, namely: “how and why?” By examining opportunities and threats, we try to answer the question about why the public sector cannot remain indifferent to the ongoing digital transformation and the accompanying robotic process automation. On the other hand, the indication of opportunities and threats is the basis for selecting future directions of empirical research. They are interdisciplinary, because they concern research related to the evolution of implemented technological solutions in public services, new management styles in the context of these changes, the adaptation of Polish society and individual social groups to new opportunities, as well as ethics and safety, including responsibility for the work of public-sector robots.

Poland is not one of the most digitised countries in Europe, especially in the public sector; therefore, the prospect of introducing advanced digital technologies might be causing anxiety among the rulers, employees, and citizens (Kawecki, 2017). This is evidenced by the fact that already nearly one-third of the world’s leading companies believe that their revenues will be threatened in the coming years by digital disruptions, i.e. the phenomenon of a sudden appearance of new technologies and business models affecting the value of the products and services currently provided by these organisations (Adamczewski, 2017, p. 10). These unpredictable, complex, and ambiguous phenomena are often described as VUCA, the acronym for the four dominant properties: volatility – related to a relatively unstable change; uncertainty – a lack of knowledge as to whether an event will have meaningful ramifications; complexity – related to an overwhelming situation characterised by many interconnected parts; and ambiguity – a lack of knowledge as to the basic rules



of the game (Bennett & Lemoine, 2014, pp. 312–316; Adamczewski, 2017, pp. 10–11). This acronym has recently found its way into the business lexicon and the four properties are seen both as challenges and opportunities (Bennett & Lemoine, 2014). VUCA genuinely describes the world of digital transformation and is a significant source of the opportunities of – and threats to – the robotic process automation of public services identified in this study.

The aim of the research, which was the description and explanation of the opportunities and threats connected with the automation and robotisation of public services, allows for the elimination of one of the main factors hindering these processes, namely awareness related to the fear of using this type of innovative solutions. However, this research study has its limitations, which is why this question needs to be justified and deepened in further context-based empirical research.

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Maria Płonka

## The Implications of the Fourth Industrial Revolution for Information Asymmetry on the Market: Selected Aspects

### Abstract

*Objectives:* The identification and systematisation of the phenomenon of information asymmetry on the market in theory and practice, and anticipating the impact of this phenomenon on the market and socio-economic relations in the era of the Fourth Industrial Revolution.

*Research Design & Methods:* Theoretical and cognitive studies, case studies, and inductive reasoning.

*Findings:* In the era of the Fourth Industrial Revolution, the innovation and information sector determines changes in the direction, dynamics, and structure of socio-economic development, which means that information has become an independent resource of special value. In the face of changes, the asymmetry of information on the market will deepen. This is due to the growing gap between the exponential increase in knowledge and anti-knowledge, and the limited, constant perception of the human brain and human tendency to opportunism, which means that in the field of information processing, artificial intelligence will be winning against human intelligence. Against this background, new threats are emerging that require new knowledge, skills, and competences from market participants and the state.

*Implications / Recommendations:* Solving the problem of information asymmetry is a common economic good that should be co-created by all sides of social, market, and public relations through regulatory and educational mechanisms. It is better to anticipate the cooperation of human intelligence with that of machines rather than engage in a conflict. The use of rich information resources, including the selection of irrelevant, manipulated, or false information will become a key skill of market participants, and the state should, through its tools, eliminate the negative effects of information asymmetry.

*Contribution / Value Added:* The subjective evolution of approaches to the phenomenon of information asymmetry from classical economics to behavioural economics, the identification of the relationship between information asymmetry and moral hazard and their consequences, the exemplification of problems on the basis of positive economics in the conditions of the Fourth Industrial Revolution.

*Article classification:* theoretical and review article

*Keywords:* information asymmetry, the Fourth Industrial Revolution, moral hazard, negative selection, behavioural economics, artificial intelligence

*JEL classification:* D82, D91, D81, B25, D01

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## Introduction

The growing volume of information poses the need to ask about its utility and cognitive value in the conditions of ‘big data’. The American futurists F. Fukuyama and A. Toffler rightly stated that “with the technological development of communication tools, reliable information will replace the unreliable (...) and the information revolution will lead to universal changes (...)” (Fukujama, 2004, pp. 49–50). In a similar vein, American sociologist Manuel Castells (2000) claims that “the information and technological revolution will reveal its transformational potential (...). The share of wealth that goes to individuals will depend on their access to education and society as a whole – from their innovation system” (pp. 600–601). Against this background, the problem of information asymmetry will emerge.

**Information asymmetry** is a situation in which one of the parties to the relationship has more or better information knowledge regarding the subject of the transaction than the other party (see, e.g., Akerlof, 1970; Rothschild & Stiglitz, 1976). It has been a common phenomenon in social, market, and public relations since the dawn of history. It can be considered an objective and natural phenomenon resulting from the fact that certain people or social groups are better-informed than others. However, in the case of market transactions, which is the area of research presented below, asymmetry of information might be a source of market advantage, which is associated with moral hazard (*ex-ante* factor) and negative selection (*ex-post* factor) (Mróz, 2016).

**Moral hazard** occurs when the better-informed party uses hidden information and has a material incentive to use the other party’s incomplete information to gain additional benefits at the other party’s expense.

**Negative (adverse) selection** is a situation in which the asymmetry of information causes an imbalance of power and position in the functioning of specific transaction markets (Czochański, 2017). In general, it causes the displacement of a better

product by a worse one, disturbing the functioning of the market, social relations, and the state.

The aim of this article is to identify and systematise the phenomenon of information asymmetry in the market, doing so in the context of theory and practice, and to anticipate the impact of this phenomenon on the market and socio-economic relations in the era of the Fourth Industrial Revolution.

The following research theses were formulated as part of the study:

- behavioural economics is a research trend that most adequately explains the phenomenon of information asymmetry, undermining the neoclassical model of rationality;
- the economy of excess implies the deepening of the asymmetry of information on the market;
- in the conditions of an overload of information, procedural and emotional reasoning supersedes optimisation and rational reasoning;
- artificial intelligence introduces new dimensions of relations associated with possible information asymmetry;
- the state can and should mitigate the negative effects of information asymmetry in market transactions.

## Information asymmetry in retrospect

Information asymmetry is a phenomenon that historically always occurred in social, economic, and political relations, but this empirically known problem had not been explained on the basis of mainstream economic theories until the end of the 19th century. The classical and neoclassical economic model explains the behaviour of economic entities, based, *inter alia*, on the assumption that decision-making units (*homo oeconomicus*) are rational, i.e. that they operate relying on complete and perfect information (Solek, 2010, p. 22). At the turn of the 19th and 20th centuries, representatives of the Austrian school, and their followers, rejected the concept of *homo oeconomicus* as inadequate to the then current activities. C. Menger (1871) drew attention to the influence of the process of obtaining information and learning as scarce

resources which constitute significant constraints on the rationality of actions and decisions of market entities. A later representative of the Austrian school, L. von Mises (1949), claimed that “people subjectively define goals that they want to achieve through their actions, and under such assumption they do not necessarily lead to maximization of the benefits achieved” (p. 45). The 1974 Nobel Prize winner F. von Hayek claimed that “resource allocation (...) is a problem of using knowledge not given to everyone in the whole community” (1945, pp. 6–11).

As early as in 1947, American economist H. A. Simon, the 1978 Nobel Prize laureate in economics, criticised the assumptions of neo-classical thinkers about the unlimited ability to process information, creating the theory of human-bounded rationality in the face of increasingly limited knowledge, perception, subjective expectations, or preferences. Simon argued that

the principle of bounded rationality [is] the capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behaviour in the real world — or even for a reasonable approximation to such objective rationality. (1947, p. 198)

As the author continues in his later work, “The first consequence of the principle of bounded rationality is that the intended rationality of an actor requires him to construct a simplified model of the real situation in order to deal with it” (Simon, 1957, p. 198).

In the conditions of an overload of information, he proposed procedural rationality instead of optimisation reasoning, i.e. the separation of procedures under the conditions of a limited set of decision variables.

J. K. Galbraith, in his concept of the *Affluent Society* (1998 [1958]), drew attention to the growing influence of corporations manipulating information and advertising messages in order to shape excessive consumer demand.

In the second half of the 20th century, the problem of information asymmetry was reflected in numerous scientific papers and was acknowledged with Nobel prizes. Information economics as a new field of science was appreciated in 1996 with the award of the Nobel Prize to J. Mirrlees and W. Spencer Vickrey for research on economic situations, whose participants have asymmetric information at their disposal. The same line of research was also recognised in 2001 by awarding George A. Akerlof, A. M. Spence, and J. E. Stiglitz with the Nobel Prize for their analysis of markets with information asymmetry.

These researchers have shown that the asymmetry of information at the micro-level (irrational decisions) has consequences at the macro-level (market failure, country failure), thus challenging the neoclassical model of rationality, which assumed that market participants had full information and did not incur the costs of obtaining information.

Under these conditions, in economic theories and in practice, instead of the classic *homo oeconomicus* assumption, the emotional human paradigm (*homo sapiens oeconomicus*) is more and more often taken into account (Wach, 2010). Here, emotional reasoning dominates over rational reasoning.

This reasoning is exemplified in the publications of R. Thaler (1980) and Sustein (Thaler & Sustein, 2008), which initiated the development of behavioural economics. Thaler was recognised with the Nobel Prize in 2017. In the mainstream of behavioural economics, information asymmetry is already a kind of *ex-ante* assumption, because anomalies, weaknesses of the human mind, and potential cognitive errors which can arise as a result of these weaknesses are its main research problem.

The dynamic development of behavioural economics has resulted in important scientific theories, introducing an interdisciplinary, holistic developmental approach, using knowledge from psychology, sociology, and economics, and taking into account social, ecological, and emotional factors. An interesting research trend is ecological adaptation and social rationality (Gigerenzer,

2000, 2007, 2008, 2015; Katsikopoulos, Schooler, & Hertwig, 2010).

Unlike the neoclassical theorists of expected utility, psychologists D. Kahneman and A. Tversky (1974) explained, with the help of experimental research, the mechanisms and heuristics of decision-making and the actual behaviour of people towards risk.

Behavioural economics is a research trend that most adequately explains the phenomenon of information asymmetry, representing a positive trend in economic research and undermining the neoclassical model of rationality. This results in the diversification of its trends, which include: *the Michigan school* (G. Kanton), *psychological economics* (D. Kahneman – Nobel Prize winner from 2002; A. Tversky, who did not live to the award, and C. Camerer, R. Thaler, E. Fehr), *behavioural macroeconomics* (G. Akerlof – Nobel Prize winner from 2001), *evolutionary economics* (R. Nelson, S. Winter), *behavioural finance* (R. Shiller – Nobel laureate in 2013), and *experimental economics* (V. Smith – Nobel Prize winner in 2002) (more in: Solek, 2010; Dudziak, 2013).

### Information asymmetry and its consequences

In an economy based on knowledge, skills and competences that transform the possessed information into added value are and should be a source of competitive advantages in the market and non-market relations (Płonka, 2008; Dziekański, 2012; Godlewska-Majkowska, Skrzypek, & Płonka, 2016; Santarek, 2017; Wiktor, 2018; Stanienda, 2019). In the education system, it is desirable to enhance skills and competences in order to develop the ability to identify anti-knowledge and shape the competence to eliminate it (Paprocki, 2019).

The problem is moral hazard and treating information as a tool of power and manipulation. Here, instead of partners in the exchange of goods and values, there are “tricksters” and “phools”, and the economy of equilibrium transforms into the “economy of manipulation and deception”

(Akerlof & Shiller, 2015)<sup>1</sup>. Irregularities and even pathologies and crimes related to this problem pose potential threats to the integrity and transparency in market, public-private, and social relations.

From the epistemological point of view, three normative situations can be ascribed to the phenomenon of information asymmetry and moral hazard. These are presented in Table 1.

In the first two cases, the asymmetry of information does not have negative consequences, building and petrifying trust in the axionormative system (system of values and social norms) in market relations as well as in the public and the social spaces. Only the third case implies phenomena that disrupt the functioning of the market, the state, and the society. It is important to distinguish between the phenomena that accompany moral hazard:

- ‘being cheated’ (real, penalised fraud, e.g. identity theft);
- ‘feeling cheated’ (no actual cheating, but there is a subjective feeling of being harmed);
- not causing the effect of ‘feeling cheated’ (usually due to the lack of awareness of this fact).

The above statements can be exemplified by three cases observed in financial market transactions, where the asymmetry of information has particularly unfavourable and visible social implications, because financial institutions are perceived as public trust institutions, or might be perceived as such.

The case of Amber Gold is one of ‘being cheated’; extreme, penalised dishonesty which was inherent in the incomplete information contained in the advertising message, which included, among others, keywords such as: trust, security, profit up to 16.5% per annum, 100% guarantee of security, and capital invested in gold. It was a typical financial pyramid without foundations based on risk awareness, which in 2012 did not exist for

<sup>1</sup> Both terms are taken from Akerlof’s book (1970), where fools, spelled as “phools”, are understood as naive victims, suckers, while the “tricksters” are deceivers, fraudsters, information manipulators, cheaters.

Table 1. Relationships between information asymmetry and moral hazard – their premises and consequences on the market and in the public and the social spaces

|   | <b>Information asymmetry occurs</b>  | <b>Potential “trickster”<br/>Motives, conditions, consequences</b>  | <b>Potential “phool”<br/>Motives, conditions, consequences</b>  |
|---|--|---|---|
| 1 | There is no moral hazard;<br>No tricksters and no fools;<br>Benefit-sharing.   | Fairness of market transactions;<br>Transparency of the public space;<br>Sharing, support, trust in the social space.   |   |
| 2 | There is a moral hazard, but it cannot be realised (the costs of moral hazard are higher than the benefits of implementing it.)  | Fear of losing trust;<br>Fear of penalisation;<br>The conviction that the moral hazard is not profitable.   | No “phools” (knowledge, education, awareness);<br>Strong legal and institutional protection of fools;<br>No negative selection.   |
| 3 | There is a moral hazard and opportunities to implement it (the benefits of moral hazard are higher than the costs of its implementation);<br>There are tricksters and fools. | Greed (appetite for profit) outweighs the fear of losing trust and even the fear of being penalised;<br>There is a regulatory and mental space (consent) for abuse. | Greed and naivety;<br>Poor legal and institutional protection of “phools”;<br>Loss of trust in fraudsters or public institutions;<br>Anomy of the axionormative system. |

Source: own elaboration.

11,000 victims, who were scammed for a total of 660 million PLN. However, it could have been found that since December 2009 this entity had been placed on the list of public warnings from the Polish Financial Supervision Authority.<sup>2</sup> The mirage of extraordinary profits excluded any rational thinking by the victims, who filed a class action against the state in 2014, which was then rejected by the court. These events resulted in a decline in confidence in the state and in banks (although Amber Gold was not a bank) as a consequence of using information asymmetry to implement the moral hazard.

The case of Amber Gold is an exemplification of many financial pyramids that also appear today, which proves that society does not learn from the mistakes of its predecessors and that emotions (greed) exclude rational actions.

The situation of ‘feeling cheated’ is exemplified by cases of Polish customers of mortgage loans

denominated in Swiss francs. This feeling arose as a consequence of the lack of awareness of the potential loss resulting from the exchange rate risk when submitting declarations of will in agreements with the bank. The advertising and media message from 2007–2008 suggested that the exchange rate risk would not be realised to the same extent as it was in the previous years (Szewczyk & Hajkowski, 2019).

However, there are many abuses that do not cause the effect of ‘feeling cheated’ by the other party to the transaction, because they are not aware of it. A typical abuse that does not constitute a crime but uses the phenomenon of asymmetry of information is ‘misselling’, i.e. selling products which the buyer does not need. This situation most often occurs in the markets of professional services. For example, when concluding an insurance contract, the policyholder or the insured is not aware that the concluded insurance contract contains unnecessary additional products or contractual clauses unfavourable to the client. A financial intermediary, architect, doctor, lawyer, or other entity with specialist knowledge might be

<sup>2</sup> <https://www.bankier.pl/wiadomosc/Amber-Gold-od-powstania-do-decyzji-o-likwidacji-2614344.html> (accessed: December 2020).



tempted to abuse it and, for example, recommend unnecessary products in a situation where the other side of the market does not have the professional knowledge to be able to notice it.

Information asymmetry can also apply to situations in which it is the buyer who has an information advantage. For example, when concluding an insurance contract, the insurer does not know about the intentions of the other party, who might act with the intention of extorting compensation, benefits, or take advantage of the opportunity to extort or to perform a criminal activity (more in: Pawłowska-Szawara, 2020; Stanienda, 2020; Jedynek, 2020; Strupczewski, 2020; Klonowska, Małeczka-Łyszczek, Snarska, & Wyrobek, 2020; Płonka, 2019, 2020).

### **The Fourth Industrial Revolution and its impact on the scale of information asymmetry**

As a result of successive industrial revolutions, which marked the development of civilisation (steam, electricity, digitisation, the Internet), the society of ‘excess’, consumption, and intensive information transmission on a global scale (mass media, means of transport) was formed. The Fourth Industrial Revolution (Industry 4.0) initiated the widespread use of the Internet, which changed technological, economic, and social relations on the global scale, especially in the area of information transmission and storage<sup>3</sup>.

From 2000 to 2018, the computing capacity of supercomputers recorded growth of 3,500%, while data storage costs decreased by 99.5%, which led to a rapid increase in the amount of data generated by humanity: 80% of data in world history was created between 2015 and 2018, and, on average, the computing power of computers

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<sup>3</sup> *Przemysł 4.0 PL Szansa czy zagrożenie dla rozwoju innowacyjnej gospodarki?* (2016). Boston Consulting Group. <https://docplayer.pl/24443942-Przemysl-4-0-pl-szansa-czy-zagrozenie-dla-rozwoju-innowacyjnej-gospodarki.html> (accessed: July 2020).

doubles every two years<sup>4</sup>. In 1995, storing 1GB of data cost about USD 10,000/year, while in 2018 it cost only 3 cents a year<sup>5</sup>.

This data proves that Industry 4.0 opens the way to increasing information potential through three development paths, namely:

- *The Internet of Things* (IoT) – it allows for global access to machines connected to the network, giving the possibility of registering emotions and sharing all available information;
- *Smart Factory* – it allows for autonomous coordination of production through personalised adaptation to market needs (mass customisation) on the global scale (Schwab, 2016). The available applications create augmented reality, i.e. digital visualisation of invisible elements on real objects, autonomous robots, and intelligent networks of contacts in the value chain (Bujak, 2017);
- *Machine Intelligence* – based on artificial intelligence, Big Data, the Internet of Things, robotics, and cloud computing, it allows for autonomous communication regardless of the location of users. Artificial Intelligence is digital awareness that can independently assess the situation, learn about human emotions and behaviour, has a virtual personality and its own autonomy, and has the ability to learn through data analysis<sup>6</sup>.

The growing number of mobile devices connected to the Internet and the operation of a set of immense databases (Big Data) – the size of which exceeds the capabilities for recording, storing, managing and analysing by traditional systems and people – create cyberspace which, owing to

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<sup>4</sup> Ramię w ramię z robotem, jak wykorzystać potencjał automatyzacji w Polsce (2018). *Forbes*. Raport McKinsey&Company.

<sup>5</sup> <https://www.hbrp.pl/b/czwarta-rewolucja-przemyslowa-zmiana-juz-tu-jest-1/2/OmImRGYw> (accessed: July 2020).

<sup>6</sup> Człowiek ustępuje pola maszynom. Do 2040 roku mogą nam dorównać inteligencją, Business Insider, [www.https://businessinsider.com.pl/technologie/czym-jest-sztuczna-inteligencja/qzgz0wt](https://businessinsider.com.pl/technologie/czym-jest-sztuczna-inteligencja/qzgz0wt) (accessed: July 2020).

the Cloud infrastructure, is independent of place, time, distance, and administrative borders. It also ensures relative user anonymity and the tracking of both equipment and people connected to this equipment.

New civilisational opportunities resulting from the Fourth Industrial Revolution lie in the construction of autonomous vehicles, advanced robots working autonomously or together with people, and technologies, in which Polish companies have a significant share (3D printing, graphene, fighting against the coronavirus<sup>7</sup>).

Under these circumstances, information-processing functions are more and more often taken over by robots that ‘think’ for humans, support them in making decisions, and even have a quasi-personality. The humanoid robot Sophia, activated on April 19, 2015, became a citizen of Saudi Arabia in 2017, being the first robot to obtain citizenship of any country. Gifted with artificial intelligence, Sophia adapts to human behaviour and to working with people. For instance, in 2018 she took part in discussions during the “Impact ‘18” congress in Cracow, Poland<sup>8</sup>. In 2017, in turn, the anthropomorphic robot Fran Pepper became the first robot to be granted citizenship of the European Union (Belgium). He/It was trained to work as a receptionist on the university campus<sup>9</sup>. In India, at a cost of 700 USD, a humanoid robot has been created that can work as a receptionist, assistant, friend of lonely people, etc.<sup>10</sup>

The market for humanoid robots is growing and it is predicted that by 2025, one-third of traditional

workforce will have been replaced by artificial entities<sup>11</sup>.

There is no doubt that the amount of information that robots are equipped with is greater than the perception of the human mind, which is why artificial intelligence introduces new dimensions of relations linked to possible information asymmetry: human–artificial intelligence relations and artificial intelligence–artificial intelligence relations. If robots were market participants, the conditions of the neoclassical rationality, *homo oeconomicus*, would be met to a greater extent.

However, it is good that robots do not make decisions about purchasing many market products, because in the conditions of rational purchasing, most companies operating in the sector of elective goods would have to file for bankruptcy. Scientific research confirms the commonly understood fact that in the conditions of the economy of excess, most frequent purchases are made under the influence of emotions and as such they have no logical justification. On the basis of these behaviours, the trend of emotional marketing appeared, from which new trends emerged, namely neuromarketing and behavioural neurology. They are based on studies of the brain and the unconscious pattern of buyer emotions and behaviours that initiate the buying process<sup>12</sup>. Monitoring and managing the emotions of customers in the purchasing process is a new, developmental area that implies a specific information market and new ways of manipulating the recipients, who are not only tracked via mobile devices, but who themselves publish on social media data that has value on the information market. The Internet of Things opens the possibility of continuous profiling of buyers, tracking their interests, views, and preferences in order to offer personalised advertising.

In this context, behavioural economics is a research trend that most adequately explains

<sup>7</sup> <https://www.sztucznainteligencja.org.pl/datawalk-z-wroclawia-rusza-na-koronawirusa/> (accessed: July 2020).

<sup>8</sup> <https://www.forbes.pl/wiadomosci/konferencja-impact-w-krakowie-spotkanie-z-sophia-humanoidalnym-robotem/100gmtz> (accessed: December 2020).

<sup>9</sup> <https://noizz.pl/nauka-i-technologie/robot-obywatelem-belgii-zobacz-jak-wyglada-i-co-potrafi/4hf2c0w> (accessed: December 2020).

<sup>10</sup> According to: *The Hindustan Times*; <https://www.rt.com/news/435986-hindi-speaking-rashmi-humanoid/> (accessed: July 2020).

<sup>11</sup> <https://www.forbes.pl/biznes/roboty-do-2020-roku-zabiora-5-mln-miejsc-pracy-na-swiecie/smz1z38> (accessed: July 2020).

<sup>12</sup> <https://pieknoumyslu.com/marketing-emocjonalny/> (accessed: July 2020).

the phenomenon of information asymmetry, undermining the neoclassical model of rationality.

New technologies based on neuromarketing allow, for example, an X manufacturer of T-shirts using a brainwave analysis scanner to track customers' reaction to images displayed on the screen of their smartphone or computer, owing to which they can offer an assortment adequate to their emotional preferences. Cosmetics brand Y has created an m-commerce (mobile commerce) application that allows customers to search for available products based on their current mood<sup>13</sup>. These examples lead to the conclusion that the asymmetry of information can be enhanced by the behaviours and emotions of the buyers themselves, confirming in them the paradigm of the *homo emotionalis*.

Against this background, one can risk a thesis that the scale of information asymmetry is largely dependent on the scale of emotions accompanying knowledge, competences, selection, and information-processing skills, as well as preferred values. Emotions accompanying people distort the decision field, contributing to behaviours consistent with the principle of bounded rationality.

The human tendency to simplify things means that in the conditions of an informational overload, they narrow down their perception of the environment and stimuli (e.g. preferring one TV channel, social networking site, doctor, service technician, advisor, product brand, influencer) as a result of being anchored in the original information. As long as they are convinced about the correctness of their choice, they do not bother to consider other, perhaps more favourable, alternatives. Emotional purchases, made in conditions of deep asymmetry of information, generally do not bear the 'being cheated' sign, but they are often accompanied by a feeling of 'being happy' (often for both parties to the transaction). This is one of the interesting heuristic facts of behavioural economics.

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<sup>13</sup> <https://www.mediafeed.pl/zakupy-pod-wplywem/> (accessed: July 2020).

## Concluding remarks and contribution to the discussion

Information has a specific economic value and as such can be a source of competitive advantage for its holder.

Modern technologies deepen both the democratisation of access to information and the possible asymmetry of information, and the overload of information does not go hand in hand with the increase in knowledge and skills for how to use it effectively. This is due to the growing gap between the exponential increase in information and the limited, constant perception of the human brain and human tendency to opportunism, explained on the basis of behavioural economics (limited rationality, emotions, values, anchoring effects in the context of decisions, etc.) Under these circumstances, an influencer can become a quasi-authority who creates a moral hazard. It is not without significance that the marginal cost of obtaining additional information is increasing, while the marginal benefits of obtaining additional information are decreasing. These facts confirm the thesis that the economy of excess implies the deepening of the asymmetry of information on the market. However, it is not this fact itself that is dangerous as much as the lack of information management skills and possible monopolisation of know-how on the part of technology-and-information distributors. The thesis that in the conditions of an overload of information procedural and emotional reasoning supersedes optimisation and rational reasoning can be empirically tested on the basis of research tools and techniques used in behavioural economics.

The development of artificial intelligence creates conditions for both cooperation and competition with human intelligence. Certainly, robots will win against humans in terms of the ability to process information, but the competitive advantages on the market also result from other factors, including from using emotions, with which artificial beings can cope even less. The advantage of a human being may also

be intuition, unexplained on the basis of rational data analysis. One can imagine a futuristic fight (competition) between humans and robots, but it is better to anticipate the cooperation of human intelligence with the intelligence of machines. This is a contribution to the discussion on the thesis that artificial intelligence introduces new dimensions of relations associated with possible information asymmetry.

Solving the problem of information asymmetry is a common economic good that should be co-created by all sides of social, market, and public relations. This is achieved by IT tools (Internet resources, search engines, social networks, databases, public registers, comparison engines, applications, etc.), which enable quick use of knowledge resources, but at the same time the gap between the information available and the information needed is growing exponentially, creating an even greater distance between knowledge and anti-knowledge. Technological solutions also limit access to information for people without skills, competences, or authorisations to certain functions and resources of the IT system, which implies a gap between the growing level of IT technology and inadequate skills of network users. The possible digital, technological, and mental exclusion can be reduced through systemic solutions implemented by various institutions.

Moral hazard on the part of bidders is reduced by market instruments (e.g. image, brand, reputation), warranty (e.g. warranty, certification, standardisation, accreditation), and legal means (e.g. consumer protection, public registers, including the threat of penalisation). On the buyers' side, moral hazard is reduced by consumer awareness.

The Fourth Industrial Revolution translates into growing expectations and new functions of the state in solving the problems of information asymmetry. In addition to traditional public goods, new public goods continue to appear, such as digitisation, cybersecurity, consumer protection, access to information, respect for the constitutional

information autonomy<sup>14</sup>. All this implies the need to build an adequate education system and legal regulations enabling inclusive and sustainable development of society.

Technology is way ahead of regulation; there is no codification of norms and legal effects of acts committed by artificial intelligence. The problem is noticed by lawyers, e.g. 'Who is responsible for any damage caused by an automatic vehicle?'<sup>15</sup> Taczkowska-Olszewska (2020) quotes "Asimov's laws", the first of which is: "A robot cannot harm a person or allow a person to suffer harm by failure to act..." (p. 223).

In this context, the thesis that the state can and should mitigate the negative effects of information asymmetry in market transactions is indisputable; it is only the methods and tools of influence that are debatable. The state, having at its disposal a wide range of financial, administrative, regulatory, and penal instruments, and being equipped with control functions, can and should limit the impact of negative effects of information asymmetry. The EU and various national regulations impose certain information obligations of financial institutions on their clients under the penalty of criminal sanctions. The state is also responsible for the supervision and subject-and-object licensing of market activities of public trust institutions as well as the creation of central databases (public information databases, registers of prohibited clauses, public warnings). However, these tools become useless in the case of low public awareness, which is why it is necessary to build a system and solutions that strengthen consumer awareness and protect all parties to the transaction against the negative effects of information asymmetry.

<sup>14</sup> Art. 51 of the Constitution of the Republic of Poland of April 2, 1997 (Journal of Laws 1997.78.483 with follow-on amendments).

<sup>15</sup> In March 2018, an autonomous vehicle belonging to the Uber company fatally hit a pedestrian. One year after the accident, it was found that there was no possibility of bringing charges against the vehicle owner. More in: Taczkowska-Olszewska, 2020.

Information asymmetry leads to selection. It is the effectiveness of the state in mitigating its effects that determines whether this selection will be negative or positive.

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Michał Zubek

## The Role of Management Information in Education Management

### Abstract

*Objectives:* In management processes, information is very important, but in the educational system its role is crucial. According to the author, decisions made in the current Polish educational system are not based on mechanisms derived from management science which includes the role of information. The aim of this article is to present the role of management information in the educational system, the main mission of which is to overcome the distance between the Polish educational system and modern, worldwide educational standards.

*Research Design & Methods:* The conducted quantitative research was based on critical analysis and interpretation of sources from literature as well as on the observation of specific phenomena, behaviours, and events. As far as qualitative methods are concerned, the author used Time-Driven Activity-Based Costing and an analysis of municipal budgetary accounts, which was treated as a credible and reliable source of information of the studied phenomena.

*Findings:* The results of the TDABC prove that the potential of the Polish educational system has not been fully exploited.

*Implications / Recommendations:* The system's time and financial reserves could be used to minimise the distance between the Polish education standards and modern educational requirements if the information channels were made more efficient.

*Contribution / Value Added:* The author points to potential further research on the role of management information in the educational system.

*Article classification:* research article

*Keywords:* management information, education, management, Time-Driven Activity-Based Costing (TDABC)

*JEL classification:* M540 Personnel Economics: Labor Management

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## Introduction

The future of Poland, its place in the world, and its quality of life for future generations are increasingly dependent on the effects of broadly defined education system, which undoubtedly should occupy a prominent position in sustainable development. Looking back over the decades, the Polish education is half-way from a rigid system during the Polish People's Republic towards a flexible system which will not only follow a rapidly developing environment, but will also soon become an important driving force behind the necessary changes in all domains of social life. The distance between the Polish education and the requirements of today's modern world demands constant research in the field of education management on all its levels, as well as using the results of this research in managing educational processes. Closing the gap would be a skilful use of all available information as well as demanding and searching for deeply processed information for all the participants of education processes.

The author of this article has formulated the following main hypothesis: a proper use of the available information as well as searching and demanding information by all the participants of the educational process are essential for making a full use of the potential and resources, which will decrease the distance to the world's highly-developed education systems. In order to verify this hypothesis, the author has formulated a sub-hypothesis: the information demand on the part of school-supervising local governance, i.e. municipalities and poviats, is low also due to the discrepancy in goals.

The author's basic research question is: what is the role of information in the education system, whose main mission is to reduce the distance between the Polish education and the requirements of today's modern world? There is also a need to raise a question about whether the information gathered by researchers (e.g. from The Educational Research Institute, IBE) – such as the Boards of Education as the supervisory authority for

the school, municipalities as the bodies responsible for its operations, and, finally, the schools themselves implementing the education process – is being used properly? Seeking answers to these questions, the author used qualitative research methods based on critical analysis and interpretation of sources from literature as well as on the observation of phenomena, behaviours, and events. As to quantitative methods, the author used Time-Driven Activity-Based Costing and the analysis of the municipal budgetary accounts, which was treated as credible and reliable source of information in the studied phenomena.

## Management in education

Management is a complex and universal process, which Griffin (2002) defines as “a set of activities (including planning and decision-making, organizing, leading, and controlling) directed at an organization's resources (human, financial, physical, and information), with the aim of achieving organizational goals in an efficient and effective manner” (p. 38). Public management is a specific discipline in the field of management science and its fundamental research concentrates on the management of individual organisation from the public sphere, primarily public institutions and macrosystems (macro organisations), such as the national economy and the state, and also the mesosystems, e.g. regions and individuals areas of public life (Kozuch, 2004, p. 59). According to Kozuch, a **public organisation** is a socio-economic system consisting of subsystems: (1) goals and values, (2) psychosocial, (3) material and technical (4) structure, and, above all, management subsystem and interactions with external environment (2004, p. 96). The inherent characteristics of public organisations which clearly distinguishes them from other types of organisations is their ‘public’ character, which means that in public organisations the public goods are the object of transaction, while in private sector it is the private goods (Bednarczyk, 2001, p. 19).



School is a specific public organisation with local authorities as its supervisors. School is expected to provide both public education services and the effective use of public funds. According to Kobylński (1996, pp. 167–168), school management (as well as any other educational establishment) might be defined as a mission to uphold the school statutory objectives (for which it was established) being a priority for the school staff.

Although knowledge management is universal, the simple transfer of theories and rights as described and used in the field of economic governance is not possible due to the specificity of management in education. The thoughtless transfer of strategies used by the New Public Management concept to the field of education management remains a serious problem for the emerging field of management in education; it prevents the emergence of theories and knowledge which would allow one to properly understand some education processes and at the same time manage these processes in a better way (Dorczak, 2012, p. 40). From the organisational and social point of view, school belongs to those institutions which are difficult to manage.

In modern education systems, two main models of school management are on the rise: the socialised form of management and the innovative management. Answering the ‘who runs the school?’ question is not simple. Certainly, a head teacher is the main manager of a school. However, they also have superiors, namely a minister for education, a school superintendent, as well as representatives of social organisations, members of trade unions, etc. They co-create, *inter alia*, social, material, and technical working conditions; they assign the tasks and evaluate them, etc. In this way, they influence school work effects (Pielachowski, 2002, pp. 113–114). The Polish regulations and laws impose several hundred obligations on a head teacher; primarily, it is about orderly and systematic work. The local government, as a supervisor, is expected to improve resource efficiency in the context of the expenditure on education. In addition, the education system is not free from political pressure, which prevents schools from adapting

their curricula and teaching methods to the needs and capabilities of their students, as well as from creating opportunities for teachers, parents, and students to participate in decisions concerning the functioning of the education system.

The management of schools should mainly focus on building human capital and managing its resources, since the role of teachers and other school actors – such as students and parents – is crucial and cannot be underestimated. There are three main doctrines in the science of human resources management that vary according to the process of involving and encouraging employees to work. These are: 1) Taylorism – traditional doctrine of motivation; 2) ‘human relations’ doctrine of motivation (human relationships); and 3) modern doctrine of motivation in human resources (Szczupaczyński, 2004, p. 77). The motivation concept, which is widely used in modern organisations, is the two-factor theory also known as the Herzberg’s motivation-hygiene theory, which states that there are certain factors that result in job satisfaction and productivity at work, and then there are those which cause employees’ dissatisfaction. In their essence, all these concepts focus on various material motivators (such as earnings and working conditions) and non-material ones (individual fulfilment, promotion opportunities, personal development). In the Polish reality, a salary still remains the most important motivator and as such it is not satisfying. It may be that work conditions, especially those connected with working hours (as a material motivator influencing the teachers’ satisfaction level), can be treated as a compensation for a lack of a decent wage. Certainly, research in this field provides some information on education sector. However, the following questions arise: is this information used, and how? And do the actors participating in the education processes put considerable effort to use information in the decision-making processes? When the information reaches the authorities, it should be processed in a way that allows and facilitates management, thus rationalising the administrative processes.

## Information in organisation management

The meaning of the term ‘information’ is very broad. Essentially, anything that can be digitised – i.e. encoded as a stream of bits – is information (Shapiro & Varian, 2007, p. 15). In other words, information is a dataset which is properly arranged in a sequence to facilitate the cognitive processing, which is the beginning of the deduction process for making decisions. There are many definitions of information in the literature. In terms of management science, information means knowledge necessary for reaching the goals of an organisation (Penc, 1997, pp. 81–82).

The **information system** of an organisation which possesses a wide range of information pieces from different areas of its activities performs management functions by ensuring input, processing, and transfer of data. As a consequence, owing to the feedback it enables the management to respond to the current and future changes both inside the organisation and in its environment. As Zajac et al. emphasise (2012, p. 50), management information system results from the management’s demand for accurate, timely, and useful data in order to plan, analyse, and manage the company’s work, thus optimising its development. Building information systems that simplify and facilitate a company’s management is an important challenge faced by the leadership. However, the effective provision of relevant and up-to-date information is essential for effective management (Vollmuth, 2007, p. 237). Information is regarded as a factor of production. In this context, the role of information is crucial for social and economic development.

Nowadays, the economic standing of a country is not determined by natural resources. The key role is played by information resources of a given society. In modern countries’ economies, the information field is an increasingly important and rapidly growing sector of the national economy. These observations justify the statement that information, both in the economic theory and in its practical dimension, should be qualified as a factor of

production, similarly to natural resources, capital, and labour (Oleński, 2001, p. 271). Therefore, it is an essential determinant of a company’s success. Properly processed and used, information might undertake a competitive advantage of a company on the market. Thus, each company (organisation) must have an effective and complex system to generate the most useful information possible, namely information that is up-to-date, accurate, complete, and related to the actions and goals of the given product.

Based on the above-mentioned definitions, three fundamental aspects of the notion of ‘information’ can be indicated. They confirm that information plays an overriding role in the functioning of organisations which struggle with changes in the environment. These aspects can be summed up as follows:

- information as a representation of reality,
- information as a measure of complexity and diversity,
- information as a causal and controlling factor.

‘Information’ is commonly associated with terms such as: wisdom, knowledge, data, information, message. All these terms are connected with the intellectual capital of a company, and the level of their importance can be depicted through the pyramid (Figure 1). The first three levels – i.e. collecting messages, entering them to the information system in the form of raw data, and even data-processing to receive information in the next step – do not bring any benefits to the company yet. As the pyramid shows, all these factors are dependent on the quality of the human capital, as it is people who ultimately determine their value.

Information is valuable only if it is up-to-date, which, in practice, means that the manager is able to interpret the data and make the right decisions. If the received information is outdated, it means that the decision-making process is not based on an accurate and complete dataset. As Filipiak concludes (2008, pp. 205–218), completeness is the disposal of the necessary information which is required in the decision-making process. Certainly, this does

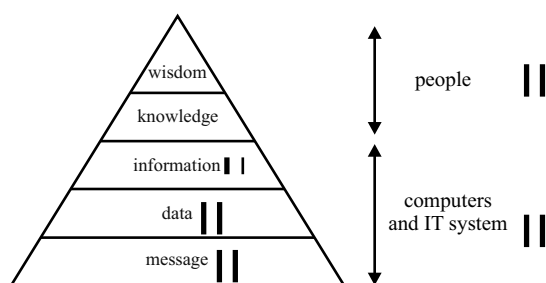


Figure 1. The elements of intellectual capital in a company

Source: Heracleous, 1998, p. 29.

not mean that any piece of information describing a certain phenomenon in which a manager is interested should be treated as useful. The major feature of management information (MI) is its usefulness in the management decision-making process. From the perspective of management, it is the form of information as well as its speed and range that makes for its essential features. Form is the length and complexity of a message; speed is about the time in which information reaches the recipient; range refers to the possibility of transferring management data to many recipients. Information should respond to the needs, which may vary in different periods or situations. Nowadays, information is more accessible and, as a result, more valuable owing to popular and available data carriers and technology. However, this might also cause the risk which was rightly worded by Herbert Simon (1971, p. 40) when he said that “a wealth of information creates a poverty of attention”.

The robust information systems for management consist of, among others, operational and strategic information, interviews, research, experiments, observations, and surveys. Data contained in the management information system – which requires cooperation of all organisational units in the company as well as the employees at all levels of management – is knowledge. In the implementation of management activities, managers are assisted by information management systems (programmes), which consist of elements

such as: analyses, evaluations, datasets, presentation methods, etc. These are created by people supported by technology and information infrastructure. The technological infrastructure makes information more accessible and thus more valuable. Distinguishing relevant information from irrelevant information is key, as well as estimating whether irrelevant information will not become relevant. This is why an appropriate system is needed. A real-time system will verify the data reliability, describe the structured data, and present how to use the acquired knowledge – all this simultaneously so that it can help managers with both the internal and external process control.

In the light of these considerations, it is my view that there are problems that cannot be ignored, especially a lack of essential management competencies, insufficient competencies, and/or a lack of digital skills among managers. Information is useless when head teachers and municipalities’ management do not have the basic competence to move into the world of information. The additional challenge today lies in digital education – not only in the field of organisation management, but, in particular, regarding school. The urgent need for access to digital technologies is strongly connected with the global COVID-19 pandemic. The world has suffered from the virus and almost 85% of the school-age population (in 191 countries) have felt the effects of closing schools. The pandemic situation has also revealed the education digital gap caused by a lack of online education. This problem also affects Poland. In terms of digital skills, Poland is on the 63<sup>rd</sup> position, according to the latest report of the World Economic Forum (WEF). This proves that a simple transition from the traditional system to digital channels (the creation of the hybrid model) will not be easy. Ultimately, the role of teachers will change. The pandemic is changing everything (Ciesielski, 2020).

### The role of information in education

The economic system, in which all the processes emerge, is built on information. Taking account

of the above definition, information can be understood as a good which is necessary to process managing in any kind of organisation. Depending on the consumers' needs, information becomes a tool to gain knowledge from different areas. Information is crucial in the education process for all the actors involved, namely:

- the state as the main education policymaker that sets out a strategic approach;
- the Board of Educators, which is responsible for pedagogical supervision on the education process; it does not have any competence in the field of organisation and logistics; the Board operates under the voivodeship office;
- the local authorities, especially municipalities, which are responsible for the educational establishments functioning on their areas;
- the head teachers (school directors);
- the teachers, pedagogues, psychologists, speech therapists;
- the parents or legal guardians;
- the students, who are the essential element in the education process as well as its main actors.

These actors co-create a system responsible for providing teaching and educational services. Schools and educational establishments are a special part of the system, as they are production centres of responsibility which employ the teachers. In the market theory of education, a teacher is a middleperson between the local authorities – which supervise the school – and a student, who is a client, i.e. a recipient of the education service.

The following simplified scheme (Table 1) of individual actors' access to various aspects of education indicates the information demand. The presented table reveals the practical use of actual information about the education process by different beneficiaries, without any research element that might improve the whole process. Only that information which is comprehensive and well-adjusted to relevant recipients' needs should be treated as useful.

The entities that have the statutory legal authority and significant influence on the education process organisation, its funding, and pedagogical supervision, are as follows:

Table 1. Simplified scheme of the information demand by individual actors of the process according to their role

|   | The recipients of information               |                 |  |         |                    |
|---|---|-----------------|--|---------|--------------------|
|   | Superior unit/<br>the Board<br>of Education | Head<br>teacher | School<br>administrative<br>staff member | Teacher | Parent/<br>student |
| Electronic school register                          |   | x               |  | x       | x                  |
| Timetables  |   | x               | x  | x       | x                  |
| Finances /accounting, human resources               | x   | x               | x  | x       |                    |
| Performance appraisal                               |   | x               | x  | x       |                    |
| Library   |   | x               | x  | x       | x                  |
| Student data (learning process)                     | x   | x               | x  | x       | x                  |
| Employee data (employment record)                   | x   | x               | x  | x       |                    |
| Reporting related to one unit                       | x   | x               | x  | x       |                    |
| Reporting related to the units<br>in a municipality | x   | x               | x  |         |                    |

Source: own elaboration.

- public administration, especially the municipalities as the supervisors;
- the Board of Educators, which is accountable to the voivode, as the unit responsible for the pedagogical supervision over the schools.

However, the activity of primary schools, although not calculated for bringing any income, is subject to economic laws. Even the best concept of running a school is doomed to failure when confronted with the tough rules of market economy. Efficiency measurement as well as access to information are the key areas of education. Budgeting is one of the methods of collecting information and measuring the effects. Particularly, it shows to what extent the education is significant for the national economy, the municipality, and the citizens. It is worth noting that the state covers high expenditures on the education sector.

The local authority implements budgeting for the education sector in relation to its external environment: politics, local economy conditions, cultural events, and the human factor (with or without respective skills and knowledge). For a local authority, this process belongs to the most important processes in the management sector. It involves: continual information processing; planning the workflow and finance budget not only for the educational establishments, but also for units responsible for this sector (e.g. the department of education in a municipality); an economic and administrative assistance in the schools. The budgeting model currently used in municipal units is bureaucratic, obsolete, and inefficient, with regulations and strong impact of the trade unions. The costs of the education potential, its human resources, and its assets are very high. The budgetary accounts of the local authorities (which are the supervisors for 80% of schools) show a significant share of expenditure on education in the global expenditure of the municipalities. According to the Educational Research Institute (Nowakowska, 2015), these expenses represent nearly 50% of the municipal budget. However, this amount is not sufficient to provide good-quality education, so there is a need to do some research

and look for resources which will enable both the improvement of processes and the optimisation of decisions. Budget implementation in school is a part of municipal budget implementation and at the same time it is connected with performance of material tasks planned to be carried out in the accounting period. Relating these activities to such a short period of time indicates the lack of interest from municipalities and schools in implementing practical and modern solutions in budgeting.

The heart of modern management systems in the public sector is ‘making the citizens’ needs a priority’. A well-done education task is a public value undertaken for citizens and other stakeholders, and is adequate to market value in the private sector. That is why the increasing number of private schools, private preschools, and all kinds of private universities confirms the business benefits. From the business standpoint, the benefits in the public sector should be the effects of activities in the process of the optimal use of public funds assigned to educational activities.

At the beginning of the second decade of the 21<sup>st</sup> century, the Educational Research Institute conducted research which aimed to determine how much time the teachers spend on professional activities during a typical week in a school year, as well as to identify factors determining its differentiation. The research reliability and its findings should be assessed as unquestionable, as the research initiators were the teachers themselves. They were the first who, by the representatives of teacher trade unions, acknowledged the need to conduct research in this field. The research was carried out as a part of the system project titled “Research on the quality and effectiveness of education and institutionalisation of research facilities” (Federowicz et al., 2013), and it was based on a representative sampling using two research methods: Computer-Assisted Personal Interviewing (CAPI) and Computer-Assisted Web Interviews (CAWI), which were preceded by qualitative research. The results of this research were used in public debate in which the author

of this publication was trying to diagnose time and financial reserves that arise within educational activities.

The data presented in the thematic report by Federowicz et al. (2013) was considered as a reliable basis to conduct Time-Driven Activity-Based Costing: case study of primary school in Kielce in the 2018/2019 school year, as well as the municipal budgetary accounts for this period, in the part of the budget related to task no. 80101 from the relevant budget bill. The study indicates the practical processing of general information from the said Report as well as its adaptation to a form that allows for making decisions in the process of education management at the level of various bodies responsible for education. The Time-Driven Activity-Based Costing was combined with the results presented in the study by Federowicz et al. (2013); it allowed for processing independent information for its double use, namely in the education management sector (i.e. by the municipality which supervises the school) and by the Board of Educators, which supervises the education management effects.

### Time-Driven Activity-Based Costing as a research tool

The commonly used traditional costing works well for financial reporting, but it is not sufficient for management needs. A new approach, called ‘Time-Driven Activity-Based Costing’ by the authors of the Kaplan and Cooper system (Cooper & Kaplan, 1991, pp. 130–135), allows companies to calculate in an elegant and practical way the costs of processes and the degree of their use of production capacity and profitability of orders, products, and customers. This costing enables cost-accounting systems to be improved rather than shifted. Managers receive accurate cost and profitability information in order to be able to prioritise process improvement (Kaplan & Anderson, 2008, p. 18).

The TDABC approach avoids the costly, time-consuming, and subjective activity surveying of a conventional calculus. Time equations are

used that directly and automatically allocate resource costs to the activities performed and the transactions processed. Only the parameters for the unit cost of production capacity and for the consumption of production capacity by individual transactions need to be estimated (Kaplan & Anderson, 2008, pp. 21–24). The first element necessary in the Time-Driven Activity-Based Costing is the unit cost of acquiring the teacher’s service skills  $Jk_{ZP}$ .

The formula for calculating the cost of service capacity of the accountability centre, i.e. one primary school per month, is as follows:

$$jK_{ZP} = \frac{K_{ZP}}{R_{ZP}},$$

where:

$Jk_{ZP}$  – the unit cost of the service potential of a primary school (all teachers);

$K_{ZP}$  – the total cost of maintaining the service potential in a cost centre implementing processes of similar cost intensity;

$R_{ZP}$  – actual service ability, i.e. actual teacher work according to working time estimates.

The second element necessary in the Time-Driven Activity-Based Costing is time equations. The time of the education process is the sum of the individual periods of activity:

$$T_n = \beta_0 + \sum \beta_i X_i,$$

where:

$T_n$  – duration of action n;

$\beta_0$  – basic operating time n (the simplest variant);

$\beta_i$  – additional implementation time for action n in the variant per unit of its performance or per unit of another activity duration variability factor;

$X_i$  – measure of the factor of variation and action n

$$T_{process} = (\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \dots + \beta_i X_i)$$

As a result of the use of this research tool in search for time and financial reserves that arise

during the implementation of the basic educational task 80101, it was shown that:

- the unit cost of production capacity ( $j K_{ZP}$ ) was at the level of 1.73 PLN;
- the total duration of educational activities during the week in the whole school was 53,640 minutes.

Therefore, the cost of individual educational activities per week in an average primary school amounted to 92,797.20 PLN (according to the calculation of 53,640 minutes multiplied by 1.73 PLN)

- the monthly financial resources provided for the disposal of the school by the municipality are at the level of 375,285.00 PLN.

The conducted TDABC shows that the monthly costs of educational activities carried out by an average primary school run by the Kielce municipality are justified by the time worked 163,602 minutes and should be at the level of 283,031.46 PLN, while the financial resources at the school's disposal have been fully used, i.e. in the amount of 375,285.00 PLN. The difference of 92,252.62 PLN is the unused production capacity. In the time dimension, they amount to 53,656 minutes, which should be treated as time inefficiently used or lost. Making an in-depth analysis of the effects of lost profits at the level of primary education in the 2018/2019 school

year in Kielce – which is a city with the rights of a county – when comparing them to the research for the 2015/2016 school year, it should be noted that:

- Resources not used by all primary schools in the municipality amount to 24.6%, which, compared to the survey conducted in the 2015/2016 school year, indicates an increase in lost profits (unused resources back then amounted to 17.1% of the resources put at the disposal of the municipality). The increase in lost profits by 7.5% resulting from the current research results from a different structure of the school calendar (15.25 school days in the year 2018/2019, while in the year 2015/2016 – 20.00 days) (see Tables 2 and 3).
- Lost benefits in the scale of primary education in the year 2018/2019 in the municipality amounted to 16,096,800 minutes of lost time and 27,675,786.00 PLN in terms of financial outlays, which is 6.2% of annual expenditure on education (section 801) and 1.8% of the total annual budget of the municipality in 2019. In the 2015/2016 school year, lost finances were at the level of 12,479,385.60 PLN, constituting 3.9% of the annual expenditure on education (section 801) and 1.1% of the total annual budget of the municipality in 2016.

In the market theory of education, the main beneficiary of the public good which is 'educational

Table 2. The analysis of the unused educational potential at the level of primary education in 2018/2019 in Kielce, the city with the rights of a county

| Unused capacity  | In minutes  | In Polish zloty (PLN)  |
|--|-------------|--|
| The unused production capacity in one school per month<br>$92,252.62 \times 12 = 1,107,031.44$                             | 53,656'     | 92,252.62  |
| The unused production capacity in one school per year  | 643,872'    | 1,107,031.44   |
| The unused production capacity in primary schools in the municipality<br>per year $1,107,031.44 \times 25 = 27,675,786.00$ | 16,096,800' | 27,675,786.00  |
| The expenses on primary education in 2019 according to budget costing<br>for 2019, section 80101                           |             | 112,585,218.25   |
| <b>The share of lost profits in total expenditure</b>  |             | <b><math>27,675,786.00 : 112,585,218.25 \times 100\% = 24,6\%</math></b> |

Source: own elaboration based on the author's research conducted with the use of model.

Table 3. Analysis of the unused educational potential at the level of primary education in 2015/2016 in Kielce, the city with the rights of a county

| Unused capacity   | In minutes  | In Polish zloty (PLN) |
|---|---|-----------------------|
| The unused production capacity in one school per month  | 30 220'   | 43,331.20             |
| The unused production capacity in one school per year   | 362 640'  | 519,974.40            |
| The unused production capacity in primary schools in the municipality per year                    | 8 703 360'  | 12,479,385.60         |
| The expenses on primary education in 2016 according to the budget costing for 2016, section 80101 |   | 72,925,319.03         |
| <b>The share of lost profits in total expenditure</b>   | <b>12,479,385.60 : 72,925,319.03 x 100% = 17,1%</b> |                       |

Source: own elaboration based on the author's research conducted with the use of model.

service' is the student. Despite a 23.4% increase in expenditure on education of one student in the period from 2015/2016 to 2018/2019, an increase in intellectual capital should not be expected in the studied municipality, because the increase in lost profits shows as much as 77.2% growth dynamics. Per student, lost benefits in 2018/2019 amounted to 2,327.07 PLN, while in the survey for 2015/2016 they amounted to 1,313.10 PLN.

The results of the TDABC proved that the potential of the Polish education system is not fully exploited. Using the efficient information channels is essential to fully exploit the time and financial resources within the system, which will minimise the distance between the Polish education and the modern-world requirements.

## Conclusion

Information in education is a causal factor for the education management process control not only in the macro scale, but also in the context of school as a core element of the system. Education management requires the use of information from multiple sources both by the head teachers as the leaders and by the local authorities. The head teachers are searching for information about problem-solving tools in the context of previously

unknown circumstances which can influence the educational establishment.

On the basis of the conducted studies, both the main hypothesis and the sub-hypothesis were verified and confirmed. The efficient use from proper information by all members of the education process will improve the effectiveness of education processes owing to full exploitation of resources, provided that other necessary conditions are fulfilled. The sub-hypothesis was confirmed, because the information demand from local authorities which supervise the schools is low. The efficient use of financial resources, which is crucial in building an efficient education system, is not taken into consideration. Another reason why the demand for information is low can be the previously mentioned Educational Information System, i.e. a part of the Polish education system, which includes only reporting features. From the author's point of view, making two updates a year does not bring any quality changes of published information, which makes the whole system ineffective in education management processes. It shows that the education management system requires major changes and should give accurate information research a priority role in decision-making processes. The research conducted by the IBE and other organisations provides a lot of information, but processing as well as practical



implementation of this information is also required in decision-making processes.

It could be argued that information-and-data transformation into information using IT technology is a set of aggregate facts, but does not constitute a basis which can be used in enhancing knowledge. Consequently, there is a lack of ‘building material’ for the last value in the information pyramid, namely wisdom, which determines the quality of human capital. The defining lines for action should be based on the use of information. However, this information has to be processed and adapted to the specific needs of individual beneficiaries. The role of information in education management processes is very important, which was demonstrated in the TDABC method with the use of data from the IBE Report.

The research presented in this article indicates that:

- Information has a significant role in the education process management. This information, when properly processed and used, is a substantial reserve for the education potential.
- There is a need to implement the modern methods and tools in management of the education processes, which will guarantee resource efficiency in the field of the quality of the services provided by schools, as well as in the financial dimension. All the units responsible for primary education should take the necessary action.

Information plays a prominent role in the education system. Filling the gap between the Polish education and the modern-world requirements demands proper use of information in education management. The research question about whether the actors of the Polish education system use the information cannot be answered in the affirmative, especially if the scope of this question is broadened to include the element of the quality of education associated with the methods of education which guarantee the proper level of education for young generations. The context of the research question should also be extended to the qualitative aspect of information provided

by the Educational Information System (SIO), which still does not meet the public expectation despite the attempts to improve it in 2012. Building human capital in the future depends on whether the information is recognised and enhanced. In conclusion, a lack of the understanding of the role of information in management results in low financial efficiency, because “only a man supported by good information creates knowledge and contributes to generating specific benefits” (Litwa, 2007, pp. 11–12). Its key role – and also the need for proper use of knowledge by all the participants of the system – was confirmed by the qualitative findings in the education system. In principle, the question remains open as to whether the Polish education and its quality meet the challenges of the 21<sup>st</sup> century and give a chance for a decent standard of living. When the local authorities execute the laws without accurate information about its effects on the education sector, it can be assumed that their activities are inefficient and non-economical.

Today, organisation management requires access to processed data and expert information at the same time. The world is developing rapidly. Crises, migration problems, and terrorism make us live in the conditions of uncertainty, which is what defines the new faces of the global risk (Beck, 2012, p. 21). Nowadays, the COVID-19 pandemic belongs to the phenomena that cause the crises with particularly negative effects on the education sector’s goals. In the face of these risks, information is valuable only if a manager is able to respond to the current data and make the right decisions.

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Piotr Pietrzak, Małgorzata Cieciora

## Academic Rankings as a Source of Information for Study Candidates

### Abstract

*Objectives:* The aim of the article is to present a proposal for a ranking of public universities in Poland, taking into account the position of their graduates on the labour market.

*Research Design & Methods:* Three reflective indicators were used to create the ranking: average time (in months) from obtaining a diploma to taking up the first job under a contract of employment by graduates; the relative unemployment rate of graduates in the fifth year after graduation among graduates with no work experience prior to graduation; the relative wage rate of graduates in the fifth year after graduation among graduates with no pre-graduation work experience. The structure of three indicators has been based on zero-unitarisation.

*Findings:* The leading universities in the ranking were technical and economic universities. Their 2014 graduates (in all the variety of fields of study offered by these universities) found a job relatively quickly – i.e. within five years of obtaining their diploma – as well as experienced less than average unemployment in the poviats of their residence and their earnings were higher than the average in the poviats of their residence.

*Implications / Recommendations:* It is advisable to continue research on the methodology of creating academic rankings (including reflective indicators). In this regard, it is worth taking into account possibly large – but at the same time homogeneous – research samples.

*Contribution / Value Added:* Extended research on how to create academic rankings (in particular devoted to study candidates).

*Article classification:* research article

*Keywords:* ranking, Higher Education Institutions, didactics, graduate, Poland

*JEL classification:* A23, I23

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## Introduction

Rankings of universities are an important element of the academic order, enabling the evaluation of the quality of didactic or scientific-research processes taking place within them (Urbanek, 2018, p. 456). A high position in prestigious global and national rankings may be an indicator of the application of the highest academic standards by the university, and a confirmation of the right choice of the educational offer made by potential candidates for studies. What is more, academic rankings can be the basis for allocating funds for institutions financing higher education.

It is worth noting that most of the rankings provoke numerous objections from the representatives of the academic community (Pusser & Marginson, 2013, pp. 544–568). Their comments concern mainly: the criteria used (and their weights), unreliable information provided by some universities participating in the ranking (which cannot be verified on the basis of other sources), improper selection of the research sample (e.g. employers to assess their preferences towards graduates, or academic staff to assess the reputation of universities), or unethical operation of journals creating rankings towards academic institutions (e.g. putting pressure on their participation in the ranking and buying advertising space in the journal at the same time) (Hall, 2013, p. 499). Despite negative views on how universities are ranked, no satisfactory alternative has been found so far. Hence, the aim of the article is to present an original proposal for the ranking of public academic universities in Poland, which would take into account the qualitative effects of the academic education (the position of graduates on the labour market). Thus, the proposed ranking will refer only to one of the processes carried out in universities, namely didactics. It can also be a valuable source of information for applicants to study. It should be noted that the ranking was created using the composite indicators method.

The article consists of five parts. The first part is an introduction and the second part presents

the essence and meaning of academic rankings. In the next, methodical part, the research sample and the variables used for the construction of the ranking are defined. The research results and their interpretation are presented in the fourth part. Concluding remarks and recommendations for further research are presented in the fifth part of the article.

## Literature review

In the light of the popular and common but informal definition, ranking is “organising information about certain objects according to some criterion or set of criteria” (Rocki, 2019, p. 343). In the literature on the subject, one can find many articles, studies or reports on academic rankings, including their methodology (Dill & Soo, 2005, pp. 495–533; Marginson, 2007, pp. 131–142; Amsler, 2014, pp. 155–166; Lynch, 2014, pp. 141–153; Dembereldorj, 2018, pp. 25–35).

Generally speaking, it can be said that the purpose of the university rankings is to indicate the “best” institution in terms of teaching, research, or dissemination activity (Rocki, 2019, p. 346). In most cases, authors of academic rankings look for a set of factors (indicators) which, in some way, combined with an aggregating function, allow for ordering the analysed universities (Rocki, 2019, p. 346). The choice of indicators depends, among others, on to whom the comparison is addressed (applicants for studies, academic teachers, regional authorities, central authorities, employers). International rankings focus primarily on the evaluation of the scientific and research achievements of universities. In the case of rankings aimed at informing students (predominantly domestic), the emphasis is on didactics indicators (Urbanek, 2018, p. 454). According to Szadkowski (2019, pp. 17–18), the main benefits of creating university rankings include: (1) the ability to monitor progress in the implementation of public policy goals related to higher education in a given country; (2) openness to global flows of students and faculty; (3) simplifying the vision of science

and higher education in order to make the practice of communicating it to the general public easier.

It is worth noting that rankings of academic institutions have been an important part of the landscape of national higher education systems for over 100 years (Hazelkorn, 2015, p. 133). The first rankings of American universities, published since 1910 by J. McKeen Cattell (Hammarfelt et al., 2017, p. 392), paved the way for comparisons developed later in the *US News and World Report* ranking, similarly to the German university ranking conducted by the Center Für Hochschulentwicklung (Usher, 2016, p. 24). Global rankings of universities began to develop dynamically after 2003, when the first edition of Shanghai Jiao Tong's *Academic Ranking of World Universities* (ARWU) was issued (Liu, 2009, p. 2).

There are currently nearly 30 different world university rankings (Hazelkorn, 2015, p. 2). Among them, the most popular and prestigious are: *QS World University Rankings* and *Times Higher Education World University Rankings* by Thomson Reuters and ARWU (Hall, 2013, p. 499). Also in Poland, the ranking of universities of the *Perspektywy* monthly, published since 1999, has managed to build a strong position and gain trust of both future students and their parents, as well as academic institutions that decided to become subjects to comparisons (Siwiński, 2002, p. 399).

The structure of the indicated global rankings (indicators used in them) emphasises openness to the socio-economic environment (e.g. employers' opinions about universities, knowledge transfer), as well as the internationalisation of studies (number of students or lecturers from abroad and other international scientific successes, including the number of graduates or employees who received the Nobel Prize, Fields medals, etc.) (Hall, 2013, pp. 497–498). For example, in the QS ranking, indicators such as university reputation, employers' opinion, international staff, and foreign students have a combined weight of 60%.

On the other hand, most of national rankings (e.g. the *Perspektywy* ranking) concentrate mainly on the quality of educational programmes, i.e.

didactics indicators (Urbanek, 2018, p. 453). When writing about the “quality” of the educational process, it should be noted that this is a difficult concept to define (Grudowski & Lewandowski, 2012, p. 399). Its extent depends, among others, on the composition, commitment, and competence of the academic staff, the quality and scope of research, the completeness and method of implementation of the study programme, the infrastructure of a university (Rocki, 2019, p. 346). In soft modelling (Rogowski, 1986, pp. 367–384), these variables are called generating indicators. It is worth emphasising, however, that there are also reflective indicators, relating to the effects of the “quality” of the teaching process, which are particularly important from the point of view of university graduates. Among them, the following can be indicated: the average time of looking for the first job, the average number of months during which graduates were registered as unemployed, average monthly salaries, etc.

These indicators are very often not included in national rankings, or they are given a low weight (in the *Perspektywy* ranking, this weight is at the level of 5%). This may be due to a lack of access to this kind of data. In Poland, however, the Polish Graduate Tracking System (hereinafter ‘the ELA system’) was launched several years ago. It collects information about graduates of individual universities, registered with the Social Insurance Institution (ZUS) (Pietrzak, 2020, p. 205). The ELA system guarantees full anonymity of the persons covered by the study (Pietrzak, 2018, p. 104). Moreover, this data is not burdened with biases resulting from the imperfect memory of the respondents, or the tendency to round numbers or colour the reality (Pietrzak & Khovrak, 2019, p. 342).

The methodology of the ranking based on the achieved economic status of university graduates will be presented in the further part of the article. This comparison is intended to be a valuable source of information for study applicants and their families.

## Material and methods

Due to the profile of the Journal, public academic universities have been chosen as research objects. The ranking includes 58 out of 59 higher education institutions supervised by the Ministry of Science and Higher Education (MSHE). The

Christian Theological Academy in Warsaw was excluded from the study due to the specific nature of its functioning (the only theological university under the supervision of the Ministry of Science and Higher Education). Table 1 presents the list of universities included in the study along with their

Table 1. Universities included in the ranking

| University code | University name  | Percentage of graduates present in ZUS registers (in %) |
|-----------------|--|---|
| U1              | AGH University of Science and Technology in Cracow           | 94.3  |
| U2              | Jan Długosz University in Częstochowa                        | 97.4  |
| U3              | Maria Grzegorzewska University in Warsaw                     | 98.6  |
| U4              | Pomeranian University in Słupsk                              | 96.0  |
| U5              | University of Technology and Humanities in Bielsko-Biała     | 98.5  |
| U6              | Gdansk University of Physical Education and Sport            | 98.1  |
| U7              | University School of Physical Education in Cracow            | 97.1  |
| U8              | Poznan University of Physical Education                      | 97.1  |
| U9              | The Jerzy Kukuczka Academy of Physical Education in Katowice | 97.8  |
| U10             | Józef Piłsudski University of Physical Education in Warsaw   | 97.9  |
| U11             | University School of Physical Education in Wrocław           | 96.4  |
| U12             | Białystok University of Technology                           | 96.7  |
| U13             | Częstochowa University of Technology                         | 98.5  |
| U14             | Gdansk University of Technology                              | 96.2  |
| U15             | Koszalin University of Technology                            | 98.3  |
| U16             | Cracow University of Technology                              | 97.2  |
| U17             | Lublin University of Technology                              | 97.4  |
| U18             | Lodz University of Technology                                | 97.6  |
| U19             | Opole University of Technology                               | 96.4  |
| U20             | Poznań University of Technology                              | 97.4  |
| U21             | Rzeszów University of Technology                             | 96.8  |
| U22             | Silesian University of Technology                            | 97.9  |
| U23             | Kielce University of Technology                              | 99.0  |
| U24             | Warsaw University of Technology                              | 95.3  |
| U25             | Wrocław University of Science and Technology                 | 95.8  |
| U26             | Warsaw University of Life Sciences                           | 96.3  |
| U27             | Warsaw School of Economics                                   | 96.4  |
| U28             | University of Economics in Katowice                          | 98.4  |
| U29             | Cracow University of Economics                               | 96.6  |

Table 1 – continued

| University code | University name  | Percentage of graduates present in ZUS registers (in %) |
|-----------------|--|---|
| U30             | Poznań University of Economics and Business                        | 96.8  |
| U31             | Wroclaw University of Economics                                    | 97.4  |
| U32             | University of Gdańsk   | 97.3  |
| U33             | Adam Mickiewicz University in Poznań                               | 96.3  |
| U34             | Jagiellonian University  | 94.9  |
| U35             | Jan Kochanowski University in Kielce                               | 98.4  |
| U36             | Cardinal Wyszyński University in Warsaw                            | 98.4  |
| U37             | Kazimierz Wielki University  | 98.0  |
| U38             | University of Lodz   | 97.3  |
| U39             | Maria Curie-Skłodowska University                                  | 95.2  |
| U40             | Nicolaus Copernicus University                                     | 97.2  |
| U41             | University of Opole  | 96.4  |
| U42             | Pedagogical University of Cracow                                   | 98.3  |
| U43             | Siedlce University of Natural Sciences and Humanities              | 96.6  |
| U44             | University of Life Sciences in Lublin                              | 92.9  |
| U45             | University of Life Sciences in Poznań                              | 96.0  |
| U46             | Wroclaw University of Environmental and Life Sciences              | 94.5  |
| U47             | University of Agriculture in Kraków                                | 95.6  |
| U48             | University of Rzeszów  | 96.4  |
| U49             | University of Szczecin   | 96.6  |
| U50             | University of Silesia in Katowice                                  | 96.6  |
| U51             | Kazimierz Pułaski University of Technology and Humanities in Radom | 98.2  |
| U52             | University of Technology and Life Sciences in Bydgoszcz            | 96.3  |
| U53             | University of Białystok  | 95.7  |
| U54             | University of Warmia and Mazury in Olsztyn                         | 95.4  |
| U55             | Warsaw University  | 94.8  |
| U56             | University of Wrocław  | 95.4  |
| U57             | University of Zielona Góra   | 97.6  |
| U58             | West Pomeranian University of Technology in Szczecin               | 96.6  |
|                 | Minimum  | 92.9  |
|                 | Average  | 96.8  |
|                 | Maximum  | 99.0  |

Source: own elaboration based on: ELA, 2020.

codes and the percentages of graduates included in the Polish Social Insurance Institution's (ZUS) registers.

The ranking was created using the composite indicators<sup>1</sup> method (CIs). It is being increasingly employed to make cross-national comparisons of country performance in specified areas such as competitiveness, globalisation, innovation, etc. Rather than using a disaggregated set of individual indicators, aggregated composites supposedly allow for an analysis of interrelated performance. Composite indicators method can also be used successfully in the creation of various rankings, including for higher education institutions.

The strengths and weaknesses of composite indicators largely derive from the quality of the underlying variables. Ideally, variables should be selected on the basis of their relevance, analytical soundness, timeliness, accessibility. What is important is that the data selection process can be quite subjective, as there may be no single definitive set of indicators. That is why five reflective indicators were selected for the construction of the ranking, relating to the effects of "quality" of the higher education process. Their selection was based on the experience of other researchers (Rocki, 2018, pp. 343–354; Pietrzak, 2019, pp. 148–160).

Assuming that a substantive selection of variables for the ranking was made, the next step was to assess the power of population discrimination by a given variable, using the classic coefficient of variation (Vs). Due to the low level of the coefficient of variation Vs (below 10%)<sup>2</sup>, two indicators were excluded from the ranking structure, leaving the following:

- $I_1$ : average time (in months) from obtaining a diploma to taking up the first job under a contract of employment by graduates (the day

of having a job is the moment of paying the first contribution to ZUS for the received remuneration, regardless of the type of employment);

- $I_2$ : the relative unemployment rate of graduates in the fifth year after graduation, among graduates with no work experience prior to the graduation;
- $I_3$ : the relative wage rate of graduates in the fifth year after graduation, among graduates with no pre-graduation work experience.

The relative unemployment and wage rates indicators make it possible to relate the absolute values of the unemployment risk and the remuneration of graduates to the situation in the poviats<sup>3</sup> in which they had lived in the period covered by the study. The relative unemployment rate ( $I_2$ ) is the average value of the quotient of the unemployment risk among graduates to the registered unemployment rate in their poviats of residence (ELA, 2020). The closer the indicator is to zero, the better is its value, and values lower than 1 mean that the risk of unemployment among university graduates is lower than average. A pointer value of zero means that none among the graduates in the analysed period registered as unemployed. From the construction and definition of  $I_2$  it follows that this indicator is a destimulant.

In turn, the relative earnings ratio ( $I_3$ ) is the average value of the quotient of the average monthly remuneration of a graduate to the average monthly remuneration in his/her poviats of residence (ELA, 2020). The higher this indicator, the better its value, thus it is a stimulant. Values greater than 1 mean that the salaries of graduates of a given university are higher than average.

<sup>3</sup> In Poland, there is a three-level administrative (territorial) division into 16 provinces, called voivodeships, 314 poviats (counties), and 66 cities with the status of poviats, further subdivided into 2477 municipalities (Pol. *gminy*). In NUTS (Fr. *Nomenclature des Unités territoriales statistiques*) classification – which is a geographical standard used for a statistical division of the EU Member States' economic territories into three regional levels of specified classes of the population – poviats would correspond roughly to NUTS 3.

<sup>1</sup> An indicator is a quantitative or qualitative measure derived from a series of observed facts that can reveal a relative position in a given area and, when measured over time, can point to the direction of change.

<sup>2</sup> In the literature, the minimum level of the coefficient of variation of the discriminating parameter is generally assumed to be 10%–20% (Tarka, 2012, pp. 47–73).



Short time of job-seeking after graduation, high wages, low unemployment rate among graduates all mean that universities offer study programmes in line with the needs of society and the economy (Rocki, 2018, p. 346). Indirectly, it also means that the university is able to successfully establish cooperation with employers on the improvement of study programmes.

It is worth emphasising that the indicators used in the ranking ( $I_1, I_2, I_3$ ) referred to graduates of the second-cycle studies in 2014 from particular academic universities. However, they do not make it possible to distinguish between graduates of different modes of study. This means that the achievements of full-time and part-time graduates are described jointly.

## Results

Table 2 presents synthetic characteristics of academic universities in the cross-section of the three proxy indicators of teaching quality ( $I_1, I_2, I_3$ ) included in the ranking.

As these indicators were expressed in different units, it was necessary to make them comparable before creating the ranking. The analysis of the literature on the subject shows that the best formal properties among the normalisation methods have zero unitarisation (Kukuła, 2012, pp. 5–16). The normalising formulas used for the  $I_3$  indicator being a stimulant (the stimulant set is marked with the symbol  $S$ ) and the destimulant indicators, i.e.  $I_1$  and  $I_2$  (the destimulant set is marked with

the  $D$  symbol) assume the following form (Kukuła, 2012, p. 7):

$$z_{ij} = \frac{x_{ij} - \min_i x_{ij}}{\max_i x_{ij} - \min_i x_{ij}}, X_j \in S(1)$$

$$z_{ij} = \frac{\max_i x_{ij} - x_{ij}}{\max_i x_{ij} - \min_i x_{ij}}, X_j \in D(2),$$

where:

$z_{ij}$  – unitarised value of the  $j$  indicator for the  $i$  object (here: an academic university),

$x_{ij}$  – value of the  $j$ -th indicator for the  $i$  object,  $j$  indicator range.

Another issue is the selection of weights for indicators. As in the *Perspektywy* ranking ‘the status of economic achievements of graduates’ is reduced to one indicator with a weight of 5%, it was decided that  $I_1, I_2, I_3$  should be assigned the same weights (moreover, it is a common practice in this type of research). Thus, the ranking of academic universities according to the ‘quality’ of the results of the didactic process was created as the arithmetic mean of the three unitarised values of indicators. The intention was that the university with the first position is the one whose graduates of the year 2014, on average, looked for a job under an employment contract for the shortest time as well as are characterised by the lowest relative unemployment rate and the highest relative earnings rate in the fifth year after graduation. The created ranking is presented in Table 3.

Table 2. Characteristics of academic universities according to indicators used in the ranking

| Specification | Average time (in months) from obtaining a diploma to taking up the first job under a contract of employment by graduates ( $I_1$ ) | Relative unemployment rate of graduates in the fifth year after graduation, among graduates with no work experience prior to graduation ( $I_2$ ) | Relative wage rate of graduates in the fifth year after graduation, among graduates with no pre-graduation work experience ( $I_3$ ) |
|---------------|--|---|--|
| Minimum       | 4.14   | 0.25  | 0.67   |
| Average       | 8.26   | 0.60  | 0.92   |
| Maximum       | 13.75  | 1.27  | 1.68   |

Source: own elaboration based on: ELA, 2020.

Table 3. Ranking of academic universities according to the achieved economic status of their graduates

| University code | The unitarised value of the indicator $I_1$ | The unitarised value of the indicator $I_2$ | The unitarised value of the indicator $I_3$ | Ranking place |
|-----------------|---|---|---|---------------|
| U27             | 1.00  | 0.88  | 1.00  | 1             |
| U20             | 0.84  | 0.91  | 0.65  | 2             |
| U25             | 0.71  | 0.95  | 0.66  | 3             |
| U24             | 0.70  | 1.00  | 0.55  | 4             |
| U22             | 0.81  | 0.94  | 0.50  | 5             |
| U30             | 0.85  | 0.87  | 0.51  | 6             |
| U18             | 0.75  | 0.93  | 0.55  | 6             |
| U31             | 0.92  | 0.75  | 0.55  | 8             |
| U16             | 0.67  | 0.96  | 0.52  | 9             |
| U29             | 0.85  | 0.83  | 0.46  | 10            |
| U1              | 0.68  | 0.84  | 0.60  | 11            |
| U14             | 0.75  | 0.86  | 0.50  | 12            |
| U28             | 0.98  | 0.80  | 0.27  | 13            |
| U52             | 0.77  | 0.86  | 0.30  | 14            |
| U17             | 0.79  | 0.72  | 0.36  | 15            |
| U26             | 0.70  | 0.81  | 0.34  | 16            |
| U45             | 0.66  | 0.73  | 0.29  | 17            |
| U38             | 0.68  | 0.75  | 0.21  | 18            |
| U3              | 0.89  | 0.72  | 0.02  | 19            |
| U55             | 0.53  | 0.78  | 0.27  | 20            |
| U15             | 0.78  | 0.61  | 0.19  | 21            |
| U58             | 0.50  | 0.75  | 0.30  | 22            |
| U23             | 0.41  | 0.77  | 0.32  | 23            |
| U32             | 0.69  | 0.61  | 0.20  | 24            |
| U12             | 0.56  | 0.67  | 0.26  | 25            |
| U56             | 0.47  | 0.75  | 0.19  | 26            |
| U13             | 0.55  | 0.60  | 0.27  | 27            |
| U21             | 0.52  | 0.59  | 0.30  | 28            |
| U49             | 0.70  | 0.55  | 0.12  | 29            |
| U54             | 0.50  | 0.71  | 0.16  | 30            |
| U5              | 0.73  | 0.42  | 0.21  | 31            |
| U19             | 0.56  | 0.58  | 0.21  | 32            |
| U34             | 0.37  | 0.75  | 0.21  | 33            |
| U50             | 0.53  | 0.70  | 0.09  | 34            |

Table 3 – continued

| University code | The unitarised value of the indicator I <sub>1</sub> | The unitarised value of the indicator I <sub>2</sub> | The unitarised value of the indicator I <sub>3</sub> | Ranking place |
|-----------------|--|--|--|---------------|
| U40             | 0.45   | 0.70   | 0.17   | 35            |
| U57             | 0.60   | 0.54   | 0.14   | 36            |
| U46             | 0.32   | 0.67   | 0.23   | 37            |
| U9              | 0.47   | 0.68   | 0.06   | 38            |
| U36             | 0.56   | 0.52   | 0.13   | 39            |
| U41             | 0.56   | 0.55   | 0.10   | 39            |
| U33             | 0.56   | 0.51   | 0.14   | 41            |
| U42             | 0.60   | 0.52   | 0.08   | 42            |
| U51             | 0.65   | 0.46   | 0.07   | 43            |
| U37             | 0.55   | 0.53   | 0.10   | 43            |
| U6              | 0.29   | 0.82   | 0.02   | 45            |
| U10             | 0.21   | 0.82   | 0.06   | 46            |
| U53             | 0.45   | 0.59   | 0.05   | 47            |
| U47             | 0.35   | 0.56   | 0.16   | 48            |
| U8              | 0.39   | 0.59   | 0.08   | 49            |
| U11             | 0.26   | 0.57   | 0.11   | 50            |
| U7              | 0.26   | 0.64   | 0.01   | 51            |
| U4              | 0.64   | 0.20   | 0.04   | 52            |
| U35             | 0.41   | 0.46   | 0.00   | 53            |
| U39             | 0.24   | 0.46   | 0.12   | 54            |
| U48             | 0.27   | 0.24   | 0.04   | 55            |
| U2              | 0.35   | 0.04   | 0.03   | 56            |
| U43             | 0.35   | 0.00   | 0.05   | 57            |
| U44             | 0.00   | 0.32   | 0.07   | 58            |

Source: own elaboration.

## Discussion

Among the best academic universities offering second-cycle studies, the dominant position of technical and economic universities should be noted. Among the first 13 universities in the ranking, there were 8 technical universities (Poznań University of Technology – U20, Wrocław University of Science and Technology – U25,

Warsaw University of Technology – U24, Silesian University of Technology – U22, Lodz University of Technology – U18, Cracow University of Technology – U16, AGH University of Science and Technology in Cracow – U1, Gdansk University of Technology – U14) as well as all economic universities (Warsaw School of Economics – U27, Poznań University of Economics and Business – U30, Wrocław University of Economics – U31,

Cracow University of Economics – U29, University of Economics in Katowice – U28).

The highest position in the ranking was occupied by the Warsaw School of Economics (SGH). On average, its graduates needed 4.4 months to find their first job under an employment contract after graduation. Moreover, the unemployment rate in the group of graduates in the fifth year after receiving the Master's degree was lower than the average in the poviats of their residence (relative unemployment rate equalled 0.37). Graduates of the SGH also received higher than average earnings in the poviats of their residence (relative earnings index of 1.68). It is worth noting that despite the short work experience, their situation on the labour market is good. It should be stressed, however, that more information should be obtained from a ranking made on the data particular fields of study, because in this case the ELA system also provides data on the mode in which the studies were conducted (full-time or part-time).

On the basis of the obtained ranking, it can also be concluded that the labour market, on average, does not value graduates of natural-science or agricultural universities too highly (the lowest positions in the ranking were taken by the Jan Długosz University in Częstochowa – U2, Siedlce University of Natural Sciences and Humanities – U43, and the University of Life Sciences in Lublin – U44). One should remember, however, that these universities also have technical and economic faculties (e.g. Economics at the Jan Długosz University in Częstochowa or Management at the Siedlce University of Natural Sciences and Humanities).

It should also be stressed that the created ranking is relative. Supplementing the list with universities supervised by other ministries (e.g. medical universities) as well as non-public institutions would have probably change the obtained classification. Moreover, the indicators used in the construction of the ranking referred only to one year of graduates whose length of employment is relatively short.

## Conclusion

The primary role of academic rankings is to evaluate the achievements of universities in the field of teaching, research, and dissemination activities. Currently, there are several dozen competing rankings (based on various methodologies) at global, international, and national levels. This may support the thesis that measuring something as immeasurable as academic excellence is not a trivial task. In addition, there is always a lack of comparisons that would be addressed to a specific group of recipients (e.g. candidates for studies). Hence, the aim of this article was to attempt to create a ranking that would take into account the qualitative effects of the academic education process.

The findings of the study showed that the leading universities in the ranking were technical and economic universities. Their 2014 graduates (in all the variety of fields of study offered by these universities) found a job relatively quickly within five years of obtaining their diploma, experienced less than average unemployment in the poviats of their residence, and their earnings were higher than the average in the poviats of their residence.

It is worth noting that the use of reflective indicators in the study increased the objectivity of the obtained results. In the case of popular rankings, data from surveys completed by universities independently is often used, and such data is difficult to verify reliably. It may be an incentive for universities to improve the values of individual indicators (generating indicators) in order to obtain a better position in the ranking. In the case of the proposed ranking, indicators describing the effect of the university's activities in the field of teaching were taken into account. Thus, the presented comparison of universities can be a valuable source of information, e.g. for study candidates.

At the same time, one should be aware of the shortcomings of the adopted research methodology. First, the research was an exploratory pilot study

(according to the Authors' knowledge, few studies to date have been devoted to rankings of universities dedicated to selected groups of stakeholders). Second, the obtained results are relative. Including e.g. non-public universities in the analysis would probably change the obtained classification. Third, the study did not take into consideration graduates (3.2% on average) who did not appear in the ZUS reports, such as people insured with KRUS (Agricultural Social Insurance Fund), people with employment contracts signed abroad, and people without a formal contract of employment. Fourth, the ZUS data does not contain information about graduates' occupation, which is why it is not known whether the job undertaken by the graduates is consistent with the profile of their completed studies.

Therefore, it is advisable to continue research on the methodology of creating academic rankings (including those dedicated to university candidates). In this regard, it is worth taking into account possibly large (also including different countries), but at the same time homogeneous research samples. It would be worth considering the expansion of the pool of non-public universities as well as those supervised by ministries other than the Ministry of Science and Higher Education. Another interesting research direction would be the inclusion of individual study groups, which would encourage the creation of a separate ranking for full-time and part-time graduates.

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Natalia Buczyńska-Pizoń

## The Promotion of the Zero-Waste Concept by Influencers in Social Media

### Abstract

*Objectives:* The aim of the conducted research was to examine the level of knowledge of the idea of zero waste as well as to correlate it with the use of social media and influencers' followings.

*Research Design & Methods:* The research methods used in the study are as follows: descriptive research, Internet research, observation, and graphical presentation of data.

*Findings:* Those respondents who see that influencers promote the zero-waste concept have significantly higher index of the time spent in social media. Education level of the survey participants does not translate into the level of knowledge about the zero-waste concept.

*Implications / Recommendations:* The analysis shows that values of the promotion of the zero-waste concept are important in caring about the natural environment. Influencers can effectively promote the zero-waste concept via social media.

*Contribution / Value Added:* The author tries to show the purpose of the promotion of the said concept by using influencers in social media. The topic of environmental care is extremely important, especially in this day and age, when the climate crisis is progressing. Influencers who impact their customers can contribute to the spread of the zero-waste concept, which fits into an alternative economic model – namely circular economy – in place of a linear model.

*Article classification:* research article

*Keywords:* climate crisis, influencer marketing, Anthropocene, Zero Waste, circular economy social media, consumer behaviour

*JEL classification:* M31, Q51, Q54

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## Introduction

In the era of the development of the Internet and social media, consumers' awareness regarding the use of plastic is gradually increasing. The perception of individual products or services that are not only supposed to satisfy consumer needs, but also to be environmentally-friendly, is constantly changing. The idea of zero waste is a concept which promotes lifestyle according to which a human being tries to produce as little waste as possible and not to pollute the environment. For example, consumers extensively promote buying coffee to go in their own reusable cups, packing sausage in their own food containers instead of a plastic bag offered by a supermarket, using their own cotton bags to pack bread or vegetables in a shop, etc. Consumers are becoming increasingly aware of the environmental impact of food packaging or elements such as plastic straws for drinks or unnecessary plastic films on perfume boxes. The concept of zero waste is not difficult to understand; it merely requires a change in habits to make our planet less polluted. The goal of the zero-waste concept has ethical, economic, and visionary dimensions as well as it aims to help people understand that all discarded materials are to become resources again.

## Literature review

Making purchases in an environmentally-friendly way requires going beyond the needs of the company and considering the effects of each purchase in the long run. When looking at the zero-waste concept and the 5R principle, both the state – when it makes public statements – and the consumer – who makes daily decisions as to shopping – should ask themselves whether a given product is needed at all.

The aim of the zero-waste concept is to care for – and protect – the environment. Taking care of the environment is a utilitarian goal of any country. The circular economy model and the zero-waste concept – which itself is

part of the circular economy model due to its specificity and nature – aims to improve the quality of society, but also of future generations. Public procurement is the main driver of the transition to a circular economy. The European Union Circular Economy Plan includes actions to maintain resources in the economy as well as their value, contributing to a sustainable, low-carbon, resource-efficient, and competitive economy. In order to achieve these objectives, social media influencers can be useful, which is also confirmed by the results of the study presented later in the article. For example, purchasing products with lower utility and energy or water consumption can help significantly reduce utility bills, while governments implementing green public procurement will be better placed to meet changing environmental challenges. The idea of zero waste is intended to motivate not only consumers or residents of the countries concerned, but, above all, the authorities of the countries so that they can set targets for reducing CO<sub>2</sub> emissions, increasing energy efficiency, etc.

Green public procurement is the process by which public bodies seek to obtain goods, services, and works, whose environmental impact during their life cycle is lower than that of other goods, services, and works of the same character, which would have been ordered otherwise (Budzyński, 2020, pp. 37–38). Green public procurement can provide public authorities with financial savings, taking into account the cost of the products or services procured throughout their life cycle and not just through the prism of the purchase price (definition by the European Commission)<sup>1</sup>.

Many authors around the world are conducting research on the introduction of the zero-waste concept, but research into the promotion of zero waste by influencers is rather uncommon compared to other aspects, such as the introduction of zero-waste activities into entire cities. Cole et al. (2014)

<sup>1</sup> See: <https://www.uzp.gov.pl/baza-wiedzy/zrownowazone-zamowienia-publiczne/zielone-zamowienia> (accessed: 22.11.2020).



conducted a case study on the development of a zero-waste strategy for the Charnwood Borough Council (a local authority in England), which established a household waste management system. The waste management system fits not only into the concept of zero waste, but also into the circular economy model. The project was subject to a broader public consultation, highlighting areas for review. The zero-waste system took into account local issues as well as national strategies and legislation (Cole et al., 2014, pp. 1–12.) On the other hand, a study by Săplăcan and Márton (2019) aimed at examining and outlining the behavioural dimensions of zero-waste lifestyles at the consumer level, as well as identifying the motivation of a given behaviour. According to the authors, waste reduction is considered by consumers to be the main dimension of lifestyle according to the concept of zero waste. Using one's own textile bags for confectionery or vegetables, one's own water bottle and food box, or refusing to use plastic straws and other disposable items for daily consumption could be managed independently of the surroundings, i.e. at the household level of each consumer. These individually executed efforts are seen by the authors' respondents as the main elements of the lifestyle in accordance with the idea of zero waste (Săplăcan & Márton, 2019, pp. 9–25, 58–60).

In contrast, other authors have conducted a study to explore how resource strategies to reduce waste and increase recycling affect people's exposure to hazardous chemicals when recycling materials. In order to investigate the flow of hazardous chemicals in recycled material, a mass flow analysis of plastics and paper was carried out at the European level. The results for 2012 show that 26% of plastic waste and 60% of paper consumed in Europe were recycled. This corresponds to the finding about 4% and 18% of annual demand in Europe, as the raw material re-enters the product cycle of recycled plastics and paper (Lee, Pedersen, & Thomsen, 2014, pp. 312–332).

To sum up the review of some studies into the subject, the field of zero waste is wide, but it

has many research gaps that are worth investigating, as there is only one Planet Earth and it should be taken care of. Living in line with the idea of zero waste allows consumers to be more aware and spread the concept on a larger scale. Many consumers are not yet aware of the negative effects of reckless purchasing decisions. The limitation lies in the lack of knowledge of the concept, which is why the use of influencers for its promotion can be a very positive step. Social media continue to grow stronger and it is worth using their potential.

### **How influencers build consumer awareness**

Climate change is a controversial topic, but environmental protection is not controversial at all. People are increasingly aware of the fact that oceans and forests are getting more and more polluted. That is why humanity finally decided to take action to protect the environment and produce less pollution. We do not need to be like Greta Thunberg, it is enough to modify our daily habits. Social media such as Facebook or Instagram are an inherent part of our life, hence the enormous popularity of influencers who promote zero waste. Man-made degradation of the natural environment and the resultant disturbing news make us anxious. Media informs us about global warming, pollution of rivers and oceans, smog, droughts and floods caused by human activity. However, we can follow zero-waste rules every day to make the Earth a clean and safe place again. Our environmentally-friendly behaviour will help to protect the natural environment. Posts published by social media influencers can help us to be more zero waste.

In influencer marketing, digital opinion leaders such as bloggers, vloggers, owners of popular social media profiles, and also experts, use their images in social media. Media constitute a channel to communicate with their audiences (Sammis, Lincoln, & Pomponi, 2015, pp. 16–19). Social media influencers who interact with their audience are treated as ordinary and impartial people who

present expertise in social media (Bareman, 2015, pp. 1–3).

Internet users treat influencers as friends and trust information published in social media by them. That is why influencers who promote zero waste may encourage consumers to be more eco-friendly, e.g. to reduce the amount of plastic in packaging, use reusable shopping bags, or stop packing a single lemon in a plastic bag (Futrell, 2004, pp. 147–149). Social media influencers who promote zero waste may persuade consumers in the same way as brands do. An influencer is perceived as an impartial person who is seeking to maximise profit. But in the case of zero waste, it is about maximising the welfare of the planet and not maximising corporate profits (Kiss & Bichler, 2008, pp. 233–240).

Consumers have more trust in recommendations from other people (even if they do not know them) than in brand communication in social media. When someone popular promotes a product, a brand becomes more reliable and its value is increasing. Such a type of communication enjoys a ‘halo effect’, i.e. a psychological tendency for unaware (automatic) attribution of consistent and positive features on first impression to an object or other accompanying objects (Talamas, Mavor, & Perrett, 2016, pp. 165–167).

When it comes to marketing communication, social media are a place which connects directly and meaningfully market participants who wish to interact voluntarily with an influencer. That is why following profiles of influencers who promote use of shampoo bars packed in cardboard boxes instead of shampoos in plastic bottles contributes to building awareness about a specific brand product. At the same time, it is an advertisement of a product which is less harmful for the natural environment. Social media constitute a communication channel which helps to keep steady relations and facilitate two-way communication with consumers at a relatively low cost. Another important characteristic of social media is their global extent (Szpura, 2019, pp. 197–199).

## Zero waste as a concept supporting the circular economy model

Circular economy is a modern concept of an economic system that involves less resource consumption and less waste. Circular economy is also intended to reduce emission and energy loss in a closed-loop system, where waste from one process is used in other process, not necessarily in the same industry (Linder & Williander, 2015, pp. 183–189).

In 2012, the Ellen MacArthur Foundation developed an idea which is currently treated as a basis for many definitions of circular economy. Reports created by the Ellen MacArthur Foundation describe the circular economy as a production (industrial) system that is aimed to use more renewable energy, eliminate use of toxic chemicals (reusing such substances is more difficult) and, more importantly, give back resources to the biosphere. Circular economy seeks to eliminate waste by well-thought-out design of products, systems, and business models. Circular economy model places emphasis on the modernisation and use of products, components and materials, as well repairing, refurbishment, and recycling. Circular economy uses natural resources such as solar and wind energy, biomass energy from waste collected within a whole value chain and a life cycle described as ‘cradle to cradle’. It is a zero waste approach to product design (Braungart & McDonough, 2019, pp. 15–20; MacArthur, 2015, pp. 2–5). This holistic design approach is intended to manufacture products, which would not harm the ecosystem and quite the opposite – they would support the natural environment. The Ellen MacArthur Foundation has developed a set of six action areas for business, which emphasise advantages of circular economy, i.e. so called “RESOLVE” (MacArthur, 2015, pp. 2–5):

- **RE**generate
- Share
- **Optimise**,
- **Loop**,
- **Virtualise**,
- **Exchange**,

Those action areas facilitate the utilisation of physical resources and also extend a product's life cycle, render the use of renewable resources instead of non-renewable resources, and improve the effectiveness of resource exploitation. All these action areas both accelerate as well as reinforce operations of the remaining elements of the circular economy.

Circular economy is promoted by the European Commission and many enterprises and business environments all over the world. Currently, business models are linear – they are based on continuous growth and involve the consumption of more and more natural resources as well as the production of a considerable amount of waste (Zielińska, 2019, pp. 339–341). The linear model is not sustainable and does significant harm to the natural environment. A final stage of the linear business model entails the accumulation of waste on dumping grounds and leads to a loss of energy contained in the product. Burning or recycling unusable goods reduces energy use, but reusing products helps to save energy (Nowaczek, Kulczycka, Smol, Avdiushchenko, & Hausner, 2017, pp. 19–27).

### **The origin and definition of the zero-waste concept**

The term 'zero waste' was used for the first time by Dr Paul Palmer in the 1970s<sup>2</sup>. Dr Palmer is a founder of the Zero Waste Systems Inc. in Oakland, California. The company recycles chemical resources utilised in electronic equipment. Since that time, the zero-waste movement has been slowly growing – it is focused on environmental issues and a conscious approach to waste in the economy, i.e. circular economy. Dr Palmer established the Zero Waste Institute to promote reusable product design. The zero-waste movement gained more publicity in the period of 1988–2002. Dr Daniel Knapp, the representative of the Urban Ore from Berkeley, California,

held a series of meetings with governments, entrepreneurs, and residents of big cities during his journey throughout Australia (Węgrowka, 2017, pp. 10–13). He talked about ways to maximise the recovery of materials and minimise waste from recycling and composting. In 2003 in Beaumarisna (Wales), during an international meeting, the Zero Waste International Alliance's Charter Principles were discussed and developed (Silva, Rosano, Stocker, & Gorissen, 2017, pp. 547–549).

The Zero Waste International Alliance, which is an international organisation, was established to promote positive alternatives for storing and burning waste as well as to increase social awareness about the social and economic benefits of circular economy. This approach treats waste as a resource base which supports employment and business opportunities (Song & Zeng, 2015, pp. 199–202). Living a zero-waste life involves simple technologies and methods that exist in every population all over the world. The Zero Waste International Alliance connects interested business environments with leaders in the zero-waste movement, who can provide communities with models, designs, human capital, and means to facilitate the development of zero-waste companies. Zero-waste product design and packing entails manufacturing that allows products to be repaired, restored, processed, and reused in other related industries (Zaman & Lehman, 2011, pp. 177–179).

Zero waste is not limited only to rational waste management, but it also recommends recycling optimisation. It aims to create and use new innovative methods to minimise waste. Zero waste motivates consumers to care for the environment more, not only through recovery and recycling processes. Recycling involves using waste as a secondary raw material in industrial processes. However, recycling concentrates directly on the waste problem and not on the source of the problem. The zero-waste approach aims for the smart redesign of industrial and trade practices to eliminate as much waste as possible (Zaman & Lehmann, 2011, pp. 177–187).

<sup>2</sup> See <https://zerowasterepublic.com/the-zero-waste-movement/>.

## The 5R concept – Bea Johnson

Bea Johnson reduces waste on a daily basis of her family life. Currently, annual waste produced by her four-member family can fit into 1 litre jar. Her blog and book titled *Zero Waste Home* became very popular; the book was translated into 12 languages. When it achieved bestseller status, Johnson became a prime mover of the global zero-waste movement; she also received the ‘Green Award’. Johnson uses her icon status to promote zero waste. Owing to growing media attention, she has been invited to universities, company events, conferences, and fairs. She has been present in media all over the world – from *New York Times* to BBC. Johnson became a global promoter of zero-waste life. She has about thousand followers on Instagram, 152 thousand fans on her fan page on Facebook, and 45 thousand subscribers on Youtube.

Zero production of waste means that in practice we need to follow several rules known as the 5R concept:

- **Refuse** – say no to shopping which does not suit your needs, e.g. when you are tempted by sales promotion. Consumers often decide to buy a product they do not need. Refusing means saying no to disposable packaging and products, whose production is harmful to the environment and which generate waste and pollution, e.g. plastic straws, plates, cutlery;
- **Reduce** – reduce your shopping to the minimum. Buy only essential goods and follow the principles of minimalism;
- **Reuse** – give a second life to an empty jam jar and fill it with your own home-made jam, and use glass coffee jars to store rice, groats, or cereal. Waste can often be reused;
- **Recycle** – make sure that items you do not need are recycled and reused. Sort waste properly (paper can be reused up to 6 times) and take it to waste collection points. Recycle whatever you can, even household items (you can make a shopping bag from an old bed sheet);
- **Rot** – compost organic waste, use it to produce energy or a natural fertiliser.

Other actions could be added:

- **Repair** – mend your clothes on your own (e.g. those that are seemingly not suitable for wearing), go to a shoemaker to mend your shoes instead of buying a new pair, weld a broken bicycle frame, solder a broken cable;
- **Remember** – you have a choice what to buy.

## Material and methods

For the purpose of this article, a survey was carried out to examine knowledge of the ‘zero waste’ term as well as to associate it with social media use and following influencers. It was an exploratory study, because it is the author’s first study on the relation between social media influencer marketing and zero waste knowledge. 251 respondents took part in the survey, out of which 247 included complete answers. The main objective of the study was exploration. The selection of the sample was the snowball method. The first stage of the study was to measure the questionnaire. The trial was made up of self-selected volunteers.

The purpose of the survey was to research how knowledge of the zero-waste concept correlates with social media use, time spent in social media, the respondents’ education, and promotion of zero waste by influencers.

The questionnaires were distributed to respondents electronically; anonymity was ensured. The respondents answered questions with different types of scales. The survey was carried out from 19 to 25 September, 2019.

Most of the respondents were women (68%). The respondents were predominantly young people aged 15–24 (36%) and 25–34 (53%). This could be attributed to the fact that it is mostly people from these age groups who have come across terms such as ‘marketing influencer’, ‘social media’, and ‘zero waste’. These groups also have more leisure time, which allows them to take part in the survey. The respondents are generally people with secondary education (68%) and higher education (32%). The respondents are residents of towns with a population

of more than 100 thousand (53.5%), country (20%), and small towns (22%). Income of the respondents is proportionally diversified, although almost half of the respondents earn a monthly salary of no less than 2,500 PLN per person in an individual household. Most of the respondents earn income of more than 3,000 PLN (31%), while 11% earn a living of 2,001–2,500 PLN. The respondents are formally educated, which can explain the level of income.

## Results and discussion

### *Descriptive analysis of variables*

The analysis takes into account responses of 247 respondents. It starts with testing normality of the distribution of the analysed indices. The survey was analysed with the SPSS – a statistical analysis software.

The Kolmogorov–Smirnov test showed that the distribution of the ‘social media use’ and ‘time spent in social media’ indices does not differ from normal distribution substantially. That is why in further analysis I decided to use the non-parametric Mann Whitney U test instead of the parametric t-student test for independent groups in order to compare two groups regarding the indices.

When it comes to the index of social media use, the respondents obtained results from 1 to 6. The average of the index was 3.06. Half of the respondents achieved higher results, while half – lower than 3. Standard deviation indicates a moderate the differentiation of index results in the analysed group.

For the index of time spent in social media, the respondents’ results were from 1 to 6. The average of the index was 3.73. Half of the respondents obtained results higher than 3.86, while the other half had lower results. The standard deviation shows a moderate differentiation of the index in the analysed group.

The following Tables and Figures present distributions of the results of the analysed indices in a graphic form.

As many as 2 out of 3 respondents (67.2%) have higher education, whereas 28.3% have secondary education. Far less respondents have vocational education (2.8%) or primary education (1.6%). Since only a small number of the respondents have primary or vocational education, they were put in one category, namely ‘primary and vocational education’ in order for me to examine the correlation between the level of education and knowledge of the zero-waste concept.

The vast majority of the respondents (70.4%) have heard about the zero-waste concept. The

Table 1. Normality tests of the analysed indices

| Indices                    | Kolmogorov–Smirnov |     |            |
|----------------------------|--------------------|-----|------------|
|                            | K-S                | N   | p          |
| Use of social media        | 0.266              | 247 | < 0.001*** |
| Time spent in social media | 0.188              | 247 | < 0.001*** |

Source: own elaboration.

Table 2. Descriptive statistics of the analysed indices

| Indices                    | N   | Min | Max | M    | Me   | SD   |
|----------------------------|-----|-----|-----|------|------|------|
| Use of social media        | 247 | 1   | 6   | 3.06 | 3.00 | 1.09 |
| Time spent in social media | 247 | 1   | 6   | 3.73 | 3.86 | 0.87 |

Source: own elaboration.

remaining 29.6% of the respondents have not heard about this concept.

Less than half of the respondents (42.9%) recognises promotion of the zero-waste concept by influencers. The remaining respondents (57.1%) do not notice that influencers promote the zero-waste concept.

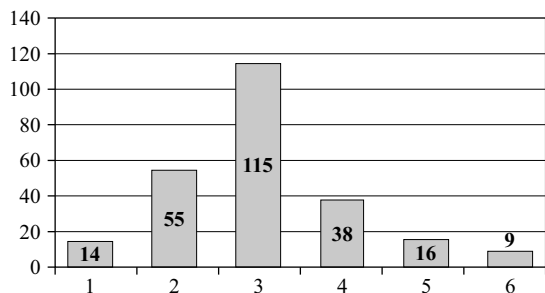


Figure 1. Histogram of the distribution of the 'use of social media' index

Source: own elaboration.

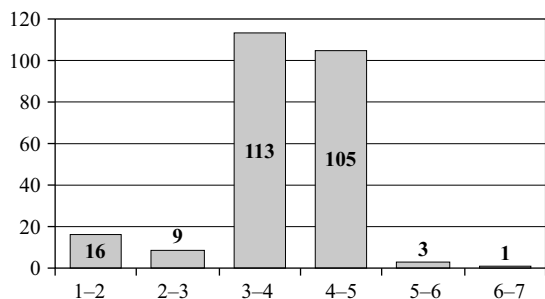


Figure 2. Histogram of the distribution of the 'time spent in social media' index

Source: own elaboration.

Table 3. Education of the respondents

| Education            | N   | %     |
|----------------------|-----|-------|
| Primary education    | 4   | 1.6   |
| Vocational education | 7   | 2.8   |
| Secondary education  | 70  | 28.3  |
| Higher education     | 166 | 67.2  |
| Total                | 247 | 100.0 |

Source: own elaboration.

### Dependency analysis

In order to verify whether social media use and the time spent in social media correlate with the perception that influencers promote zero waste, people who have heard about zero waste were compared (with regard to the 'social media use' and 'time spent in social media' indices) with those who have not heard about this. Another comparison was between those respondents who had noticed that zero waste was promoted in social media with those who had not.

The Mann-Whitney U Test showed that people who have heard about zero waste differ significantly from those who have not heard about it with regard to both the index of social media use and the index of time spent in social media. It turns out that the respondents who have heard about zero waste are characterised by a significantly higher index of social media use and, at the same time, by a substantially lower index of time spent in social media than people who have not heard about the zero-waste concept.

Table 4. Comparison of people who have heard about the zero-waste concept with those who have not heard about the concept with regard to the use of social media and the time spent in social media

| Indices                    | Have you heard about the zero-waste concept? |      |      |      |      |      | Mann-Whitney U test |        |
|----------------------------|--|------|------|------|------|------|---------------------|--------|
|                            | Yes  |      |      | No   |      |      | Z                   | p      |
|                            | M  | Me   | SD   | M    | Me   | SD   |                     |        |
| Use of social media        | 3.17   | 3.00 | 1.10 | 2.79 | 3.00 | 1.04 | -2.233              | 0.026* |
| Time spent in social media | 3.69   | 3.86 | 0.82 | 3.84 | 4.00 | 0.98 | -2.275              | 0.023* |

Source: own elaboration.

Table 5. Comparison of people who notice that influencers promote the zero-waste concept with those who do not recognise this with regard to the use of social media and the time spent in social media

| Indices                    | Do you notice that influencers promote the zero-waste concept? |      |      |      |      |      | Mann-Whitney U Test |        |
|----------------------------|--|------|------|------|------|------|---------------------|--------|
|                            | Yes  |      |      | No   |      |      | Z                   | p      |
|                            | M  | Me   | SD   | M    | Me   | SD   |                     |        |
| Use of social media        | 3.19   | 3.00 | 1.05 | 2.97 | 3.00 | 1.10 | -1.528              | 0.126  |
| Time spent in social media | 3.70   | 3.79 | 0.69 | 3.78 | 4.00 | 0.94 | -2.087              | 0.037* |

Source: own elaboration.

The Mann-Whitney U Test showed that persons who had noticed that influencers promote zero waste differ substantially from those who did not observe that, also when it comes to the index of time spent in social media. It turns out that the respondents who did not recognise that influencers promote zero waste are characterised by a significantly higher index of the time spent in social media in contrast to those who did notice that influencers promote zero waste. In the case of the index of social media use, there was not a statistically significant difference between the groups.

The Chi-2 test did not show any significant correlation between education and the knowledge of the zero-waste concept. It turns out that similar numbers of people with secondary education (72.9%), higher education (69.9%), and primary/vocational education (63.6%) heard about zero waste.

### *Summing up the results*

Consumers make purchasing decisions by taking into account opinions of other people, even if they do not know them. Zero waste may be promoted in an original and unobtrusive way. Social media influencers are able to reach wide audiences. Showing zero waste and eco-friendly practices allows influencers to create relations via social media.

Social media provide a communication channel which helps people to promote eco-friendly practices, which was confirmed in the research. The respondents came across this term mostly online. The specific nature of social media – i.e. posting pictures with comments, videos, and live streaming – helps to promote zero waste. Influencers use social media to promote this concept among people who are interested in zero waste. They use e.g. hashtags to spread their ideas.

Table 6. Correlation between education and knowledge of the zero-waste concept

| Have you heard about the zero-waste concept? | Education           |       |           |       |        |       | total |       |
|--|---------------------|-------|-----------|-------|--------|-------|-------|-------|
|  | primary /vocational |       | secondary |       | higher |       | N     | %     |
|  | N                   | %     | N         | %     | N      | %     |       |       |
| Yes  | 7                   | 63.6  | 51        | 72.9  | 116    | 69.9  | 174   | 70.4  |
| No   | 4                   | 36.4  | 19        | 27.1  | 50     | 30.1  | 73    | 29.6  |
| Total  | 11                  | 100.0 | 70        | 100.0 | 166    | 100.0 | 247   | 100.0 |

Test Chi-2: Chi-2=0.466, p=0.792

Source own elaboration.

The vast majority of the respondents have heard about zero waste. Less than half of the respondents notice that influencers promote zero waste in social media. People who have heard about zero waste differ significantly from those who have not heard about this when it comes to the index of time spent in social media. The index was significantly lower than in the case of people who do not use social media. The respondents who recognise that influencers promote zero waste have a significantly higher index of the time spent in social media. The education level of survey participants does not translate into the level of knowledge about zero waste.

The survey also proved that followers watch influencers voluntarily and this is why they decide to take up a challenge and live a zero-waste lifestyle, or just simply follow influencers and their zero-waste practices. Zero-waste influencers use simple everyday life examples and this can make people eager to follow their steps. The use of social media makes influencers more authentic. The specific nature of social media allows influencers to post photos and videos, live streaming, InstaStories (videos available to the followers for 24 hours) in order to regularly show their activities. To promote zero-waste lifestyle, influencers share their shopping with reduced plastic content or plastic-free, present ideas of how to avoid throwing away food, or show methods of making cleaning supplies using e.g. baking soda.

## Concluding remarks

The world suffers from an ecological, economical, and health crisis. Natural resources are depleting, the economy is unstable, and living standards in many places all over the world are record low. Although there are less and less natural resources, consumers still buy petroleum products. Local economies are waning and consumers choose branded foreign products. Consumers are accustomed to comfortable shopping; however, their comfort is not good for the Planet. Consumer choices have a direct impact

on the natural environment, economy, and people's health. Many feel the need to live an eco-friendly lifestyle and would like to learn what more they can do for the natural environment apart from recycling. This is why social media influencers have a chance to contribute to spreading eco-friendly practices and show that it is not difficult to adopt them; it is just a matter of modifying habits. Circular economy is a challenge for the whole humanity; it requires changing habits and thinking about natural resources. Making purchases in an environmentally-friendly way requires going beyond corporate needs and considering the long-term effects of each purchase. When looking at the zero-waste concept and the 5R principle, both the state – when it makes public statements – and the consumer, who makes daily purchasing decisions, should ask themselves whether the purchase of a given good is needed at all. However, implementing a zero-waste lifestyle is not as difficult as the transformation of the economy model is. Zero waste involves the reduction of waste at many stages – from shopping, through usage (i.e. an adequate storage of food so that it can be eaten before it goes off), the maintenance of equipment so that it can be used longer, to the management of leftovers (composting kitchen waste and reusing and repurposing objects to give them a second life). It is enough when consumers start making little steps every day. However, circular economy sets goals such as production of goods which can be easily reused, disassembled and reassembled, or recycled. The zero-waste concept and its application can support the implementation of the circular economy model if instead of using raw materials more consumers start to reuse materials that are recyclable.

In the described study, I wanted to explore this topic in depth. In my previous paper (Buczyńska-Pizoń, 2021), I researched influencers themselves; now I want to focus on those who are engaged in promoting topics as important as taking care of the environment. I believe that influencers who promote zero waste are one of such groups. I am convinced that this subject is worth a more



extensive exploration. The field of zero waste is very wide, but it has many research gaps that need to be filled; the Planet Earth is one and it should be taken care of. Living in line with the idea of zero waste allows consumers to be made aware. The concept of zero waste should be spread on a larger scale; many consumers are not yet aware of the negative effects of reckless purchasing decisions. The limitation, however, lies in the general lack of knowledge of this concept, which is why the use of influencers for its promotion can be a positive step. Social media continue to grow stronger and their potential should be used. In my next studies, I want to research the popularity of individual influencers and their recognition among respondents, as well as investigate consumers' actual zero-waste practices.

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# *Public Governance / Zarządzanie Publiczne*

## **Aims and scope**

*Public Governance / Zarządzanie Publiczne* is a quarterly published since 2007. It is intended for experts and researchers who specialise in public issues, including political decision-makers and students. It offers a forum for debates between academics and practitioners interested not only in the theoretical foundations of public governance but also in the opportunities for its practical application. The quarterly is international in scope, which is reflected in the nature of research issues (they involve matters of interest to academic circles worldwide), the contributing authors (a significant proportion of them comes from different countries), and the composition of its Programme Board as well as the make-up of the team of reviewers (it includes international research and academic centres).

The mission of *Public Governance / Zarządzanie Publiczne* is to publish advanced theoretical and empirical research in public management, governance, public policy analysis and evaluation, public sector economy as well as strategic management, which reflects new developments in the methodology of social sciences. The editors select papers with an original theoretical background and those that discuss the results of pioneering empirical research. We are also eager to promote the interdisciplinary and comparative approaches based on qualitative, quantitative, and experimental studies that provide new insights into the construction of theoretical models along with the methodological concepts in the field of public management.

In our journal, we adopt a unique approach to specific issues inherent in the sphere of public governance. The originality of our approach consists in the selection of both research areas and research methodologies.

A significant proportion of texts published by our journal is devoted to the analysis of the mechanisms of public governance at national and regional government levels (respectively), relevant to the administrative culture predominant in Central and Eastern European countries with a particular focus on the programming, implementation, and evaluation of public policies. The texts:

- a. focus on problems occurring in post-transition countries which build their own public governance institutions and mechanisms, including the sphere of good governance;
- b. represent attempts at a creative transposition and adaptation of international achievements in developing original solutions in the field of public governance in post-transformation countries.

The distinguishing features of the research methodologies preferred by our journal include:

- a. a strongly established interdisciplinary approach to the study of public governance, combining research and analyses in the areas of economics, political science, management, public policy, sociology, and psychology;
- b. the published texts are firmly rooted in social science theory.

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## **Reviewing Policy and Procedures**

The Editorial Board will make a preliminary decision to either accept the paper for further review or reject the paper (desk rejection) if the submitted article does not meet our editorial requirements or

is beyond our aim and scope. The author will be notified of the decision no later than 10 days from the date of submission. In certain situations, this decision will be made following consultation with a member of the Editorial Board specialising in a given area of research.

1. The reviews are prepared by at least 2 independent reviewers indicated by the Editorial Board. Reviewers are not associated with the author's parent institution (reviewers external to the author).
2. Reviews are prepared to use a double-blind peer review. This process is based on the rule that the reviewer does not know the identity of the author and vice versa.
3. Each review is issued in written form (later revealed to the Author) and ends with a recommendation for or against publication.
4. Evaluation criteria: clarity of the stated objective, originality of research issues, theoretical background, quality of empirical research, originality of conclusions, significance for the research area aligned with the scientific profile of the quarterly, quality of language, comprehensibility, punctuation, and appropriate source selection. Each review ends with an unambiguous recommendation:
  - the paper can be published as submitted,
  - the paper can be published pending minor modifications and inclusion of additional relevant information,
  - the paper can be published pending substantial revision and re-review,
  - the paper is unsuitable for publication.
5. In addition to the recommendations made by reviewers, the Author may receive additional editorial suggestions from:
  - **the Editorial Board**, only in urgent cases,
  - **a layout editor** for technical and editorial comments,
  - **a statistical editor** if the paper contains statistics.
6. The Author must reply to all comments and suggestions (a special form is required to be filled in and to be sent back).
7. The Author should be familiar with the following forms and evaluation criteria:
  - **Internal Review Form – Checklist of the Article** (\*.docx),
  - **External Review Form** (\*.docx),
  - **Author's Statement after the Reviews** (must be attached to the revised article),
  - **Statement by Author** (must be signed before publishing).
8. Before publishing each article is proofread by a linguistic editor (a native speaker or a bilingual speaker). Authors are obliged to apply all necessary changes, however they can negotiate special terminology use.
9. Prior to publishing, the Corresponding Author must sign and submit the Statement by Author, otherwise we will not be able to publish the given article.
10. Each Author must follow the principles of transparency and best practices in scholarly publishing (see our website for details). Editors and the Publisher will be documenting all forms of scientific misconduct and malpractice, particularly violations of ethics and science principles. Any such cases will be reported to the employer of the Author and to the relevant public and state institutions.

Submissions from Programme Board and Editorial Board members are handled in the same way as those from other authors.

## Publication Ethics and Malpractice Statement

The author's statement including the copyright notice as well as the statement on ethics and good practice in science (including financial disclosure, ghost-writing firewall, guest authorship firewall) must be submitted alongside the manuscript according to the form provided (see our website) as well as to be mentioned on the article title page.

The detailed information on Ethics and Malpractice is available in the guidelines established by the Ministry of Science and Higher Education of the Republic of Poland: Scientific Research and Articles Solidity and Intellectual Rights Respect.

We use the following guidelines (extract from Scientific Research and Articles Solidity and Intellectual Rights Respect):

1. Articles must be original and cannot include borrowings from other works, which could result in liability of the publisher. Papers cannot infringe any third-party rights.
2. Articles must reveal the contribution of all individual authors in the creation of publications (with their affiliations and contributions, such as information about who is the author of concepts, principles, methods, protocol, etc. used in the preparation of publications).
3. Articles cannot display any signs of 'ghost-writing', that is not to disclose the names of authors who have made a significant contribution to the publication of, or otherwise contributed to its creation.
4. Articles cannot display any signs of 'guest authorship', i.e. assign a person who did not contribute to the creation of publications.
5. Articles must include complete information concerning sources of funding, the contribution of research institutions, associations, and other entities ('financial disclosure').
6. Editors and the Publisher will be documenting all forms of scientific misconduct and malpractice, particularly violations of ethics and violations in science. Any such cases will be reported to the employer of the author and to the relevant public and state institutions.

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