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Foreign Direct Investment from Emerging Markets. Theory and Practice

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Abstract

This text presents a critical review of theoretical approaches to Foreign Direct Investment. Since, in recent years, the contribution of emerging markets to FDIhas increased (especially on less advanced markets), it is interesting to define how the existing theory can explain the new players phenomenon on these markets. There are two hypotheses considered: one – the existing theoretical explanations of FDI are limited and, today, even historical; second – the essence of the comparative advantage of FDI from emerging markets is a smaller technological and organizational distance between investors and less developed host markets. The discussion is illustrated by Chinese and Indian FDI experience to support the authors' assumptions.

Keywords: FDI, emerging markets, theory, Chinese and Indian experiences

JEL: F2, F21, F23

Introduction

In 2018, Kishore Mahbubani, professor of economics from Singapore, published a book entitled "Has the West lost it?" The author writes that the end of the West's 200-year domination in the world economy is inevitably coming. With the adoption of pragmatic policies and the rejection of idealistic and dogmatic methods of governance (according to Machiavellian philosophy), many Asian countries (especially China and India) are becoming economic leaders in the world. There is nothing strange about it, because these countries were significant economic and political players until the 18th century. Over the last few decades, Asia has taken over from the West the ability to adopt a logical and scientific approach to problem-solving (Mahbubani 2018). In this context, thisarticle provides a voice in the discussion on the place and role of the main Asian economic powers.

The theoretical discussion on foreign direct investment (FDI) has been taking place at least since the end of World War II . However, the history of FDI started earlier. For some US companies, the process of internationalizing their operations began as early as the mid-19th century, for example, when Colt established a subsidiary in the UK. Major direct investments were made by Americans after WWII. At the beginning of the 20th century, 90 percent of all international capital movements took the form of portfolio investment, that is, the acquisition of securities by individual actors or institutions without any associated control over or participation in the management. During the years 1914–1945, the FDI growth rate was very low. This state of affairs only changed after WWII by the activities of American companies in Europe (the Marshall Plan) and later on by multinationals, which developed first in the mining industries, then in manufacturing and services (like Amazon, Google, Yahoo, etc. today).

The main questions accompanying the existing theoretical discussion on FDI covered three key issues: what factors influence the internationalization of production? Why does the company invest directly abroad? Where does the company invest abroad? These questions are dealt with the theory of enterprises (management), with the first question being part of the theory of international exchange and industrial organization; the second one deals with investment theory in the microeconomic aspect, while the last one deals with location theory.

Interest in FDI expansion has highlighted the role of economic tycoons, i.e.,investments from Americanas well as other highly developed economies, followed by investments from transnational corporations. Meanwhile, for more than two decades, competitors appeared from the emerging markets, i.e., those that were liberalizing their economies, achieving high economic growth and large trade volumes, and increasing the advancement of the national economy. Apart from China and India, today's giants of the world economy, include other countries that representt emerging markets. Whether they are able to compete in terms of foreign investment and what influences it are issues that puzzle economists dealing with FDI.[1]

1 For more details see: Piasecki R., Gudowski J. (2015).

The above comments allow two hypotheses to be formulated for the purposes of this text. The first one concerns actual theoretical concepts that dea lwith FDI. These concepts focus on the investment activities of advanced economies and do not explain the cross-border activities of companies from emerging markets. They are, therefore, limited, and today, even historical.

The second hypothesis concerns the comparative advantage of companies from emerging markets, and it supplements previous approaches to the essence of FDI. Bearing in mind that companies from these economies often locate in niche branches of host countries, it may be assumed that the essence of the advantage is a smaller technological and organizational distance between investors and less developed host markets. Although the empirical verification of this thesis exceeds the possibilities of this article, let usnote, however, that it is of great importance for the practical approach to FDI issues.

A supporting hypothesis may also be formulated, which concerns the circumstances which accompany an investment. There is the question of security as a prerequisite for attracting foreign investment of any origin, i.e., both large partners and those taking their first steps in the FDI market. The host state guaranteesinvestment security (including protection against nationalization). The free transfer of profits, the reduction of the tax burden, as well as predictions concerning the economic situation in the host country are nothing more than circumstances that are favorable to the investment multiplier in Keynesian theory or visible today in the model of Porter's diamond.

The essence of FDI

The practice of FDI is far ahead of the theoretical approaches since the beginnings of capital export took place in the colonial era. Smith's theory of trade and its extension by Ricardo gave impulse to the movement of physical capital. Theoretical approaches to FDI are much younger – in fact, they are only, at most, several decades old. Their origin deals with the cooperation of Western economies. Alater impulse was the interest in supportingless advanced economies, which was followed by the growing trend of the open economy, globalization, and finally, the collapse of the Iron Curtain and the transformation of post-communist countries.

Theoretical considerations of FDI are based on various assumptions. Diversity is mainly due to the adoption of different criteria and methods forevaluating foreign investment. Greenfields, brownfields, and joint ventures have various consequences for the investor as well as for the host country (both micro- and macro approaches). Also,the micro-micro approach is considered (B2B, foreign investor – local partner; so again, brownfields or joint ventures), as well as thespatial approach (locating investment in centers or particular locations).[2] There might be different motives forinvesting,

2 Illustrated by Bilateral FDI Statistics 2016.

like transferring outdated products to new clients, seeking new markets, or searching for cheaper subcontractors. An investment might be focusedon export (e.g., an export promotion strategy) or satisfying internal demand in the host country (e.g., the import substitution strategy). Investments related to exploiting mineral resources may reduce the costs of input supplies and transport. Another FDI variety results from privatization and selling former state companies to foreign investors. A foreign investor may act as the client, or – reversely – a host country applies for an inflow of foreign capital. The multitude of approaches to FDI issues meansthat some authors focus on classifying foreign investment according to the motives and circumstances that accompany investment decisions.

Theoretical concepts of FDI: a literature overview

Few achievements in FDI research deserve the name "theory." The variety of approaches allows us to use the term "paradigm," which is mentioned in the FDI literature, especially since some studies arerelated to other disciplines.

Amongst the numerous works on FDI, the publications by Vernon, Dunning, and Markusen and A.J. Venables deserve special interest. Their works have been discussed many times; however, some thoughts which affect the character and functions of FDI should be emphasized. Raymond Vernon, using data on 1950s trade between the USA and Western countries, distinguished three stages of product life cycle: innovation, maturity, and standardization (imitation) (Vernon 1966). The first concerns the functioning of investment in the country of origin. It lasts as long as the marginal cost of producing the given goods plus its transport costs are lower than the marginal costfor this product in the partner country. Moreover, as Vernon said, in this stage, price elasticity for the good is low in the home country, which suggests monopolization, or at least limited competition, and it encourages the company to focus on the home market only. Incentives to export a product are, therefore, limited at this stage.

In the second phase, the demand for a good in the home country decreases, which results in adecrease in the supply. The opposite is true in the partner country, where there are relatively cheap labor resources but high income demand elasticity. This is a chance for the original producer to reduce the costs of production and to get new clients, but only if production is moved to a partner/host country. In the third phase, this situation encourages the relocation of production to the partner country, and, as a result, the original home country becomes an importer of the given product from the host country.

Vernon's concept has found followers. The most interesting seems to be the Uppsala model designed by the Scandinavians Johanson and Wiedersheim-Paul (1975, and later modified). This is an interdisciplinary approach that takes into account elements of management and organizational behavior. According to this model, the internationalization of production is implemented in stages, according to Vernon's cycle, al-

though critics indicate that, today, some companies are already focused on foreign activities from their inception (like FDI in IT services implemented in African countries). It is interesting to interpret where the production of a given good will be transferred. For Vernon, they were primarily developed in European countries. The authors of the Uppsala model assumed that the choice of the partner and product location depend on the "mental distance" between the home country and the partner country. They include linguistic, cultural, and legal barriers, which are smaller the closer the level of economic development between the home country and partner country. This assumption implicitly repeats Vernon's approach of cooperation between developed countries but does not take into account the current trends in FDI around the world.[3]

However, the authors of that model go further than Vernon, as they write about setting up subsidiaries in the host country that are linked to greenfield investments, which Vernon omitted. It is worth emphasizing that the authors of the Uppsala model state that the main barrier to the internationalization of production is the lack of knowledge (the company in the home country is more inclined to relocate abroad the more knowledge about the conditions in the partner country it has). It brings this approach closer to the concept of development economics. Let us recall that Polish trials in FDI were often accused of lacking recognition of local systems, which resulted in the failures that occurred.

John Harry Dunning is the second figure after Vernon who is particularly notable for his FDI research. Dunning developed a model that describes the investment activity and the intensity of the inflow of FDI to the host country. It was an attempt to adjust various concepts, which led Dunning to call his proposal eclectic theory, while others described it as the eclectic paradigm, or the OLI paradigm (O – ownership advantage, i.e., own specialized staff, technology, know-how; L – location advantage, i.e., abundance of resources in the host country; I – internalization advantages, i.e., more favorable possibilities of transactionsinside than on external markets). These advantages do not, obviously, exclude various forms of cooperation, such as subcontracting or outsourcing.

The last FDI researchers mentioned above are James R. Markusen and Anthony J. Venables. In one of their numerous works, they discussed in model form the influence of FDI on the development of local industry in the host country (Markusen, Venables 1997). An increase in prosperity in the country receiving FDI is supported by the production of intermediate goods produced by the domestic sector for the final good, generated by foreign investment. This is what we call investment cover of FDI, which brings economic recovery most often in the microregion. It has even a broader scope since it includes services development by subcontractors. The prosperity that results from FDI manifests itself in the form of higher employment and increased consumer demand.

3 Even so, the Uppsala model has beenproven by Chinese efforts to implement FDI by using Chinese diasporas in host countries.

Critical comment

The multitude of FDI targets and scenarios results in the lack of universal FDI definition. The one elaborated by the OECD is partial and does not consider today's expectations of partners engaged in these investments. The OECD defines FDI as the acquisition of an effective influence on the management of an existing company, the lower limit of which is considered to be at least 10% of the shares.[4] This approach to FDI is close to what Dunning determined earlier. In 1972 he wrote in the Introduction to International Investment: "The main distinguishing feature of direct foreign investment is that, unlike portfolio investment, the investing unit (usually a business enterprise) purchases the power to exert some kind of control over the decision-taking process of the invested-in unit. This immediately suggests that something other than money capital is (or may be) involved in direct investment" (Dunning 1972, p. 12).

Like the OECD definition, Dunning did not avoid simplification. A direct investment, understood as gaining an appropriate position in an existing organization, may only concern brownfield solutions and it ignores the interests of the host country, apart from capitalizing an existing company. This kind of simplified approach to FDI is, therefore, of a historical character today. It concerns only the micro-micro approach mentioned above, and at the same time, it is an argument for the remaining few supporters of the opinion of threats to the national economy as a result of an inflow of foreign investments.

Meanwhile, what is most needed from the point of view of the host country, but with a lower level of development than the country of FDI origin, is greenfield investment. It provides jobs, generates budget revenues (although, depending on the arrangements, the investment may be exempted from contributions, even for many years), provides new technological opportunities, or has multiplier effects in the form of investment cover by local partners. Thus, when FDI is identified in the interest of the host countries, it can be referred to as measures thatare intended to bring the above-mentioned effects to the host countries.

Commenting on the achievements of the authors mentioned above, it should be emphasized that those works appeared many years ago. Vernon's publication, referred to many times in the literature, was published more than fifty years ago, while the works of Heckscher, Ohlin, and Leontief, came out twenty to thirty years ago. Vernon used data on US trade relations with highly developed countries, and he takes little account of the markets of underdeveloped countries, which was logical at the time. In practice, however, even when it was created, Vernon's concept was disproved by research on the so-called Leontief paradox. Leontief showed that, at least in the US economy, the theory of Heckscher-Ohlin's abundance of resources does not work because, contrary to it, the USA was then an exporter of labor-intensive goods and an importer of capital-intensive goods, although it should be the other way round. So, how did Vernon manage to prove the three-phase product cycle, with the example of the American economy?

4 https://www.oecd.org/daf/inv/investment-policy (accessed: 12.03.2019).

Perhaps the solution lies in the post-war economic order of the Western world, which resulted from the Bretton Woods agreement. For more than two decades after the war, the dollar exchange ratio remained fixed in the trade between the US and Western Europe, and customs protection against the inflow of cheap imports existed even longer in the USA. Therefore, according to Vernon's assumptions,investment capital flows must have faced barriers, and these could have been the premises for the first phase of the product cycle. Growing competition in the domestic market increased the initially low price elasticity of demand, so it was no longer justified to maintain production in the domestic market. In addition, the abolition of the principle of the fixed dollar exchange rate made it possible to weaken national currencies in Western European countries, which caused cheaper export from these countries.

Does Vernon's concept fit in with today's situation, where emerging markets partly take over as a source of FDI? In other words, have some products in these countries reached Vernon's second stage, encouraging the transfer of the product to less advanced markets? The situation of emerging markets is, in some respects, incomparable to the conditions analyzed by Vernon. These markets have operated practically since their inception as open economies, and they were subject to external competition, and except for China and India, they have relatively little capital. However, since entrepreneurs from these countrieslook for niche solutions for their foreign activities, it cannot be ruled out that the investment flow mechanism nevertheless contains similarities to the model observed by Vernon.

Among such diverse FDI scenarios, the issue of competition between external investors in today's political and economic situation in the world has been treated as subordinatein theoretical terms. While in the era of the previous East-West division it was logical to locate investment in a given area of influence, i.e., the issue of investors' competition was hardly encountered, today, in an open economy, various players appear. Apart from multinational corporations and leading companies from highly developed countries, and apart from new giants of the world economy, i.e., China and India, there are also investors from medium developed countries, who are becoming increasingly active in terms of direct investments in foreign markets. However, there is a lack of empirical studies that justifythe growing competitive strength of these investors.

The need for FDI in less developed countries is significant, and – apart from the mining sector – they are often niche industries, which are essential for the local recipient and, in the future, also for export. This applies primarily to agri-food products. The reduction in export subsidies for these products in developed countries as a result of WTO negotiations (developing countries may be subsidized until 2023 and the poorest until 2030) has not, however,had the expected result in increasing the export of these goods by developing countries. Was it due to previously popular hypothesis of the "backward bending supply curve by poor farmers" due to the increase in price of crops? Regardless, agri-food processing on the local markets is still an untapped opportunity for foreign investors, and not necessarily ones from the richest countries.

While speaking of investments in underdeveloped markets, it is worth recalling the statement of Paul Streeten, one of the leading proponents of development economics in the times of its splendor, i.e., in the years of scientific interest in the issues of the development of the Third World.Writing about these issues in 1969, Streeten stated that many of his reflections on the importance of foreign investment for development are burdened by the experiences of the nineteenth century. Paraphrasing these words today, one can say that the current approach to these issues is burdened with views from the early post-war years, conditioned by the Bretton Woods agreements that shaped relations between the USA and Western Europe. In other words, the adequacy of theoretical approaches to contemporary conditions is limited.

Streeten warned against excessive foreign capital participation in the economy of a less developed country, as this capital is located in strategic sectors of the economy, which may lead to a loss of economic independence. It can, therefore, be concluded that the public sector should dominate in sensitive areas of the poorer country's economy. In such an arrangement, niches would remain to be developed by external investors, and these, as a rule, are not of interest to large corporations.

Another observation by Streeten concerned the conditions under which FDI operates in a less developed economy. Streeten considered low tax burden and investment security as factors that attractinvestors. In practice, it means the well-known "open door" strategy and its current mutation, i.e., special economic zones, in which investments are guaranteed unchanging operatingconditions.

Paul Streeten's insights, although written nearly half a century ago, contain many of today's elements. Development economics in its Third World view was dominated by post-Keynesianism, which assumedan active role of the state. Today one may observe a gradual return to this model, which is visible on more stable African or Latin American markets. This confirms the thesis of emerging opportunities for FDI from emerging markets.

FDI from emerging markets – an extension of existing theories?

China and India are the leading FDI exporters from emerging markets. Today, both are active as investors in developing as well as developed markets. The remarks below emphasize some of the peculiarities when dealing with FDI from these countries, and they alsoshow theoretical issues of FDI in a new light.

Case example: Chinese FDI in less advanced markets

China is currently the world's second-leading exporter of investment. In 2016, FDI from China (including Hong Kong) accounted for 13% of FDI outflows from the 20 top investing countries (*World Investment Report 2016*).Over the last decadeor so, China

has become a global player in the investment market, and investors are leading Chinese corporations that areinterested not only in mining but also in modern processing or technologically advanced services. Chinese companies mostly enter the markets of South East Asia (annually 49–68% of Chinese FDI outflows), although they also look to Europe (8–19%), Northern America (4–13%), Latin America (5–13%) and, in recent years, Africa (4–8%)[5], where they develop financial services, IT & software, transport and communication services, industrial production, and mining activities through acquisitions or greenfield investments.

The growing activity of Chinese investors is the result of a combination of various factors. The saturation of the internal market in China still seems to play a minor role there, which could suggest the second phase of a product'slife according to the Vernon scheme. It is true that the consumer market in China has changed significantly in recent years due to the increase in local salaries, inparticular, the lowest wages. The Atlantic Council's report talks about reducing the extent of poverty in China by nearly half the population (700 million) (Avendano et al. 2017). In addition, there is an increase in income in higher groups. The, poor until recently, mainly buy basic goods. However, it is interesting to note that Chinese households store their savings in American dollars. This creates an additional impulse to support the devaluation of the yuan by the Chinese authorities. Therefore, it is unlikely that the Chinese market will be saturated with local products as part of the product life cycle. The reason for capital to leave the country is concentration, which gives it an advantage over competitors, as in the case of the Haier consortium, which currently controls more than 10% of the world's production of home equipment.

Growing investment activity of Chinese investors on external markets is also the result of the economic downturn in China, which triggers a "flight forward" mechanism. China's FDI activity is, therefore, diverse, as evidenced by FDI in Africa. This segment of FDI has met with great interest in recent years due to the dynamics of FDI and changes in the economic and political situation in several African countries, as the scale of Chinese investments is relatively low (only about 5% of Chinese FDI is located in Africa annually). It is, however, a very attractive continent for exporters in the future, hitherto struggling for years with enormous political, social, and economic problems, which are gradually being overcome in some countries.

Western investments, for a long time, mistrusted the possibility of entering the mining sectorin less advanced economies, not only in Africa, with the numerous cases of the nationalization of foreign ownership fresh in their minds. Things have changed, but in the case of the mining sector, Chinese FDI is untypical. During particularly high economic growth in China, Chinese investments in the mining industry were guided by the idea of securing the supply of the necessary raw materials, thanks to which the Chinese economy avoided risky purchases on world stock exchanges or risky international contracts.

5 Data for 2013, various estimates according to *China's Outward FDI 2016*, bruegel.org/2015 (accessed: 12.03.2019).

In addition to investing in mining, which demands significant capital, Chinese expansion also concerns services, which account for 50% of Chinese FDI inputs, as well as the processing industry and agriculture (*Report on Development of Overseas Chinese Entrepreneurs* 2018). A significant number are greenfield projects, including those carried out by small and medium scale capital. They are able to enter external markets thanks to institutional and capital support from the State. Foreign branches of Chinese companies are installed to maintain a strategic position for future expansion. The Chinese diasporas, which has been present for many years, especially in South-East Asia, play an additional supporting role.

Is the smaller technical and organization distance between Chinese companies and local partners key in having acompetitive advantage? It seems to be a temporary situation and concerns clients in developing countries with low-skilled labor resources. In any case, it is an impulse for the expansion of FDI in such markets. Lower local remuneration causes an additional impulse to invest. There is no need to look for examples in Africa. In eastern Poland, Korean companies benefit from the minimum wage allowed by the government, which is twice as low as the national average. A statutory wage increase is the only way to earn more in these companies.

Case example: Indian FDI

As far back as the 1960s, several Indian corporations, such as Birla and the Shriram Group, founded branches in Ethiopia (textile industry) and Sri Lanka (sewing machines). After liberalization in 1991, the competitiveness of Indian companies visibly increased, which increased Indian FDI, as well. The aim was to gain a competitive advantage in terms of technology and brand, to increase the company value, or protect intellectual property rights. Indian expansion concerned various branches of the economy, such as electronics, pharmaceuticals, telecommunication, and metallurgy. For example, they included (Athukorala 2009):

- Mineral exploitation (crude oil, copper, iron ore): the Oil & Natural Gas Corporation Ltd, the Gas Authority of India Ltd, Suzlon Energy Ltd, and Hindalco.
- The automotive industry: Tata Motors.
- New technologies (purchase of technology, acquisition of management, marketing, and network distribution).

Indian companies not only gained access to foreign capital but also the possibility to take over foreign companies on a large scale. Corporations such as Bharat Forge (car parts), Moser Baer (optics), Reliance (polyester yarn), Arvind Mills (jeans), and Zee Telefilms (satellite TV channels) have become leaders of global competition. Indian FDI has achieved historic growth in the 21st century, symbolizing the country's growing integration into the world economy (Iqbal, Turay, Hasan, Yusuf 2018).

These companies easily adapted to foreign markets, especially in less developed countries, due to the similarity of Indian conditionsof production, distribution, and sales of goods in terms of local poverty and limited capital in the host country. Local

companies in the host countries also lacked social capital, and they operated with extremely poor technical and economic infrastructure.

One of the crucial reasons for the success of Indian FDI in less advanced markets was the proper staff selection to coordinate geographically dispersed resources and use production factors. Indian corporations have demonstrated their ability to manage cultural, institutional, geographic, and market diversity. Those that introduced management change that was appropriate for foreign expansion achieved the best results. Those companies developed teams of talented managers with international experience and gave them decision-making autonomy. This is exemplified by the Dabur Company, for example, which operates through a Dubai-based subsidiary and controls all global operations and industrial subsidiaries in various countries.

Conclusions

The suggested extension of the existing FDI theory, while considering investors from emerging markets, is as follows:

First, as the Chinese and Indian experiences prove, the first stage of a product's life cycle, i.e. the saturation of internal markets with own products, does not exist. The motive to export capital is either to secure demand in strategic raw materials or to achieve an advantage over competitors due to capital concentration. Considering the similarities between FDI sequences outlined by Vernon and the activities of Chinese and Indian investors, it seems sure that the second stage (maturity) of the product life cycle in emerging markets does not occur. This conclusion supports the first hypothesis.

The second hypothesis concerned the comparative advantage of companies from emerging markets due to the shorter technical and organizational distance between investors from emerging markets and local partners in host countries. The Chinese and Indian diasporas living in some host countries play an additional supporting role. This phenomenon confirms the Uppsala model regarding the low psychological distance between foreign investors and clients in the host country.

Finally, in the case of small and medium scale sectors from emerging markets, their FDI expansion ispossible, to a great extent, thanks to institutional and capital support from the state.

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Streszczenie

Bezpośrednie inwestycje zagraniczne z rynków wschodzących Teoria i praktyka

Artykuł przedstawia przegląd teoretycznych podejść do kwestii bezpośrednich inwestycji zagranicznych, pochodzących z tzw. rynków wschodzących. Są to nowi partnerzy działający jako inwestorzy, których aktywność w ostatnich latach zwiększa się zwłaszcza w krajach słabiej rozwiniętych, gdzie inwestorzy z rynków wschodzących skutecznie konkurują z dotychczasowymi liderami bezpośrednich inwestycji. Rozważane są dwie hipotezy. Pierwsza dotyczy stanu koncepcji teoretycznych, wypowiadających się na temat bezpośrednich inwestycji zagranicznych. Koncepcje te są skupione na działalności inwestycyjnej wielkich partnerów i nie wyjaśniają podejmowania działalności za granicą w przypadku przedsiębiorstw pochodzących z rynków wschodzących. Są one więc jednostronne, a dziś mają nawet charakter historyczny. Druga hipoteza dotyczy występowania przewagi komparatywnej firm z rynków wschodzących i stanowi uzupełnienie dotychczasowych podejść do istoty BIZ. Przy zastrzeżeniu, że firmy z tych rynków lokują się często w niszowych gałęziach gospodarki krajów goszczących można przyjąć, że istotą przewagi jest mniejszy dystans techniczno-organizacyjny między inwestorami a rynkami słabiej rozwiniętymi.

Słowa kluczowe: bezpośrednie inwestycje zagraniczne, rynki wschodzące, teoria, doświadczenia chińskie i indyjskie

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Methodology for Assessing the Influence of Cultural Infrastructure on Regional Development in Poland and Ukraine

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Abstract

The aim of the article is to characterize the level of the region's diversification according to the cultural component of social infrastructure based on grouped statistical indicators. This paper uses Perkal's synthetic ratio method to characterize the level of cultural infrastructure development in Ukrainian and Polish regions. The analysis, conducted between 2010 and 2017, concerned cultural organizations such as libraries, theaters, concert organizations, museums, cinemas, art and sports schools, and was based on regional data of Polish and Ukrainian public statistics. It was found that the primary barriers to access to cultural infrastructure are inadequate funding, disability, geographic remoteness, disparities in education, and material living conditions. The determinants of modernizing cultural infrastructure in the region are defined.

Keywords: social infrastructure, cultural infrastructure, human development, regional development

JEL: R1, O15, Z1

Introduction

In the recent economic crisis and the new demands of the 21st century, the basis for developing social infrastructure is a strong and comprehensive regional policy. This policy is aimed at building local partnerships, increasing human development and providing equal access, regardless of gender, to social infrastructure services (Revko 2017, p. 30). One of the main components of social infrastructure that influences human development is cultural infrastructure, which is characterized by the state of cultural development in the country, people's mentality and views, and the cultural integration of different groups. In social matters, culture can play a role in creating and maintaining the identity of the local community, its creativity, vitality, and internal cohesion.

The literature of the subject uses two meanings of cultural infrastructure: "hard," or capital cultural infrastructure, and "soft," or revenue cultural infrastructure. "Hard" involves long-term investment in facilities of cultural infrastructure, such as libraries, theaters, concert organizations, museums, cinemas, and art and sports schools, while "soft" refers to investment in information, knowledge networks, outreach programs, education, and audience development. Subsequently, these types of investment in cultural infrastructure have different temporalities: "hard" capital investments can occur relatively rapidly, are extremely visible and easily evaluated, while "soft" revenue investments occur over long periods, represent a process of performer and audience development, are relatively invisible, and are difficult to evaluate (Bryson 2007, p. 101).

It is important to note that cultural organizations constitute key elements in cultural infrastructure. For example, art schools, museums, theatres, and concert organizations play a crucial role in creating or supporting cultural infrastructures of everyday life because historically, art has played an important role in national identity-building and creating the social-humanitarian space of the region. Institutions of cultural infrastructure educate, train, and prepare people for higher levels of modern civilization (Gökçe Sanul & Bas van Heur 2018, p. 805). The cultural infrastructure transmits identities and heritages, provides the materials for imagination and innovation, and educates people to participate as creative citizens (Bawden 2002, p. 25).

It is essential to keep in mind that the probability of cultural consumption declines with the increasing spatial distance between a potential consumer and the cultural institution. Thus, the regional level is clearly closer to the actual action space than the national level. Furthermore, a regional comparison of cultural infrastructure development is more informative and more suited to capturing causal mechanisms (Rössel and Weingartner 2016, p. 370).

The goal of this article is to characterize the level of the region's diversification according to the cultural component of social infrastructure based on grouped statistical indicators. Thus, the ranking of Polish voivodships and Ukrainian oblasts will be determined in terms of the level of cultural infrastructure development.

New regionalism is increasingly developing the local economy and social and cultural identities, and it is not completely subservient to the dictates of the cen-

tral state. Moreover, the competitive position of the region is now partially founded on developing cultural infrastructure and concentrations of creativity and expertise (Bryson 2007, p. 104). In the context of the current process of decentralizing public administration, the modernization of cultural infrastructure plays a crucial role in building strong and inclusive local communities, and creating and reproducing creative and active generation. Richard Florida, for example, argues that investment in cultural infrastructure underpins regional competitiveness and requires an increase in spending from both the private and public sectors in the arts, culture, and all forms of innovation and creativity (Florida 2005, p. 77).

Trends of cultural infrastructure development in Poland and Ukraine

The degree of satisfaction of cultural needs is influenced by many factors: the degree of economic development of the region, the quantity and availability of cultural institutions, as well as the existing demand for cultural goods and services. The dynamics of the number of cultural infrastructure institutions in Ukraine is presented in Table 1. There was a negative trend in the number of Ukrainian cultural institutions between 2005 and 2017. There is a significant (20%) decrease in the number of libraries from 19,800 units in 2005 to 16,800 units in 2017. Meanwhile, compared to 2005, in 2017, the number of clubs had decreased by 11% or by 2000 units.

Table 1. Dynamics of cultural infrastructure institutions in Ukraine, 2005–2017

	2005	2010	2015	2016	2017
Number of libraries, thousand units	19.8	18.6	17.3	17.0	16.8
Number of clubs and sections, thousand units	19.1	17.9	17.2	17.1	17.1
Number of theaters, units	135	128	113	112	113
Number of concert organizations, units	78	76	73	76	76
Number of museums, units	437	511	564	576	574
Number of art schools, units	1472	1399	1295	1296	1302
Number of sports schools, units	–	1648	1397	1327	1315
Number of cinemas, units	3300	2196	1118	–	–

Source: authors' own elaboration based on data provided by the State Statistics Service of Ukraine: http://ukrstat.gov.ua. (accessed: 25.07.2019)

The dynamics of the number of cultural infrastructure institutions in Poland are presented in Table 2. Unlike in Ukraine, the number of Polish cultural institutions grew between 2005 and 2017. There is an increase in the number of almost all cultural infrastructure institutions.

Table 2. Dynamics of Polish cultural infrastructure institutions, 2005–2017

	2005	2010	2015	2016	2017
Number of libraries, thousand units	8.6	8.3	9.7	9.6	9.5
Number of clubs and sections, thousand units	3.9	–	4.1	4.2	4.2
Number of theaters, units	–	183	177	182	187
Number of concert organizations, units	–	41	41	41	43
Number of museums, units	690	782	926	945	949
Number of art schools, units	521	456	490	490	497
Number of sports schools, units	9888	13,278	–	14,009	14,858
Number of cinemas, units	536	438	444	484	491

Source: authors' own elaboration based on (Kultura… 2018, pp. 78–81)

In particular, the number of sports schools increased by almost 50%. However, the situation is worse for art schools, which decreased from 521 in 2005 to 497 in 2017 (i.e., less than 5%).

It is important to note that libraries play an important role in regional development. They support community improvement by providing programming that addresses the health, education, and workforce development needs of local residents. Libraries offer a calm, quiet, neutral space, where anyone can access information for work or leisure. They provide learning and information resources for individuals, families, businesses, and nonprofit organizations (Public Libraries… 2014, p. 35).

Figure 1 below shows that Opolskie (35), Podkarpackie 34) and Lubelskie (32) voivodships have more libraries per 100,000 inhabitants. The number of readers per 100 inhabitants ranged from 15 in the Kujawsko-pomorskie, Podlaskie, and Swietokrzyskie voivodships to more than 20 per 100 inhabitants in Malopolskie (27), Mazowieckie (22), Dolnoslaskie (21) and Lubelskie (21) voivodships.

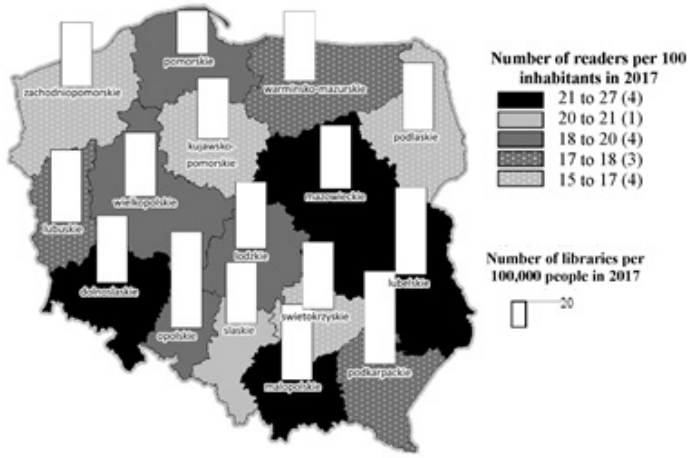

Figure 1. Number of readers and libraries in Poland in 2017
Source: authors' own elaboration based on the data provided by the Local Data Bank of Poland http://bdl.stat.gov.pl (accessed: 25.07.2019).

In Ukraine, the situation is better in this aspect (Fig. 2).

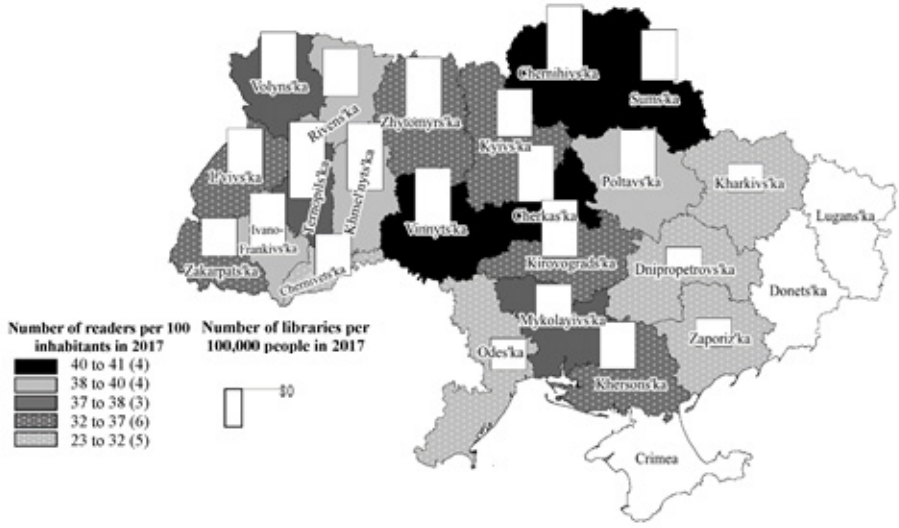

Figure 2. Number of readers and libraries in Ukraine in 2017
Source: authors' own elaboration based on the data provided by the State Statistics Service of Ukraine http://ukrstat.gov.ua (accessed: 25.07.2019).

The number of readers ranged from 23 per 100 inhabitants in the Kharkivs'ka (23), Odes'ka (24), Zaporiz'ka (24) oblasts to more than 40 per 100 inhabitants in Cherkas'ka (41), Sums'ka (41) and Vinnyts'ka (41) oblasts, i.e., twice as many as in Poland. At the same time, Ternopils'ka (81), Chernihivs'ka (71), and Khmel'nyts'ka (69) oblasts of Ukraine, according to the data for 2017, clearly outperform the remaining eighteen regions in the indicator of the number of libraries per 100,000 people. The worst situation takes place in Dnipropetrovs'ka (24), Kharkivs'ka (30), Zaporiz'ka (32), Odes'ka (34) and Zakarpats'ka (39) oblasts, where are less than 40 libraries per 100,000 people.

Figure 3 indicates the significant difference between Ukrainian oblasts regarding the number of museum visitors per 100 inhabitants.

The number of museum visitors in Ukraine per 100 inhabitants in 2017 ranged from 10 people per 100 inhabitants in Khersons'ka (10), Volyns'ka (22), Rivens'ka (22), Dnipropetrovs'ka (22), and Sums'ka (23) oblasts to 90 in Chernihivs'ka (90), L'vivs'ka (76), Cherkas'ka (68), and Zakarpats'ka (55).

During the seven years before 2017 (the last period for which data is publically available) the number of museum visitors fell in 9 oblasts from between 0.2% to 6.1% (Khmel'nyts'ka – 6.1%; Kharkivs'ka – 3.7%; Odes'ka – 2.6%; Kirovograds'ka – 2.6%; Rivens'ka – 2.3%; Khersons'ka – 2%; Zaporiz'ka – 1.5%; Chernihivs'ka – 0.7% and Poltavs'ka – 0.2%). At the same time, the number of museum visitors per 100 inhabitants rose in all voivodships in Poland from between 2.9% (in Slaskie voivodship) to 13.5% (in Mazowieckie voivodship) (See Fig. 4).

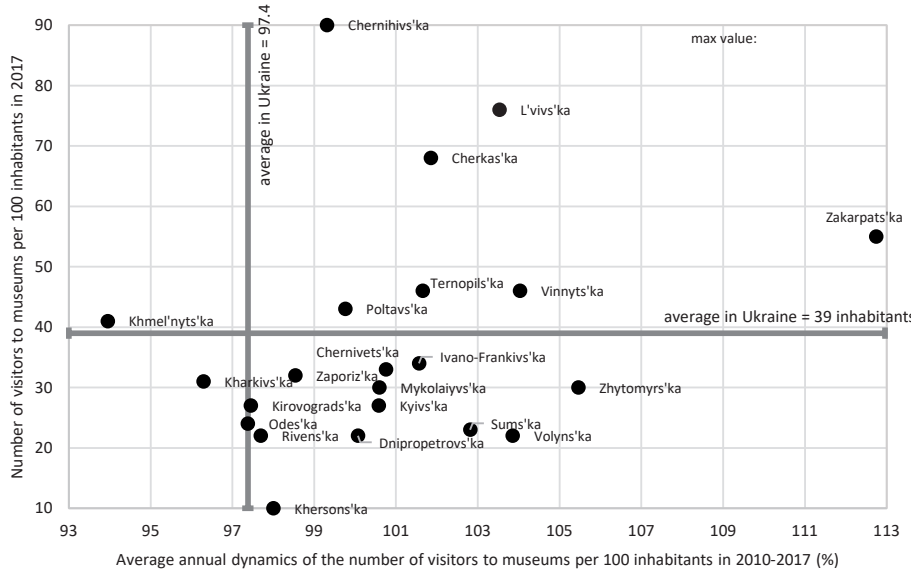

Figure 3. Number of museum visitors of Ukrainian oblasts in 2010–2017
Source: authors' own elaboration based on the data provided by the State Statistics Service of Ukraine http://ukrstat.gov.ua (accessed: 25.07.2019).

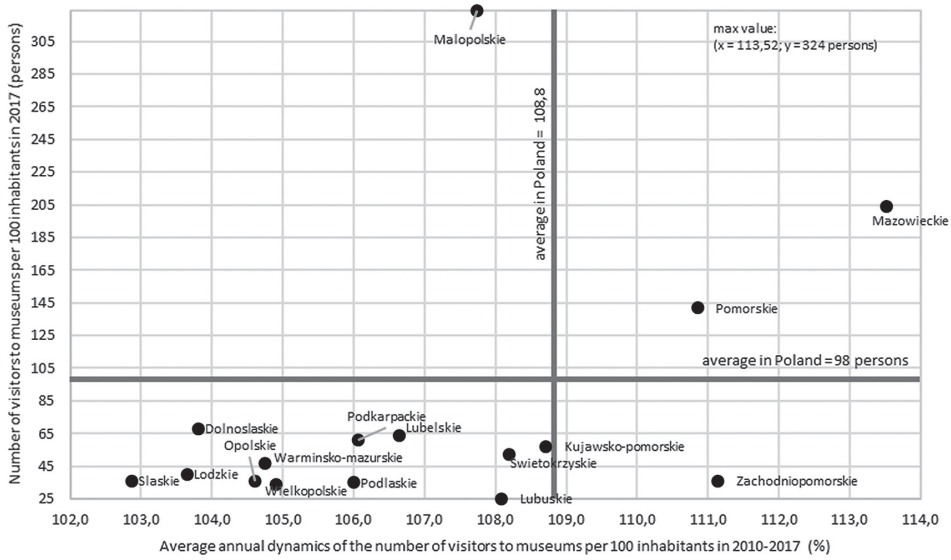

Figure 4. Number of museum visitors in Polish voivodships in 2010–2017
Source: own calculation based on the data provided by the Local Data Bank of Poland http://bdl.stat.gov.pl (accessed: 25.07.2019).

In 2017, the greatest number of museum visitors in Poland per 100 inhabitants was observed in the following regions: Malopolskie (324), Mazowieckie (204), and Pomorskie (142). At the other end of the scale were the Lubuskie (25), Wielkopolskie (34), Podlaskie (35), Opolskie (36), Slaskie (36) and Zachodniopomorskie (36) voivodships. In addition, there is a significant gap between the minimum and maximum number of museum visitors in Poland. The ratio between the highest number of visitors in Malopolskie voivodship (324 persons) and the smallest in Lubuskie voivodship (25 persons) is a factor of 13 times.

Data and methods

Methodologically, this research is based on statistical and dynamics methods used in synthetic analysis, which characterize the level of cultural infrastructure development in Ukraine and Poland. The synthetic index is determined using Perkal's synthetic ratio method, also known in the literature as Z-Scores. Perkal's method in this research is used to order the analyzed spatial units on the scale of the level of development measured by a synthetic ratio, including the values of the original indicators that describe the cultural infrastructure development of regions. Data for this analysis are from Polish and Ukrainian public statistics. The time range for assessing the cultural component of social infrastructure covers 2010–2017. The maps were created using the MapInfo Professional software.

The methodological approach of assessing the influence of cultural infrastructure on regional development is presented in Fig. 5.

To begin with, the basis for the dimensional comparative analysis is the choice of variables (statistical indicators) describing the subject of the study. The determination of statistical indicators that characterize the state of the cultural infrastructure of the regions is one of the first and, at the same time, most important and challenging stages of dimensional analysis. The reliability of the final research results depends on the quality of the variables and the accuracy of the decisions based on them.

The first step was to determine the list of statistical indicators that reflect the state of development of cultural infrastructure in Polish and Ukrainian regions. In this research, public statistics were used as the source of data. A large dataset was collected from the website of State Statistics Service of Ukraine (http://ukrstat.gov.ua) and the Local Data Bank of Poland (http://bdl.stat.gov.pl).

The next step was to identify variables that, according to this survey, do not differ from each other or differ significantly. The variables, which are characterized by a low level of differentiation, and those whose coefficient of variation does not exceed 5%, are eliminated. The elimination of variables is calculated by using the coefficient of variation as follows:

$$V_j = \frac{S_j}{\overline{x}_j} \tag{1}$$

where S_j – standard deviation of the j-th variable;
$\overline{x}_j$ – arithmetic mean of the j-th variable.

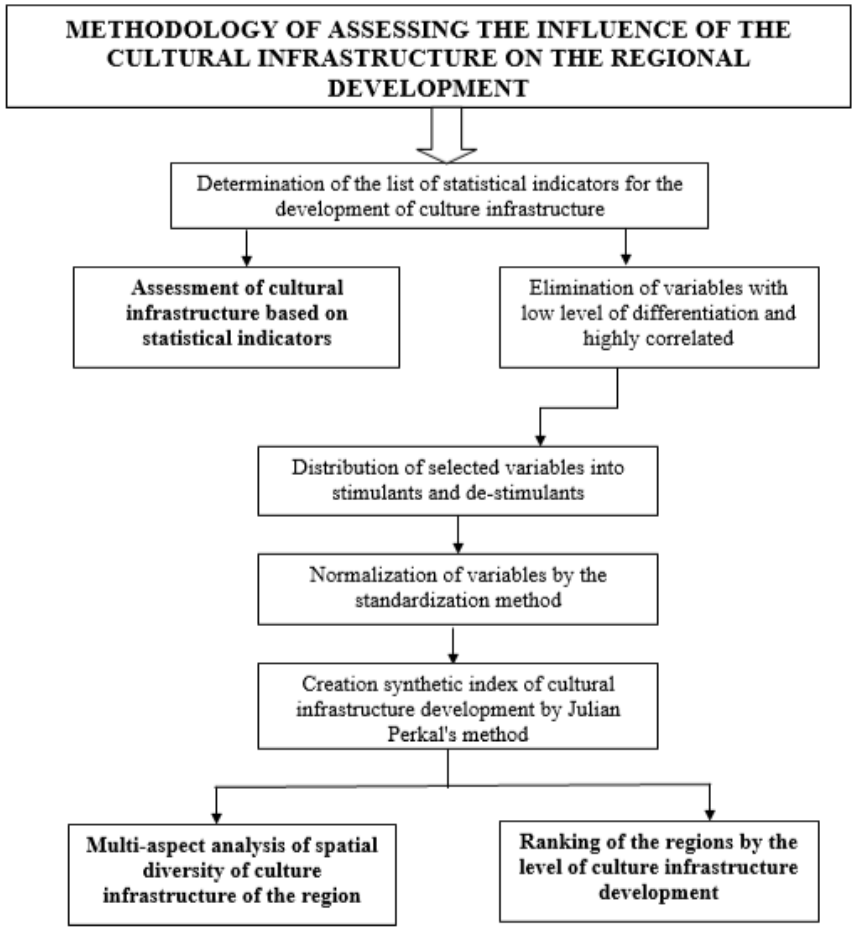

Figure 5. Research framework and methodology
Source: own study based on (Analiza Zróżnicowania 2018, p. 149).

It is important to bear in mind that the variables selected for analysis should not be highly correlated with each other. This can lead to the duplication of information about the object being studied, which can lead to incorrect conclusions. A correlation coefficient above r = 75% means that the indicator will be eliminated.

The next stage is to normalize the variables for the regions by standardizing their values. Depending on the influence of these variables on regional development, variable stimulants and de-stimulants are identified.

Standardization is carried out according to the following formula:
for stimulants

$$z_{ij} = \frac{\left(x_{ij} - \overline{x}_j\right)}{S_j}\left(j = 1,2,\ldots,n\right) \tag{2}$$

for de-stimulants

$$z_{ij} = \frac{\left(\overline{x}_j - x_{ij}\right)}{S_j}\left(j = 1,2,\ldots,n\right) \tag{3}$$

where:
z_{ij} – the standardized value of the j-th variable;
x_{ij} – value of the j-th variable for the region before standardization;
$\overline{X}_j$ – arithmetic mean of the j-th variable;
S_j – standard deviation of the j-th variable.

Applying the above formulas will lead to the fact that the range of normalized variables will be identical, which will determine the synthetic index of the regional development of cultural infrastructure.

After using the above formulas, it is possible to create a synthetic index based on the normalized variables. One can also give a graphical representation on the Polish and Ukrainian maps and determine the level of cultural infrastructure development in Polish and Ukrainian regions (16 Polish voivodships and 22 Ukrainian oblasts). Determining the synthetic index is carried out using Perkal's method of linear ordering, by grouping multidimensional objects according to the synthetic criterion, which is a function of the normalized diagnostic variables. The synthetic ratio method makes it possible to provide a linear arrangement of the Polish and Ukrainian regions by describing the values of indicators that characterize cultural infrastructure development using particular social and economic characteristics to show the level of development. The synthetic indicator is calculated by the formula:

$$W_i = \frac{1}{p}\sum_{j=1}^{p} Z_{ij} \tag{4}$$

where:
W_i – synthetic indicator;
i – region;
p – number of considered functions;
z_{ij} – the standardized value of the j-th variable.

Based on the synthetic indicator, the grouping of the Polish and Ukrainian regions was carried out according to the level of cultural infrastructure development – from the most attractive to the least attractive. In the case of standardizing the variables, the synthetic indicator usually ranges from -3 to 3. Regions characterized by a high level of development have a synthetic indicator above 0 within the study period, the average level is close to 0, while regions with a low level have a value below 0.

Finally, based on Perkal's method, the Polish and Ukrainian regions were ranked and divided into groups with different levels of cultural infrastructure development. As a result, a ranking was created by putting regions in descending order according to the value of the synthetic index. Four groups were identified:

Group A – region-leaders, in which there is the highest level of cultural infrastructure development

$$W_i \geq \overline{W} + S_{(W)} \tag{5}$$

Group B – leading regions, in which there is a high level of cultural infrastructure development

$$\overline{W} + S_{(W)} > Wi \geq \overline{W} \tag{6}$$

Group C – peripheral regions, in which there is an average level of cultural infrastructure development

$$\overline{W} > Wi \geq \overline{W} - S_{(W)} \tag{7}$$

Group D – regions-outsiders, in which there is a low level of cultural infrastructure development

$$W_i \geq \overline{W} - S_{(W)} \tag{8}$$

where:
W_i – synthetic index for a particular region;
$\overline{W}$ – the arithmetic mean value of the synthetic index of the region;
$S_{(W)}$ – standard deviation of the synthetic index of the region.

Synthetic analysis of the diversification of Polish and Ukrainian regions in terms of cultural infrastructure development

The first step in the analysis was to identify the variables that describe the object of the research. We have focused on a system of statistical indicators of cultural infrastructure development that includes:

K1. Number of libraries per 100,000 people.
K2. Number of readers per 100 inhabitants.
K3. Library fund per 100 inhabitants, copies.
K4. Number of clubs and sections per 100,000 people.
K5. Number of places in clubs per 100 inhabitants.
K6. Number of museums.
K7. Number of museum visitors per 100 inhabitants.
K8. Number of theaters.
K9. Number of seats in theaters per 10,000 people.
K10. Number of spectators at theater performances per 100 inhabitants.
K11. Number of concert organizations.
K12. Number of visits to concert organizations per 100 inhabitants.
K13. Number of art schools.
K14. Number of students of art schools.
K15. Number of cinemas.
K16. Number of seats in the cinemas per 100 inhabitants.
K17. Number of sports schools.
K18. Number of students of sports schools.
K19. Number of sports facilities per 100,000 people.

The research is based on indicators of cultural infrastructure of 16 Polish voivodships and 22 Ukrainian oblasts.

According to the adopted methodology for determining the synthetic index, the next stage of the analysis is the selection of appropriate variables that will be used in the further part of the study. It is important to note that due to lack of data in Polish public statistics about the number of places in clubs per 100 inhabitants (K5) and the number of sports facilities per 100,000 people (K19), these indicators are not included in the synthetic analysis for Poland. The analysis of cultural infrastructure allows us to identify the variables that are characterized by the lowest level of differentiation and those whose coefficient of variation does not exceed 5% are eliminated. In this research the coefficient of variation was never less than 5%.

It is necessary to eliminate variables that are characterized by a high coefficient of variation (exceeding 75%). Tables 3 and 4 present correlation matrices, which are the result of the analysis of the correlation of variables within Ukrainian and Polish regions.

The analysis of the correlation of variables of cultural infrastructure in Ukraine allows for the elimination of the following indicators from further analysis: *K1. Number of libraries per 100,000 people* (correlated to the degree of excessive variables K4 and K5); *K5. Number of places in clubs per 100 inhabitants* (correlated to the degree of excessive variables K1 and K4); *K7. Number of visitors to museums per 100 inhabitants* (correlated to the degree of excessive variable K12); *K13. Number of art schools* (correlated to the degree of excessive variables K8, K14, K17, and K18); *K14. Number of students of art schools* (correlated to the degree of excessive variables K8, K13, K17, and K18); *K17 Number of sports schools* (correlated to the degree of excessive variables K8, K13, K14, and K18); *K18. Number of students of sports schools* (correlated to the degree of excessive variables K8, K13, K14, and K17).

Similarly, the analysis of the correlation of variables of cultural infrastructure development in Poland allows for the elimination of the following indicators from further analysis: *K6. Number of museums* (correlated to the degree of excessive variables K2, K7, K8, K13, K14, K15, K17, and K18); *K7. Number of museum visitors per 100 inhabitants* (correlated to the degree of excessive variables K2, K6, and K14); *K11. Number of concert organizations* (correlated to the degree of excessive variables K8, K15, and K16); *K13. Number of art schools* (correlated to the degree of excessive variables K6, K8, K14, K15, K17, and K18); *K14. Number of students of art schools* (correlated to the degree of excessive variables K2, K7, K7, K13, K15, K17, and K18); *K15. Number of cinemas* (correlated to the degree of excessive variables K6, K8, K11, K13, K14, K17, and K18); *K18. Number of students of sports schools* (correlated to the degree of excessive variables K6, K8, K13, K14, K15, and K17).

Table 3. The level of correlation between variables of cultural infrastructure in Ukraine

K	K1	K2	K3	K4	K5	K6	K7	K8	K9
K1	1.0000	0.7394	0.4894	0.9626	0.8814	0.3700	0.3939	−0.6422	−0.6069
K2	0.7394	1.0000	0.3581	0.7056	0.6761	0.1143	0.3664	−0.5980	−0.6275
K3	0.4894	0.3581	1.0000	0.5007	0.5919	0.3974	0.3399	−0.2337	−0.0749
K4	0.9626	0.7056	0.5007	1.0000	0.9151	0.3258	0.3322	−0.6187	−0.5895
K5	0.8814	0.6761	0.5919	0.9151	1.0000	0.3758	0.3175	−0.6517	−0.6459
K6	0.3700	0.1143	0.3974	0.3258	0.3758	1.0000	0.5264	0.1246	−0.2301
K7	0.3939	0.3664	0.3399	0.3322	0.3175	0.5264	1.0000	0.0673	−0.0806
K8	−0.6422	−0.5980	−0.2337	−0.6187	−0.6517	0.1246	0.0673	1.0000	0.7090
K9	−0.6069	−0.6275	−0.0749	−0.5895	−0.6459	−0.2301	−0.0806	0.7090	1.0000
K10	−0.1606	−0.2447	0.3899	−0.1785	−0.2346	−0.0961	0.0471	0.3864	0.6421
K11	−0.0359	−0.0816	−0.0462	−0.0009	−0.2069	0.1994	0.4029	0.5457	0.2620
K12	0.5139	0.3739	0.4176	0.5104	0.4802	0.2894	0.7847	−0.0802	−0.0538
K13	−0.5501	−0.6365	−0.2877	−0.5254	−0.5587	0.2271	0.0559	0.8491	0.5296
K14	−0.4540	−0.4679	−0.2381	−0.4114	−0.4771	0.2155	0.1229	0.8294	0.4138
K15	0.3023	0.0534	0.2605	0.2558	0.2315	0.4226	0.2640	−0.0362	−0.0215
K16	0.1924	0.1087	0.3505	0.1808	0.3088	0.1576	0.1747	−0.2283	−0.1166
K17	−0.5885	−0.5454	−0.0123	−0.5363	−0.5130	0.2383	0.0375	0.8556	0.5150
K18	−0.6772	−0.6828	−0.1278	−0.6357	−0.5997	0.2548	−0.0866	0.8220	0.5162
K19	0.2865	0.2496	0.3079	0.3379	0.3411	−0.0313	−0.2576	−0.2763	−0.2807

K	K11	K12	K13	K14	K15	K16	K17	K18	K19
K1	–0.0359	0.5138	–0.5501	–0.4540	0.3023	0.1924	–0.5885	–0.6772	0.2865
K2	–0.0816	0.3739	–0.6365	–0.4679	0.0534	0.1087	–0.5454	–0.6828	0.2496
K3	–0.0462	0.4176	–0.2877	–0.2381	0.2605	0.3505	–0.0123	–0.1278	0.3079
K4	–0.0008	0.5104	–0.5254	–0.4114	0.2558	0.1808	–0.5363	–0.6357	0.3379
K5	–0.2069	0.4802	–0.5587	–0.4771	0.2315	0.3088	–0.5130	–0.5997	0.3411
K6	0.1994	0.2894	0.2271	0.2155	0.4226	0.1576	0.2383	0.2548	–0.0313
K7	0.4029	0.7847	0.0559	0.1229	0.2640	0.1747	0.0375	–0.0866	–0.2576
K8	0.5457	–0.0802	0.8491	0.8294	–0.0362	–0.2283	0.8556	0.8220	–0.2763
K9	0.2620	–0.0538	0.5296	0.4138	–0.0215	–0.1166	0.5150	0.5162	–0.2807
K10	0.2528	0.1289	0.2001	0.1614	0.0708	–0.0450	0.3709	0.2826	0.2241
K11	1.0000	0.3892	0.5651	0.6503	0.0988	–0.2317	0.5322	0.3707	–0.2779
K12	0.3892	1.0000	–0.1518	–0.1269	0.2271	0.3021	–0.1477	–0.2842	–0.0095
K13	0.5651	–0.1518	1.0000	0.8781	0.1889	–0.0541	0.7664	0.8359	–0.4212
K14	0.6503	–0.1269	0.8781	1.0000	0.0022	–0.3080	0.7899	0.7707	–0.4731
K15	0.0988	0.2271	0.1889	0.0022	1.0000	0.6886	–0.0387	0.1167	–0.1102
K16	–0.2317	0.3021	–0.0541	–0.3080	0.6886	1.0000	–0.1483	–0.0301	0.1057
K17	0.5322	–0.1477	0.7664	0.7899	–0.0387	–0.1483	1.0000	0.8886	–0.1861
K18	0.3707	–0.2841	0.8359	0.7707	0.1167	–0.0301	0.8886	1.0000	–0.2510
K19	–0.2779	–0.0095	–0.4211	–0.4731	–0.1102	0.1057	–0.1861	–0.2510	1.0000

Source: own calculation.

Table 4. The level of correlation between variables of cultural infrastructure in Poland

K	K1	K2	K3	K4	K6	K7	K8	K9	K10
K1	1.0000	0.0587	0.0807	0.6363	–0.2581	–0.1121	–0.4414	–0.6699	–0.6837
K2	0.0586	1.0000	0.5259	0.4778	0.8175	0.7869	0.6395	0.0919	0.3351
K3	0.0807	0.5259	1.0000	0.1381	0.6472	0.5266	0.7017	–0.0514	0.3386
K4	0.6363	0.4778	0.1381	1.0000	0.1920	0.2246	–0.0454	–0.1699	–0.3133
K6	–0.2580	0.8175	0.6472	0.1920	1.0000	0.8107	0.8762	0.2358	0.5389
K7	–0.1120	0.7869	0.5267	0.2246	0.8107	1.0000	0.6108	0.2992	0.5105
K8	–0.4414	0.6395	0.7017	–0.0455	0.8762	0.6108	1.0000	0.3643	0.7429
K9	–0.6699	0.0919	–0.0514	–0.1699	0.2358	0.2992	0.3643	1.0000	0.7098
K10	–0.6837	0.3351	0.3386	–0.3133	0.5389	0.5105	0.7429	0.7098	1.0000
K11	–0.5665	0.5107	0.3231	–0.0817	0.7389	0.3922	0.8443	0.4996	0.7007
K12	–0.2734	0.0387	–0.3963	–0.0851	–0.1314	–0.0863	0.0127	0.4179	0.3043
K13	–0.1066	0.7186	0.7161	0.2007	0.9044	0.6889	0.8779	0.0803	0.4703
K14	–0.0589	0.8342	0.6048	0.2364	0.8856	0.7806	0.7469	0.0184	0.3442
K15	–0.2268	0.6749	0.6443	0.1231	0.8723	0.5206	0.9177	0.1100	0.5243
K16	–0.4862	0.3747	0.1954	0.1145	0.6529	0.3219	0.6344	0.3471	0.4625
K17	–0.0931	0.6547	0.5028	0.2504	0.8105	0.4463	0.7298	–0.0393	0.2479
K18	–0.1925	0.6796	0.5818	0.1292	0.8519	0.5203	0.8570	0.0502	0.4149

K	K11	K12	K13	K14	K15	K16	K17	K18
K1	–0.5665	–0.2734	–0.1066	–0.0589	–0.2268	–0.4862	–0.0931	–0.1925
K2	0.5107	0.0387	0.7186	0.8342	0.6749	0.3747	0.6547	0.6796
K3	0.3231	–0.3963	0.7161	0.6048	0.6443	0.1954	0.5028	0.5818
K4	–0.0817	–0.0851	0.2007	0.2364	0.1231	0.1145	0.2504	0.1292
K6	0.7389	–0.1314	0.9044	0.8856	0.8723	0.6529	0.8105	0.8519
K7	0.3922	–0.0863	0.6889	0.7806	0.5206	0.3219	0.4463	0.5203

Table 4. (continued)

K	K11	K12	K13	K14	K15	K16	K17	K18
K8	0.8442	0.0127	0.8779	0.7469	0.9177	0.6344	0.7298	0.8570
K9	0.4997	0.4179	0.0803	0.0184	0.1100	0.3471	–0.0393	0.0501
K10	0.7007	0.3043	0.4703	0.3442	0.5243	0.4625	0.2479	0.4149
K11	1.0000	0.3499	0.6469	0.5398	0.8169	0.7623	0.6664	0.7382
K12	0.3499	1.0000	–0.1507	–0.0914	0.0297	0.2677	–0.0237	0.0101
K13	0.6469	–0.1507	1.0000	0.9180	0.9244	0.5723	0.8682	0.9364
K14	0.5398	–0.0914	0.9180	1.0000	0.7921	0.5164	0.8602	0.8949
K15	0.8169	0.0297	0.9244	0.7921	1.0000	0.6811	0.8638	0.9308
K16	0.7623	0.2677	0.5723	0.5164	0.6811	1.0000	0.7375	0.6936
K17	0.6664	–0.0237	0.8682	0.8602	0.8638	0.7375	1.0000	0.9631
K18	0.7382	0.0101	0.9364	0.8949	0.9308	0.6936	0.9631	1.0000

Source: own calculation.

Finally, the values of the index, rank, and group of each Polish voivodship are presented in Table 5, while the spatial differentiation of the value of the synthetic indicator is presented in Fig. 6. The highest value of the index characterizes the region with the highest level of culture infrastructure development, the lowest value – the region with the lowest level.

Table 5. Ranking of Polish regions according to the level of cultural infrastructure development in 2017

Region name	Rank	Perkal's index	Group
Mazowieckie	1	1.1027	A
Dolnoslaskie	2	0.8364	A
Malopolskie	3	0.7670	A
Slaskie	4	0.3291	B
Pomorskie	5	0.3097	B
Wielkopolskie	6	0.0177	B
Lubelskie	7	–0.0480	C
Opolskie	8	–0.1527	C
Podkarpackie	9	–0.1576	C
Zachodniopomorskie	10	–0.2670	C
Lubuskie	11	–0.2686	C
Kujawsko-pomorskie	12	–0.2733	C
Lodzkie	13	–0.3633	C
Warminsko-mazurskie	14	–0.5169	C
Podlaskie	15	–0.5251	D
Swietokrzyskie	16	–0.7900	D

Source: author's own elaboration based on data provided by the Local Data Bank of Poland http://bdl.stat.gov.pl (accessed: 25.07.2019).

Group A, with the highest level of cultural infrastructure development, consists of 3 voivodships, among which the highest level of the index was recorded in Mazowieckie, Dolnoslaskie, and Malopolskie. Group B also consists of 3 voivodships, which have a high level of development: Slaskie, Pomorskie, and Wielkopolskie. Due to their medi-

um level of development, eight voivodships (the biggest one in Poland) were classified into group C. Group D consists of only 2 voivodships with a low level of development: Podlaskie and Swietokrzyskie. These voivodships have low values of all indicators: low number of sports schools and concert organizations.

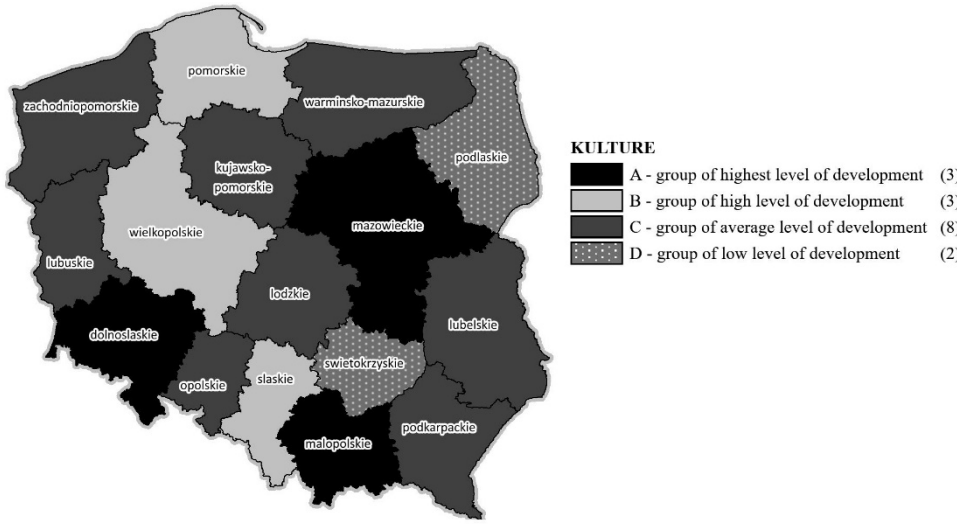

Figure 6. Map of regional differentiation of the index of cultural infrastructure development in Poland in 2017
Source: authors' own elaboration based on data provided by the Local Data Bank of Poland http://bdl.stat.gov.pl (accessed: 25.07.2019).

The synthetic index of cultural infrastructure development in Ukraine is presented in Table 6, and the spatial distribution is in Fig. 7.

Table 6. Ranking of Ukrainian regions according to the level of cultural infrastructure development in 2017

Region name	Rank	Perkal's index	Group
Chernihivs'ka	1	1.0134	A
L'vivs'ka	2	0.7602	A
Khmel'nyts'ka	3	0.5876	A
Vinnyts'ka	4	0.3513	B
Ternopils'ka	5	0.3503	B
Kharkivs'ka	6	0.2141	B
Ivano-Frankivs'ka	7	0.1545	B
Kirovograds'ka	8	0.1064	B
Mykolayivs'ka	9	0.0065	B
Dnipropetrovs'ka	10	–0.0337	C
Zhytomyrs'ka	11	–0.0652	C
Odes'ka	12	–0.0709	C

Table 6. (continued)

Region name	Rank	Perkal's index	Group
Cherkas'ka	13	–0.0866	C
Volyns'ka	14	–0.1337	C
Poltavs'ka	15	–0.1696	C
Chernivets'ka	16	–0.2114	C
Rivens'ka	17	–0.2421	C
Khersons'ka	18	–0.2605	C
Sums'ka	19	–0.2819	C
Zaporiz'ka	20	–0.4815	D
Zakarpats'ka	21	–0.6698	D
Kyivs'ka	22	–0.8374	D

Source: authors' own elaboration based on data provided by the State Statistics Service of Ukraine http://ukrstat.gov.ua (accessed: 25.07.2019).

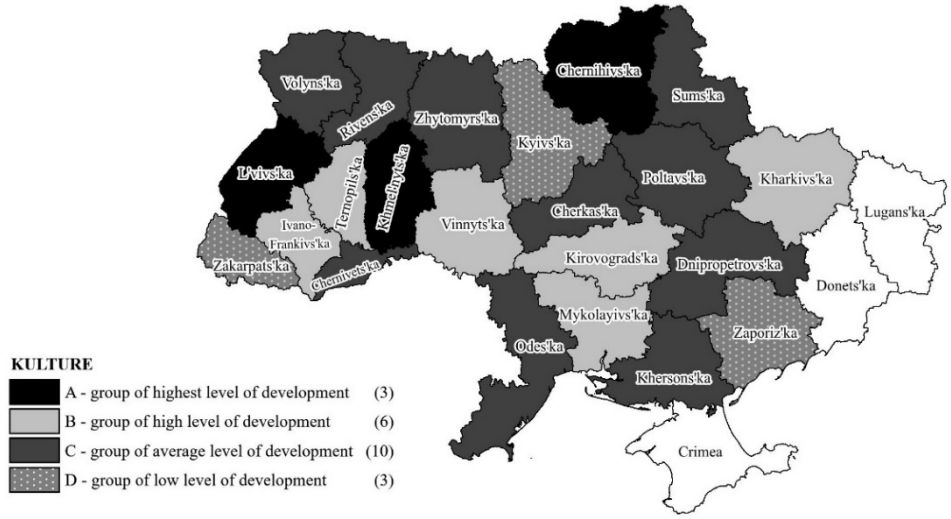

Figure 7. Map of regional differentiation of the index of cultural infrastructure development in Ukraine in 2017
Source: authors' own elaboration based on data provided by the State Statistics Service of Ukraine http://ukrstat.gov.ua (accessed: 25.07.2019).

Subsequently, the classification of Ukrainian regions according to the value of Perkal's index shows that the leader in the ranking of cultural infrastructure development in 2017 was Chernihivs'ka oblast, while last place was occupied by Kyivs'ka oblast (Fig. 7).

At the other end of the scale, group A, with the highest level of cultural infrastructure development was composed of the following oblasts: Chernihivs'ka, L'vivs'ka and Khmel'nyts'ka. A slightly less favorable situation was registered in oblasts belonging to group B, with a high level of cultural development, including Vinnyts'ka, Ternopils'ka, Kharkivs'ka, Ivano-Frankivs'ka, Kirovograds'ka, and Mykolayivs'ka.

Group C was the biggest, which included ten oblasts with a medium level of cultural infrastructure development. The weakest oblasts are in group D, and include Zaporiz'ka, Zakarpats'ka, and Kyivs'ka.

Discussions and conclusions

It is important to bear in mind that the regional cultural infrastructure is a complex system of relationships among individuals and public, private, for-profit, and not-for-profit institutions. This system provides for the transmission of culture from creators to audiences through museums, libraries, theaters, concert organizations, cinemas, and art and sports schools.

For that reason, this article analyzed the regional differentiation in cultural infrastructure development in Poland and Ukraine. The result of the study show a negative trend in the number of cultural infrastructure institutions in Ukraine between 2005 and 2017. In 2017, the number of libraries decreased by 20% in comparison with 2005, the number of theaters declined by 16%, the number art schools – by 12%, and clubs – by 11%.

Conversely, the change in the number of Polish cultural institutions between 2005 and 2017 had a positive trend. There was an increase in the number of almost all cultural infrastructure institutions.

The vast majority of people in Ukrainian regions don't have access to institutions of cultural infrastructure. One can thus conclude that the regional differentiation in cultural infrastructure has a measurable effect on cultural consumption behaviors in the respective region, even if it is not evident in all cultural realms to the same degree.

Classification of regions according to the value of Perkal's index shows that three oblasts in Ukraine (Chernihivs'ka, L'vivs'ka, and Khmel'nyts'ka) and three voivodships in Poland (Mazowieckie, Dolnoslaskie, and Malopolskie) are the leaders in the ranking of cultural infrastructure development. It is worth noting that Ukraine exhibits an uneven distribution of cultural infrastructure. As follows from the analysis, Ukraine and Poland have gaps in cultural infrastructure development, and educational and cultural resources and opportunities.

The underlying barriers to access to cultural infrastructure in Ukraine are inadequate funding, disability, geographic remoteness, and disparities in education and material living conditions. To enable fuller participation in the cultural life of the nation and to foster of cultural infrastructure development of the regions, the following must take place:

- create new cultural institutions and improve the accessibility and quality of existing ones;
- develop a system of public cultural services to meet the needs of different customer groups and develop localized service system;
- supporting entrepreneurship in the cultural and creative industries, improving the economic importance of culture;

- attract investments of regional and international significance to the sphere of culture;
- support the development of competences and skills of employees who are engaged in the cultural infrastructure;
- improve the financing system of cultural infrastructure (the effective use of state and local budgets, international funds) and social participation of local communities.

In terms of regional development, communities contribute meaningfully to the cultural infrastructure, forming the cultural ethos of the nation. Public policy should attempt to lower barriers to access and facilitate participation in the development of the cultural infrastructure. Cultural infrastructure and the creative industries are major components of a region's attractiveness and they provide a vision for its economic development and job creation.

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Streszczenie

Metodologia oceny wpływu infrastruktury kulturalnej na rozwój regionalny w Polsce i na Ukrainie

Celem artykułu jest określenie poziomu zróżnicowania regionu pod względem komponentu kulturowego infrastruktury społecznej, na podstawie zgrupowanych wskaźników statystycznych. W pracy wykorzystano metodę wskaźnika syntetycznego Perkala do scharakteryzowania poziomu rozwoju infrastruktury kulturalnej w regionach ukraińskich i polskich. Analiza przeprowadzona w latach 2010–2017 dotyczyła organizacji kulturalnych, takich jak biblioteki, teatry, instytucje organizujące koncerty, muzea, kina, szkoły artystyczne i sportowe. Wykorzystano regionalne dane statystyczne z Polski i Ukrainy. Stwierdzono, że podstawowymi barierami w dostępie do infrastruktury kulturalnej są niewystarczające fundusze, niepełnosprawność, oddalenie geograficzne, dysproporcje w zakresie edukacji i materialne warunki życia. Określono uwarunkowania modernizacji infrastruktury kulturalnej w regionie.

Słowa kluczowe: infrastruktura społeczna, infrastruktura kulturalna, rozwój człowieka, rozwój regionalny

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Modeling the Optimal Portfolio: the Case of the Largest European Stock Exchanges

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Abstract

Portfolio optimization is the main concern for portfolio managers. Financial securities are placed within the portfolio based on the investor's risk tolerance. The study measures the risk-reward relationship when the number of stocks in the portfolio increases. Six diverse portfolios have been created with a different number of stocks, such as portfolios with 47 stocks, 95 stocks, 142 stocks, 190 stocks, 239 stocks, and 287 stocks. Stock prices and trading volume were collected on a weekly basis from the six largest European stock exchanges (FTSE100, CAC40, FTSE MIB, IBEX35, DAX, and MDAX). Markowitz's (1952) diversification formula has been used to measure the risk level of the individual portfolios. The results of the study show that the diversification risk constantly decreases when we move from the portfolios with 47 stocks to the portfolios with 287 stocks. The weighted average returns increase on the portfolios with a higher number of stocks, which is contrary to the standard portfolio theories. The results of the study indicate managerial implications for financial investors that are focused exclusively on the largest European stock exchanges.

Keywords: Portfolio diversification, stock exchanges, correlation coefficient, volatility

JEL: G11

Introduction

The risk-reward relationship of financial assets is considered an everyday task for portfolio managers. Diversification is used to reduce specific risks imposed on financial assets and expand portfolio benefits. Regardless of the significant number of studies conducted in this area, there are still no widely accepted metrics for measuring portfolio risk (Meucci 2009, pp. 74–79). The concentration level within the portfolio of assets can be measured via the Herfindahl-Hirschman index (Kacperczyk et al. 2005; Kumar 2007) and a portfolio that is concentrated in a few numbers of assets is considered poorly diversified. The major limitation of the weight-based method for measuring risk is that it treats diversification outcomes merely on asset concentration. The correlation within assets in the portfolio is an extra risk component, and a higher correlation within assets increases portfolio risk and vice-versa. The risk-based method indicates that portfolios with less positively correlated assets are well diversified. However, the correlation coefficient might generate misleading results since the portfolio is influenced by multiple factors (Roll 2013, pp. 11–18). The correlation coefficient indicates short-run dependency within assets, while co-integration captures long-term associations. Skintzi and Refenes (2005, pp. 171–197) claim that the average correlation within financial assets is the best measure of diversification risk.

However, Christoffersen et al. (2012, pp. 3711–3751) propose conditional diversification benefits for measuring diversification risk. Volatility measured through the standard deviation of returns influences investor decisions. Higher volatility imposed on the financial securities increases the risk exposure of the portfolio. The portfolio is a complex arrangement of visible and invisible risk components that is barely controlled via ordinary models.

Building a portfolio that would generate the highest diversification benefits is a hot topic among scholars. Markowitz (1952, pp. 77–91) set up the foundations on the diversification risk, called modern portfolio theory (MPT). The theory is based on the allocation of the portfolio assets grounded on the risk tolerance of financial investors. The MPT is constructed under the market efficiency hypothesis, where stock prices signify the ultimate situation of the company. In contrast, stock markets are characterized by various efficiency levels and distorted speculative prices. The theory is generally recognized as the Capital Asset Pricing Model (CAPM), developed by Sharpe (1964, pp. 425–442) and Lintner (1965, pp. 587–615). CAPM indicates the equilibrium risk-return relationship of the financial securities based on two main properties. The first assumption considers that investors hold in their portfolio all possible risky financial assets. The second assumption claims that assets are spread on the equal weights within the portfolio. The model is generally constructed under the efficient market hypothesis (EMH). Fama (1968, pp. 29–40) considers that stock prices tend toward equilibrium (intrinsic value) when stock markets are efficient. The EMH was extensively criticized after the financial crisis of 2008 when stock prices remained beyond their intrinsic value for a long period. CAPM is largely used as a discount rate

indicator to determine the equity value of a company (Damodaran 2012, p. 324). Besides portfolio risk, financial securities comprise internal specific risk, measured via asset pricing models. Moreover, asset pricing models serve to detain the unsystematic risk of individual assets (Bali et al. 2008, pp. 878–896).

The study contributes to the current discussions on portfolio risk in several ways. To the best of our knowledge, there is no other study that focuses on the diversification benefits provided solely from the largest European stock exchanges. The work provides indications for the financial managers that tend to diversify their portfolio within the largest European stock exchanges. Amid this ongoing debate, the following research questions were formulated: *Q1:* What is the number of stocks that fully eliminates the diversification risk of European based portfolios? *Q2:* What are the elements that influence diversification risk the most?

Literature review

Portfolios are compounded from multiple risk components, such as controlled and uncontrolled risk elements. Individual assets hold their intrinsic risk while grouping them together generates portfolio risk. Building a portfolio that provides a market advantage is an art that depends on the talent of the managers. Diversification is considered a way to spread risk among different asset classes. Globalization, in terms of trade and financial investments, has highlighted the benefits of portfolio diversification. Cross-country investments decrease the average positive correlation within financial assets in the portfolio (Driessen and Laeven 2007; Solnik 1974). Despite the benefits of international diversification, however, financial investors keep an enormous share of their investments domestically (Abid et al. 2014; Van Niuwerburgh and Veldkamp 2009; French and Poterba 1991). Investing in multinational corporations within the country provides risk benefits on an identical scale as investing internationally (Farooqi et al. 2015; Cai and Warnock 2012). A series of studies investigated diversification benefits of investing in the domestic companies that operate on a multinational scale (Berrill et al. 2019; Aliu et al. 2019; Errunza et al. 1999). Driessen and Laeven (2007, pp. 1693–1712) show that the risk benefits from international investments remain, but the benefits accelerate at a decreasing scale. The problem of interconnected economies nowadays has dampened the benefits of international diversification. The Asian banking crisis of 1997 and the financial downturn of 2008 proved that stock markets are highly integrated. Financial problems in one country are easily transmitted to other countries.

Scholars and practitioners are highly interested in the number of stocks that reduce diversification risk. Still, there is no consensus among scholars and practitioners concerning the number of stocks that fully eliminates diversification risk. An earlier study by Evans and Archer (1968, pp. 761–767) shows that a portfolio with 8 to 16 stocks reduces diversification risk. Their work was widely used among finance text-

books and extensively considered among financial investors. Stevenson and Jennings (1984, p. 236) claim that diversification benefits can be attained in a smaller portfolio than the one proposed by Evans and Archer (1968, pp. 761–767). However, studies have been conducted at diverse time intervals and with different portfolio risk techniques. Gup (1983, p. 185) shows that total diversification benefits are achieved in a portfolio with eight or nine financial securities.

In contrast, the work by Reilly (1985, p. 96) indicates that maximum diversification benefits are achieved in a portfolio with 12 to 18 stocks. Elton and Gruber (1977, p. 415–437) confirm that when we move from a portfolio with one to ten stocks, the risk level is reduced by 50%. Increasing the number of stocks within the portfolio from 10 to 20 reduces the risk level by 5%. However, a portfolio that moves from 20 to 30 stocks reduces the diversification risk by only 2%. Statman (1987, pp. 353–363), in his study, confirm that a well-diversified portfolio must contain a randomly chosen of 30 to 40 stocks. It is the first work that contradicts the results by other scholars that 10 to 15 stocks are enough to reach maximum diversification benefits. Brands and Gallagher (2005, pp. 185–197) examined diversification outcomes on Australian equity funds. Their results show that diversification benefits are achieved when six portfolios are included within one equity fund. However, at the industry level, diversification benefits are achieved with a combination of 47 stocks from two different industries (Aliu et al. 2017, pp. 72–83).

The establishment of the European Union rapidly increased cross-border trading among member states. The introduction of the monetary union further expanded the financial and economic integration within Eurozone countries. Bartram et al. (2007, pp. 1461–1481) investigated the interdependency of seventeen European stock exchanges after the euro currency was established. The results indicate that the common currency raised the dependency of the largest European stock exchanges (Italy, Germany, France, Spain, and the Netherlands) while a recent study by Burzala (2016, pp. 556–571) confirms the co-integration within the DAX, CAC40, and FTSE100. Moreover, stock exchanges tend to be integrated during crisis periods while less integrated in normal times. The European debt crisis of 2011 caused by the Greek government's debt generated an overall downturn on European Stock Exchanges.

Listed companies in the largest European stock exchanges are geographically located within the European continent, but the majority of them operate on a multinational scale. The operational scope exposes them to several transnational risks, such as exchange rate risk, political risk, economic risk, etc. This work does not classify companies into national and multinational; it solely investigates the diversification benefits of investing in European stocks. The results of the study identify portfolio risk outcomes when the number of stocks increases.

Methodology

The study used secondary data from the Thomson Reuters Eikon database of the following stock exchanges: FTSE100, CAC40, FTSE MIB, IBEX35, DAX, and MDAX. Stock prices and trading volumes were collected weekly, from January 2007 until December 2017. The stock prices and trading volumes of the listed companies are arranged on identical dates and in an identical currency (euro). Six portfolios with a different number of stocks are constructed, i.e., portfolios with 47, 95, 142, 190, 239, or 287 stocks. Additionally, 32 companies were selected from the CAC40, 30 companies from the FTSE MIB, 35 from the IBEX 35, 30 from the DAX, 60 from the MDAX, and 100 companies from the FTSE 100. The portfolios were constructed from randomly selected stocks. The portfolio of 287 stocks was not randomly chosen since it contains the total number of stocks from the six largest European stock exchanges. The following Markowitz (1952) diversification formula was used to detect the risk level of each portfolio:

$$\sigma_k^2 = \sum_{i}^{nk} w_{ik}^2 \sigma_{ik}^2 + 2 \sum_{i}^{nk} \sum_{j<i}^{nk} w_{ik} w_{jk} \sigma_{jk} \rho_{ijk} \tag{1}$$

where: σ^2 – variance of returns (stock prices of individual listed companies in the stock indexes), σ stands for the standard deviation of returns (stock prices of the individual listed companies in the stock index) while $\varphi(i,j)$ shows the correlation coefficient within returns (stock prices of the individual listed companies in the stock index). σ_k^2 of the portfolio in year k is computed on the sample of n_k companies. The index i indicates a company, j is an auxiliary index assuring that the covariance is computed on distinct companies, ω represents the weight of each listed company in the stock index within the portfolio based on their trading volume, and ω^2 represents the squared weight.

The formula was implemented from the following programs: Python 3.6.3, Numpy (version: 1.13.3), and Jupiter Notebook (version: 5.2.0). The process starts by separating the columns that contain the stock prices and trading volumes of the listed companies in the largest European Stock Exchanges.

The calculation of the weighted average returns (WAR) does not consider dividends declared from the listed companies. WAR is generated solely from the price movements of the individual stocks (capital gains or losses). The following WAR formula was used to calculate the weighted average rate of returns for the portfolio:

$$war = \sum_{i=1}^{n} r_i wi_i \tag{2}$$

where: *war* – weighted average rate of return for the portfolio; r_i – weights of stocks within the portfolio; r_i – stock's required rate of return within the portfolio.

The model is not built on equal weights but on changeable weights. The weights within each portfolio are determined from the trading volume that the listed companies have within their stock exchanges.

Research results

The study aims to identify diversification benefits when the number of stocks in the portfolio increases. Portfolio risk is influenced by multiple elements, such as correlation within financial assets, concentration level, and volatility of returns. An increase in the positive correlation within financial securities in the portfolio increases the diversification risk, and vice versa. Diversification risk increases equally when the portfolio concentrates on a few securities. However, volatility is considered a key risk component that indicates the risk level within the group of financial assets.

In this section, we measured the average risk level and weighted average returns linked with the six diverse portfolios for the period 2007–2017. The results are presented in Table 1. Portfolio A is built with 47 stocks, Portfolio B with 95 stocks, while Portfolio F has 287 stocks. Each portfolio has been simulated with five trials based on an identical number of stocks. The stocks were selected randomly from the six largest European Stock Exchanges (FTSE100, CAC40, FTSE MIB, IBEX35, DAX, and MDAX). The results of the study show that moving from portfolio A to Portfolio B, the risk level is reduced by 28.47%, while from Portfolio B to Portfolio C, the risk level is reduced by 17.34%. However, when moving from Portfolio C to Portfolio D, the risk level is reduced by only 9.87%, while from Portfolio D to E, the risk falls by 6.84%. The risk level is reduced by only 2.9% when we move from Portfolio E to Portfolio F. The risk level falls by 51.82% when we move from Portfolio A (47 stocks) to Portfolio F (287). In order to reduce the diversification risk by 50%, we need to add, on average, 240 randomly selected European stocks. In contrast, moving from a portfolio with 47 stocks to a portfolio with 287 stocks increases the weighted average returns by 3.53%.

Table 1. The results of the average risk level and weighted average returns linked with the six different portfolios

Portfolios	Years	Number of stocks	Average Volatility	Average Correlation	Average risk	Weighted average returns
Portfolio A	2007–2017	47	4.32	+0.51	1.37	0.03%
Portfolio B	2007–2017	95	3.51	+0.39	0.98	2.20%
Portfolio C	2007–2017	142	3.01	+0.31	0.81	2.65%
Portfolio D	2007–2017	190	2.82	+0.29	0.73	3.09%
Portfolio E	2007–2017	239	2.67	+0.27	0.68	2.86%
Portfolio F	2007–2017	287	2.59	+0.26	0.66	3.56%

Source: authors' calculations based on the Thomson Reuters Eikon database.

An additional element of portfolio risk is correlation within stocks. The correlation from Table 1 is the average indicator from the correlation matrix of each portfolio. The average positive correlation declines continuously when the number of stocks in the portfolio is increased. The positive correlation decreases by 23% when we move from Portfolio A to B, while from Portfolio B to C, the average positive correlation

declines by 20.5%. However, the average positive correlation decreases by only 3.7% when we move from Portfolio E to F. Volatility measured by the standard deviation of returns is measured on the average terms. Volatility in Table 1 indicates the average standard deviation of all stocks within the portfolios. The average volatility decreases by 18.75% when we move from Portfolio A to Portfolio B, while from Portfolio B to C, it decreases by 14.22%. The average volatility declines by only 2.99% when we move from Portfolio E to F.

Portfolio A was simulated five times with an identical number of randomly selected stocks from the six largest European stock exchanges. The average risk level in Portfolio A (1.37) represents the average risk of five different portfolios with an identical number of stocks. The same process was conducted for each portfolio (B, C, D, E, F).

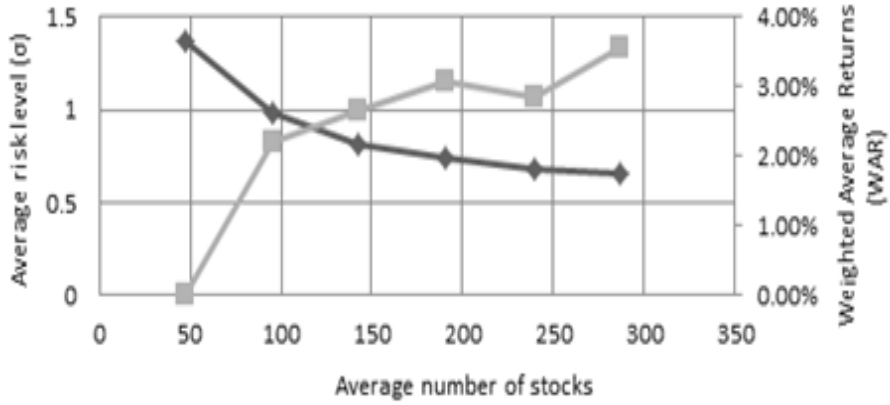

Chart 1. The relationship between the average number of stocks, average risk level, and weighted average returns
Source: authors' calculations based on the Thomson Reuters Eikon database.

Chart 1 represents the relationship between the average number of stocks in the portfolio and the average risk level (black line), and the relationship between the average number of stocks and the weighted average returns (gray line). According to the results presented in Chart 1, the average risk level decreases when the average number of stocks increases. This relationship is in line with the portfolio theories that state that more stocks in a portfolio reduces the risk level. The risk level is constantly reduced when we move from portfolios with 47 stocks to a portfolio with 287 stocks. In contrast, when the risk level decreases, the weighted average returns increase. This contradicts the portfolio theories. Since the portfolios are built with changeable weights, the WAR move in the opposite direction from the average risk level. While stocks in the portfolios hold diverse trade volumes, the study measured the weighted average returns instead of the annual returns.

The phenomenon is explained in average terms, although individual portfolios might not deliver identical outcomes. The portfolios (A, B, C, D, E, and F) show an average risk and return relationship from 2007 to 2017.

Conclusion

Financial investors tend to reduce diversification risk via investing in financial securities that are less correlated. International financial investments cannot fully eliminate unsystematic risk since, nowadays, economies tend to be highly interconnected. However, there is an ongoing debate among scholars and practitioners concerning the number of stocks that fully removes risk exposure of the portfolio. This study identifies diversification benefits when the number of stocks in the portfolio increases. Stocks were selected from companies listed on the six largest European stock markets. The portfolios were not exposed to exchange rate risk, except for the randomly selected stocks from the FTSE100.

Portfolio risk is influenced by diversifiable risk (unsystematic risk) and market risk (systematic risk). Unsystematic risk includes elements such as correlation within financial assets, weight concentration, and volatility of returns. Fluctuations of these inputs influence the risk level of the portfolio. The results of the study confirm that the number of stocks is important in reducing the risk level of the portfolio. An increasing number of stocks in the portfolio permanently reduces the risk level of the portfolio. Moving from a portfolio with 47 stocks to a portfolio with 95 stocks reduces the risk level by 28.47%. In order to reduce the risk exposure by 50%, it requires an additional 240 European stocks within the portfolio. Diversification benefits increase on the optimal scale when the portfolio contains more than 139 stocks. The average correlation and average volatility decrease the bigger the size of the portfolio. The average correlation decreases by 23% when we move from Portfolio A to B, but by only 3.7% moving from Portfolio E to F. Moving from Portfolio A to B, the average volatility decreases by 18.75%, while from Portfolio E to F, it decreases only by 2.99%. The average correlation decreases on a larger scale and with higher speed than average volatility when the number of stocks increases in the portfolio.

In contrast, an increase in the number of stocks increases the weighted average returns (WAR) of the portfolio. The results of WAR go against the general paradigms in portfolio management. The results of the study show that an increase in the average number of stocks reduces average portfolio risk, which confirms conventional paradigms on the portfolio theory. However, when the average risk level declines, the weighted average returns increase, which goes against the portfolio management theories. Weighted average returns move in the opposite direction from the average risk level, since the portfolios are built with changeable weights. The study measured weighted average returns, not annual returns, because stocks in the portfolio hold diverse trade volumes. Future research could identify if the study outcomes contradict investment theories when portfolios are arranged with identical weights and involving dividends as part of the portfolio returns.

The study does not consider transaction costs imposed on investors when buying and selling stocks. An additional limitation of the study is that portfolios are built only with European stocks, while diversification is also achieved from investing in bonds,

real estate, and other international financial assets. Weighted average returns are measured only with capital gains or losses but not from dividends as significant revenue for investors.

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Streszczenie

Modelowanie optymalnego portfela: przypadek największych europejskich giełd papierów wartościowych

Optymalizacja portfela jest głównym przedmiotem zainteresowania zarządzających portfelem. Dobór papierów wartościowych jest zależny od skłonności inwestora do podejmowania ryzyka. W niniejszym opracowaniu dokonano pomiaru zmian relacji ryzyko-zysk w miarę wzrostu liczby akcji w portfelu. Stworzono sześć różnych portfeli o liczbie akcji wynoszącej odpowiednio: 47, 95, 142, 190, 239 i 287 akcji. Dane dotyczące cen akcji i wolumenu obrotu były zbierane co tydzień z sześciu największych europejskich giełd papierów wartościowych (FTSE100, CAC40, FTSE MIB, IBEX35, DAX i MDAX). Do pomiaru poziomu ryzyka poszczególnych portfeli zastosowano wzór znany z teorii dywersyfikacji Markowitza (1952). Wyniki analizy pokazują, że ryzyko dywersyfikacji maleje dla portfeli o coraz większej ilości akcji (od 47 akcji do 287 akcji w portfelu). Średni ważony zwrot z portfela rośnie dla portfeli o większej liczbie akcji, co jest sprzeczne ze standardowymi teoriami portfela. Wyniki analizy mogą być przydatne dla inwestorów, którzy koncentrują się wyłącznie na największych europejskich giełdach papierów wartościowych.

Słowa kluczowe: dywersyfikacja portfela, giełdy papierów wartościowych, współczynnik korelacji, zmienność

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Meeting the Sustainable Development Goal of Good Health and Well-Being by European Union Countries in 2017

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Abstract

In September 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, which includes 17 Sustainable Development Goals (SDGs). One of them, Goal 3, is defined as: Ensure healthy lives and promote well-being for all at all ages. In the paper, we have considered the indices proposed by Eurostat, which help to measure the level that the targets achieve. We present the dynamics of indices over the period 2002–2017. Multi-criteria statistical analysis for 28 EU countries was conducted using data up to 2017 to show how much EU countries are diversified and to present rankings of countries on their way to achieving the good health and well-being status of their citizens. The results are compared with a global SGD-Sub-Index for Goal 3, developed by Sachs et al. (2018).

Keywords: SDG, multi-criteria rankings, health and well-being

JEL: C44, I31

Introduction

In September 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development[1] that includes 17 Sustainable Development Goals (SDGs)[2]. Among them, we can find: end poverty, end hunger, ensure healthy lives, promote well-being for all at all ages, equitable quality education, achieve gender equality, make water available for all, promote sustainable economic growth, modern energy, sustainable consumption, and combat climate change.

For each of the SDGs, between five and nineteen targets were formulated.

McGillivray and Noorbakhsh (2004) surveyed the various composite well-being indices developed over recent years, including the well-known Human Development Index (HDI). They present a critical view of the criteria and structure of the indices as well as give recommendations for future work on measuring well-being.

For sustainable development Goal 3, which is of particular interest to us in this work, the UN formlated the following thirteen targets to be achieved by 2030[3]:

T1. Reduce the global maternal mortality ratio to less than 70 per 100,000 live births.
T2. End preventable deaths of newborns and children under five years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births.
T3. End the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases
T4. Reduce by one-third premature mortality from non-communicable diseases through prevention and treatment, and promote mental health and well-being.
T5. Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.
T6. By 2020, halve the number of global deaths and injuries from road traffic accidents
T7. Ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes.
T8. Achieve universal health coverage, including financial risk protection, access to quality essential health-care services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all.
T9. Substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination.
T10. Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate.

1 "*Transforming our world …*" Resolution of UN General Assebly. September 2015.

2 https://www.un.org/sustainabledevelopment/sustainable-development-goals/ (accessed: 31.08.2019)

3 https://www.un.org/sustainabledevelopment/sustainable-development-goals/ (accessed: 31.08.2019)

T11. Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, and provide access to affordable essential medicines and vaccines.[4]
T12. Substantially increase health financing and the recruitment, development, training, and retention of the health workforce in developing countries, especially in least developed countries and small island developing States.
T13. Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction, and management of national and global health risks.

The recent comprehensive research results for the OECD approach for measuring well-being in 36 countries who are members of OECD can be found in the OECD (2017). In our research, to measure the level of "healthy" and "well-being," we use indicators developed by EUROSTAT, which are defined as follows[5]:

I1. *Life expectancy at birth* by sex [SDG_03_10]. Life expectancy at birth is defined as the mean number of years that a new-born child can expect to live if subjected throughout his life to the current mortality conditions (age-specific probabilities of dying).
I2. *Share of people with good or very good perceived health* by sex [SDG_03_20]. The indicator is a subjective measure of how people judge their health in general on a scale from "very good" to "very bad." It is expressed as the share of the population aged 16 or over perceiving themselves to be in "good" or "very good" health. The data stem from the EU Statistics on Income and Living Conditions (EU SILC). Indicators of perceived general health have been found to be a good predictor of people's future health care use and mortality.
I3. *Smoking prevalence* by sex (source: DG SANTE) [SDG_03_30]. The indicator measures the share of the population aged 15 years and over who report that they currently smoke boxed cigarettes, cigars, cigarillos, or a pipe. The data do not include the use of other tobacco products, such as electronic cigarettes and snuff. The data are collected through a Eurobarometer survey and are based on self-reports during face-to-face interviews in people's homes.
I4. *Death rate due to chronic disease*s by sex [SDG_03_40]. The indicator measures the standardized death rate[6] of chronic diseases[7]. Death due to chronic diseases is considered premature if it occurs before the age of 65. The rate is calculated by dividing the number of people under 65 dying due to chronic disease by the

4 In accordance with the Doha Declaration on the TRIPS Agreement and Public Health (November 2001), which affirms the right of developing countries to use the full the provisions in the Agreement on Trade Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all.

5 https://ec.europa.eu/eurostat/web/sdi/main-tables (accessed: 31.08.2019) All consecutive explanations in the text follow definitions presented by EUROSTAT.

6 The data are presented as standardized death rates, comparable over time and between countries.

7 International Classification of Diseases (ICD) codes C00 to C97, E10 to E14, I20 to I25, I60 to I69 and J40 to J47.

total population under 65. Unit of measurement: number per 100,000 people aged less than 65 by sex.

I5. *Death rate due to tuberculosis, HIV, and hepatitis* by sex [SDG_03_41]. The indicator measures the standardized death rate[8] of tuberculosis, HIV, and hepatitis[9] The rate is calculated by dividing the number of people dying due to selected communicable diseases by the total population. Unit of measurement: number per 100,000 people.

I6. *Self-reported unmet need for medical examination and care* by sex [SDG_03_60]. The indicator measures the share (%) of the population aged 16 and over who report unmet needs for medical care due to one of the following reasons: 'Financial reasons,' 'Waiting list,' and 'Too far to travel' (all three categories are cumulated). Self-reported unmet needs concern a person's own assessment of whether he or she needed medical examination or treatment (dental care excluded), but did not have it or did not seek it. The data stem from the EU Statistics on Income and Living Conditions (EU SILC).[10]

I7. *Obesity rate by body mass index (BMI)* [SDG_02_10]. The indicator measures the share of obese people based on their body mass index (BMI). BMI is defined as the weight in kilos divided by the square of the height in meters. People aged 18 years or over are considered obese with a BMI equal to or greater than 30. Other categories are: underweight (BMI less than 18.5), normal weight (BMI between 18.5 and less than 25), and pre-obese (BMI between 25 and less than 30). The overweight category (BMI equal to or greater than 25) combines two categories, pre-obese and obese.

I8. *People killed in accidents at work* [SDG_08_60]. The indicator measures the number of fatal accidents that occur during the course of work and which lead to the death of the victim within one year of the accident. The incidence rate refers to the number of fatal accidents per 100,000 people in employment.

I9. *Population living in households considering that they suffer from noise*, by poverty status [SDG_11_20]. The indicator measures the proportion of the population who declare[11] that they are affected either by noise from neighbors or from the street.

8 As explained in target 4.

9 International Classification of Diseases (ICD) codes A15-A19_B90, B15-B19_B942 and B20-B24.

10 Note on the interpretation: "The indicator is derived from self-reported data so it is, to a certain extent, affected by respondents' subjective perception as well as by their social and cultural background. Another factor playing a role is the different organization of health care services, be that nationally or locally. All these factors should be taken into account when analyzing the data and interpreting the results."

11 "Because the assessment of noise pollution is subjective, it should be noted that the indicator accounts for both the levels of noise pollution as well as people's standards of what level they consider to be acceptable. Therefore, an increase in the value of the indicator may not necessarily indicate a similar increase in noise pollution levels but also a decrease of the levels that European citizens are willing to tolerate and vice versa. In fact, there is empirical evidence that perceived environmental quality by individuals is not always consistent with the actual environmental quality assessed using 'objective' indicators, particularly for noise."

I10. *People killed in road accidents*[12] [SDG_11_40]. The indicator measures the number of fatalities caused by road accidents, including drivers and passengers of motorized vehicles and pedal cycles, as well as pedestrians. People who die in road accidents up to 30 days after the occurrence of the accident are counted as road accident fatalities. After the 30 days, the reason for dying might be declared differently. For the Member States that do not use this definition, corrective factors were applied. The average population of the reference year (calculated as the arithmetic mean of the population on 1st January of two consecutive years) is used as the denominator (per 100,000 people).

11. *Exposure to air pollution by particulate matter*[13] [SDG_11_50a and SDG_11_50b]. The two formulated indicators measure the population-weighted annual mean concentration, in μg/m^3, of particulate matter – PM10 and PM2.5 – at urban background stations in agglomerations.[14] The WHO guideline value for PM2.5 is to reduce its concentration to 10 μg/m^3 in 2020.

The choice of indicators does not cover the ability to measure the achievement of all 13 formulated targets. For instance, instead of indicators of maternal and neonatal mortality, EUROSTAT measures life expectancy at birth. Neither indicator measures how much effort is made to prevent narcotic drug and alcohol abuse; only smoking prevalence is considered. Universal health coverage is represented by the self-reported indicator of unmet needs for medical examination and care. The types of pollution considered are air pollution by particulate matters and the subjective perception of noise.

Main trends observed in the indices of Goal 3: Ensure healthy lives and promote well-being for all at all ages

Life expectancy continuously increased from 77.7 in 2002 to 81 years in 2016. In 2017, it decreased slightly to 80.9 years – see Fig. 1. An interesting indicator is SDG3.20, which monitors subjective perceptions of good health. It shows that starting in 2015, EU citizens each year feel better. Other indicators show that exposure to unhealthy lifestyles in the EU is, in general, decreasing. A worrying problem is exposure to air pollution – as shown in Fig. 3 and Fig. 4 for PM10 and PM2.5, respectively. For PM2.5, it increased in 2017 to 14.1 μg/m^3 from 13.8 μg/m^3 observed in 2016 – the WHO goal to reduce this value below 10 μg/m^3 seems to be unachievable.

12 DG MOVE – The European Commission's Directorate-General for Mobility and Transport.

13 EEA – European Environment Agency.

14 "Fine and coarse particulates (PM10), i.e. particulates whose diameters are less than 10 micrometers, can be carried deep into the lungs where they can cause inflammation and exacerbate the condition of people suffering heart and lung diseases. Fine particulates PM2.5 are those whose diameters are less than 2.5 micrometers. They are therefore a subset of the PM10 particles. Their deleterious health impacts are more serious than PM10 as they can be drawn further into the lungs and may be more toxic."

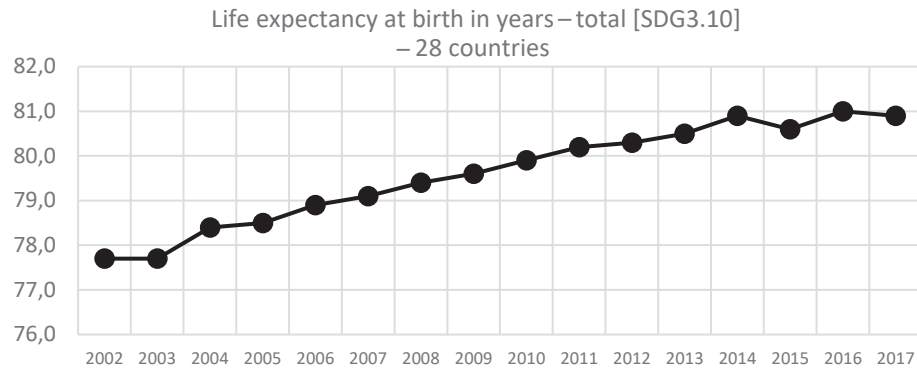

Figure 1. Life expectancy at birth in years – the mean values for 28 European countries
Source: own calculations based on data from https://ec.europa.eu/eurostat/web/sdi/main-tables (accessed: 31.08.2019)

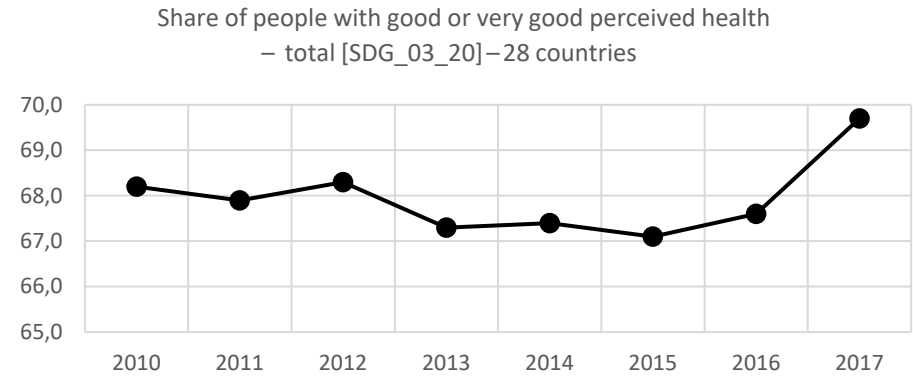

Figure 2. Share of people with good or very good perceived health – the mean values for 28 European countries
Source: own calculations based on data from https://ec.europa.eu/eurostat/web/sdi/main-tables (accessed: 31.08.2019)

In Table 1, we present elements of the statistical analysis of the cross-sectional data presented in EUROSTAT for the 28 EU countries in 2017, i.e., the quartiles and quartile deviations, which characterize the diversity of European countries (for the indicators SDG 3.40 and 3.41, the latest observations were for 2016). The highest level of dispersion was observed for SDG 3.60 *Self-reported unmet need for medical examination and care* – this indicator reflects the subjective perception of respondents and is affected by differences in the organization of health services in EU countries. The lowest relative dispersion was observed for SDG 3.10 – *Life expectancy at birth*. It means that most EU countries do not differ much, taking into account this characteristic. We also checked correlations among the indicators. We found that the Pearson correlation coefficient between SDG3.10 and SDG3.40 (death rate due to chronic diseases) was -0.96, so the criteria are strongly linearly correlated.

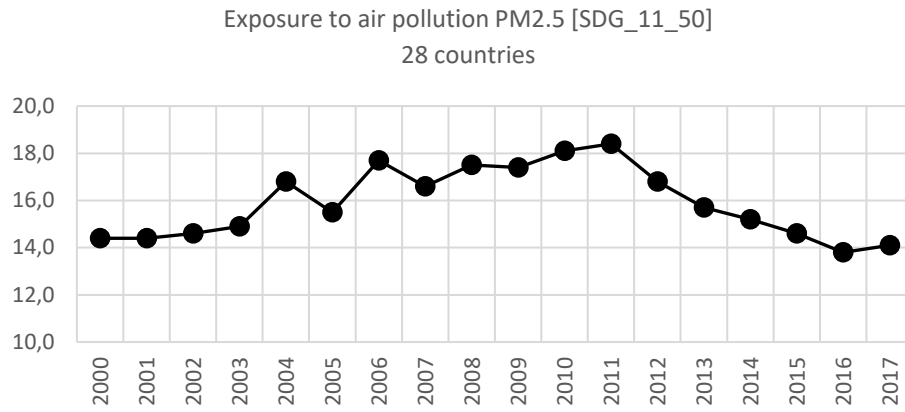

Figure 3. Exposure to air pollution PM2.5 (diameters less than 2.5 micrometers) – the mean values for 28 European countries
Source: own calculations based on data from https://ec.europa.eu/eurostat/web/sdi/main-tables (accessed: 31.08.2019).

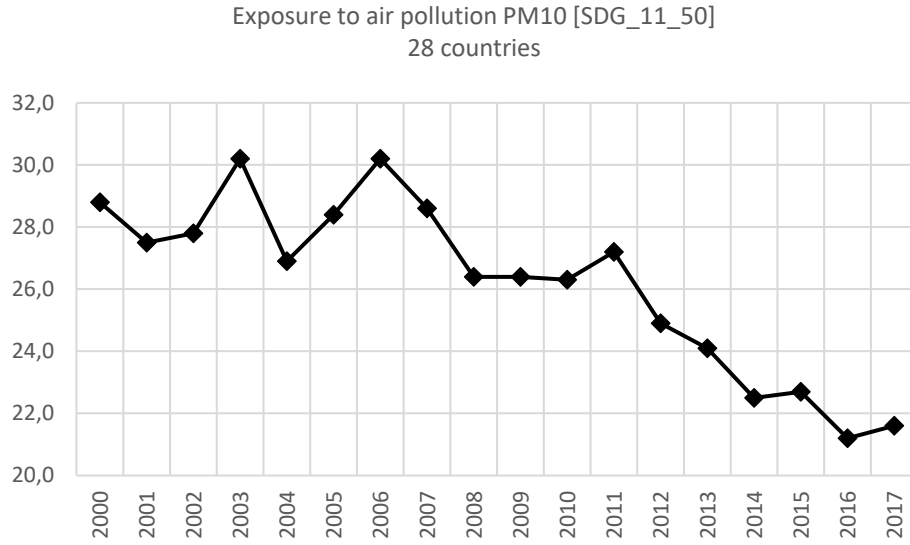

Figure 4. Exposure to air pollution PM10 (diameter less than 10 micrometers) – the mean values for 28 European countries
Source: own calculations based on data from https://ec.europa.eu/eurostat/web/sdi/main-tables (accessed: 31.08.2019).

Table 1. Statistical characteristics of the Goal 3 indices

Index	European Union – 28 countries mean	min	Q1	Median	Q3	max	Quartile deviation	Relative quartile deviation
sdg3.10	**80.9**	74.8	78.0	81.4	82.1	83.4	2.1	2.6%
sdg3.20	**69.7**	43.9	61.7	70.3	74.4	83.3	6.4	9.1%
sdg3.30	**26**	7.0	20.8	26.5	29.0	37.0	4.1	15.6%
sdg3.40	**119**	78.7	98.8	112.7	159.3	243.7	30.3	26.9%
sdg3.41	**2.6**	0.7	1.2	1.8	3.1	10.5	1.0	54.2%
sdg3.60	**1.7**	0.1	0.9	1.7	3.3	11.8	1.2	71.3%
sdg2.10	**52**	44.9	50.0	55.3	57.0	62.9	3.5	6.4%
sdg8.60	**1.68**	0.5	0.9	1.9	2.6	4.5	0.8	42.2%
sdg11.20	**17.5**	8.2	12.5	15.3	18.9	26.1	3.2	21.0%
sdg11.40	**4.9**	2.5	3.9	5.2	6.5	10.0	1.3	25.5%
sdg11.50a	**21.6**	10.0	17.3	20.4	26.1	37.3	4.4	21.6%
sdg11.50b	**14.1**	4.9	11.2	12.9	19.0	23.8	3.9	30.2%

Source: own calculations; data from https://ec.europa.eu/eurostat/web/sdi/main-tables (accessed: 31.08.2019)

Considering the desirable direction of change for different indicators, we prepared a uni-criteria ranking of EU countries based on data from 2017. These rankings for 12 criteria are presented in Table 2. The rankings are rated from best to worst, with 1 being the best.

In 2017, life expectancy was the longest in Spain and Italy, at over 83 years. In France, Sweden, Malta, Ireland, Cyprus, and Luxembourg, life expectancy was over 82 years, although it differs between sexes. For Poland, Slovakia, Hungary, Lithuania, Romania, Latvia, and Bulgaria, the statistics show life expectancy below 78 years.

Another index, which expresses the subjective feeling of good health, shows that the best comfort is expressed by citizens of Ireland, Cyprus, Italy, Sweden, and the Netherlands. In the case of Portugal, Latvia, and Lithuania, fewer than 50% of citizens presented such an opinion.

The lowest smoking prevalence was in Sweden (only 7% in total). In contrast, more than 30% of the population over 15 years smoked in Latvia, Croatia, Bulgaria, France, and Greece.

The death rate due to chronic diseases before 65 is the highest for Latvia (10.5 per 100,000), Lithuania, Romania, and Portugal. In other European countries, it is much better. Meanwhile, there were over 200 deaths per 100,000 people from tuberculosis, HIV, and hepatitis in Latvia, Lithuania, Romania, and Hungary. The self-reported, subjective indicator of unmet needs for medical care shows that in Spain, the Netherlands, Malta, Austria, Germany, Luxembourg, and Czechia citizens are content with the medical care they receive – their needs are almost satisfied (only below 1% report unmet needs). More than 10% of the population in Greece and Estonia had problems getting help from the country's medical system.

The share of obese and pre-obese people over 18 exceeds 60% of the population in Croatia, Finland, Malta, Czechia, and Romania. In all other countries, it is higher than 40%.

The number of people dying in road accidents was highest in Latvia, Poland, Croatia, Bulgaria, and Romania – more than 7 deaths per 100,000 people.

Finally, considering air pollution, extremely high pollution by particulates <2.5 (greater than 20 μg/m^3) was observed for Romania, Hungary, Bulgaria, and Poland.

Table 2. Rankings of the EU countries for Goal 3 individual criteria

Country	Index											
	sdg3.10	sdg3.20	sdg3.30	sdg3.40	sdg3.41	sdg3.60	sdg2.10	sdg8.60	sdg11.20	sdg11.40	sdg11.50a	sdg11.50b
Austria	10	14	17	12	20	3	8	21	20	12	11	15
Belgium	12	8	3	8	6	16	5	11	15	16	14	13
Bulgaria	28	18	26	24	16	16	23	27	4	27	26	24
Croatia	21	22	25	22	22	14	24	22	2	26	25	19
Cyprus	6	2	17	2	13	12	12	2	17	20	22	16
Czechia	19	21	21	19	4	7	27	12	12	16	17	18
Denmark	17	11	3	13	8	8	4	7	21	3	5	5
Estonia	20	25	9	21	24	28	16	9	1	6	2	2
Finland	10	15	7	9	1	24	25	8	7	11	1	1
France	3	16	26	11	15	8	2	23	16	15	10	9
Germany	17	19	11	14	13	5	10	5	28	7	8	12
Greece	14	10	28	18	12	27	20	10	23	22	–	–
Hungary	24	23	15	28	18	8	19	18	5	21	20	23
Ireland	6	1	3	6	8	20	22	14	3	5	3	4
Italy	2	3	11	3	23	15	1	19	7	18	22	20
Latvia	27	27	24	25	28	26	21	20	13	24	7	14
Lithuania	25	28	21	26	27	12	18	25	10	22	16	–
Luxembourg	8	12	8	4	6	5	6	23	24	10	13	7
Malta	5	6	10	10	17	3	26	1	26	9	–	–
Netherlands	9	5	3	7	1	1	3	3	27	4	11	8
Poland	22	24	23	20	18	21	15	16	6	25	24	24
Portugal	12	26	13	17	25	18	13	26	25	19	9	9
Romania	26	13	17	27	26	25	28	28	22	28	21	22
Slovakia	23	17	13	23	8	19	14	16	9	14	18	17
Slovenia	16	20	17	16	3	23	11	13	11	13	19	21
Spain	1	9	15	4	21	1	9	15	14	8	15	11
Sweden	4	4	1	1	5	11	7	6	17	1	4	3
UK	15	7	2	15	8	21	16	4	19	2	6	6

Source: own calculations; data from https://ec.europa.eu/eurostat/web/sdi/main-tables (accessed: 31.08.2019).

Multi-criteria rankings of EU countries – Goal 3

The values of the indicators for each of the N EU countries taken into account (N in our research was equal to 28 or 25, depending on data availability) were first normalized in the following way:

– For each of the component indices $f^{(k)}$,$k = 1,\ldots,K$ the range of values were calculated:

$$R\left(f^{(k)}\right) = \max_i f_i^{(k)} - \min_i f_i^{(k)},\ i = 1,\ldots,N. \tag{1}$$

– If the lowest value of the index was "the best," then the data were transformed in the following way:

$$f_i^{'(k)} = \frac{\max_i f_i^{(k)} - f_i^{(k)}}{R\left(f^{(k)}\right)}. \tag{2}$$

– If the highest value of the index was "the best," then data were transformed in the following way:

$$f_i^{'(k)} = \frac{f_i^{(k)} - \min_i f_i^{(k)}}{R\left(f^{(k)}\right)}. \tag{3}$$

– After normalization, all transformed component indicators were expressed as ascending variables, i.e., higher values denoted better performance, 1 – for the best case, 0 – for the worst.
– In the next step, the component indicators needed to be weighted and aggregated. The rule was to choose equal weights w_k for individual indicators[15], except for the SDG11.50a and SDG11.50b indicators, as they both measure the achievement of the same goal – air pollution. Finally, in the case of 12 criteria, ten indicators were weighted by 1/11 and 2 of them (SDG11.50a and SDG11.50b) by 1/22.
– The multi-criteria indicator of performance, a composite indicator, was defined as the synthetic variable being the weighted average of component indices[16]:

15 Component weighting is an especially difficult issue, and related in part to the high correlations between component variables. As it is probably impossible to achieve agreement on what the weights should be the simplest choice, equal weights seems to be the best.

16 Multi-criteria index is treated as a linear function of the component indices.

$$Q_i = \sum_{k=1}^{K} w_k f_i^{'(k)}, \; i = 1,\ldots,N. \tag{4}$$

In the 1st ranking, we excluded indicators measuring air pollution – SDG11.50 – as data for Greece, Lithuania, and Malta were not available in full. Finally, ten criteria were taken into account, and the ranking was prepared for 28 EU countries.

In the 2nd ranking, we excluded Greece, Lithuania, and Malta. Twelve criteria were taken into account, and the ranking was done for 25 EU countries.

Normalization we have used changed the sign of the highest in absolute value correlation coefficient equal -0,96 to positive.

We compared our results to the Sachs' group results on global SDG for Goal 3. Their group methodology differs, as first of all, they took into account different criteria:

- Maternal mortality rate (per 100,000 live births)[17],
- Neonatal mortality rate (per 1,000 live births)[18],
- Mortality rate under-5 (per 1,000 live births)[19],
- Incidence of tuberculosis (per 100,000 people),
- HIV prevalence (per 1,000 population),
- Age-standardized death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations age 30–70 years (per 100,000 people),
- Age-standardized death rate attributable to household air pollution and ambient air pollution (per 100,000 people), source: WHO (2018), year of reference 2012,
- Traffic deaths rate (per 100,000 people),
- Healthy life expectancy at birth (years),
- Adolescent fertility rate (births per 1,000 women aged 15–19),
- Births attended by skilled health personnel (%),
- Surviving infants who have received 2 WHO-recommended vaccines (diphtheria DTP and measles) (%),
- Universal Health Coverage Tracer Index (0–100)[20],
- Subjective well-being (average ladder score, 0–10)[21],

17 The estimated number of women between the age of 15–49 who die from pregnancy-related causes while pregnant, or within 42 days of terminating a pregnancy. Reported source of data: WHO (2018).

18 The number of newborn infants who die before reaching 28 days of age, per 1,000 live births. Reported source of data: UNICEF (2018).

19 The probability that a newborn baby will die before reaching age five. Reported source of data: UNICEF (2018).

20 Coverage of essential health services, as defined by 9 tracer interventions and risk-standardized death rates from 32 causes amenable to personal healthcare. Reported source of data: IMHE (2016) – Institute for Health Metrics and Evaluation.

21 Subjective self-evaluation of life, where respondents are asked to evaluate where they feel they stand on a ladder, where 0 represents the worst possible life and 10 the best possible life. Reported source of data: Gallup World Poll (2018)

– Gap in life expectancy at birth among regions (years) (OECD Member States)[22],
– Gap in self-reported health by income (0–100) (OECD Member States)[23],
– Daily smokers (% population age 15+) (OECD Member States).

The second point of difference between our approach and that of Sachs is the treatment of missing data. Constructing their SDG index for Goal 3, in the case of missing data, they used an available data closest in time or used an average value for neighboring countries (Lafortune et al. 2018). The authors checked correlations between goals and also across indicators within goals. They found no signs of collinearities between goals. Nevertheless, they found four cases of the Pearson correlation coefficient exceeding 0.9 among indices of Goal 3. These are found between:

– Maternal mortality rate (per 100,000 live births) & Mortality rate, under-5 (per 1,000 live births),
– Neonatal mortality rate (per 1,000 live births) & Mortality rate, under-5 (per 1,000 live births),
– Maternal mortality rate (per 100,000 live births) & Healthy Life Expectancy at birth (years),
– Healthy Life Expectancy at birth (years) & Mortality rate, under-5 (per 1,000 live births).

The arguments given by authors for not removing highly correlated variables from the construction of the indicator for Goal 3 were the following: "(i) we want to present as much data as possible, and each indicator has distinct policy implications, (ii) the purpose of the SDG Index is not to model SDG achievement, but to track progress, (iii) each indicator is supported by one or more expert communities" (Lafortune et al. 2018, p. 25). We share these arguments in this work. The data used to develop Sachs' global SDG Index were censored at the bottom 2.5 percentile before being normalized. After normalization, the value of 0 denotes the worst performance and 100 describes the technical optimum, where the level of the technical optimum depends on SDG targets formulated eventually or the average of the top 5 performers (Lafortune et al. 2018, p. 11). The aggregation for the Sachs SDG Index is done in two steps[24]: normalized variables are combined for each SDG and then aggregated across goals using the standard constant-elasticity of substitution (CES) function. For our purposes, we used the published results for the Goal 3 sub-index (Sachs et al. 2018) for EU countries presented in Table 3.

22 Difference between maximum and minimum life expectancy at birth among different regions of the country.

23 Difference between self-reported health status by income level between first and fifth quintile.

24 Sachs et al. (2017, pp. 44–46).

Table 3. Multi-criteria rankings of EU countries – Goal 3

Country	synthetic variable in 1st ranking	position in 1st ranking	synthetic variable in 2nd ranking	position in 2nd ranking	Sachs' score	Sachs' ranking
Austria	0.675694	**12**	0.667036	**14**	93.7	**9**
Belgium	0.75212	**6**	0.738126	**6**	93.1	**11**
Bulgaria	0.401247	**25**	0.362005	**23**	80.1	**28**
Croatia	0.475063	**24**	0.444714	**22**	86.1	**23**
Cyprus	0.735959	**9**	0.704164	**11**	91.5	**17**
Czechia	0.583359	**18**	0.564316	**17**	91.6	**16**
Denmark	0.778628	**4**	0.779618	**4**	95.1	**5**
Estonia	0.514865	**20**	0.556638	**18**	88.7	**20**
Finland	0.710317	**11**	0.736887	**7**	96.5	**2**
France	0.672547	**13**	0.667674	**12**	92.9	**12**
Germany	0.668779	**15**	0.667293	**13**	94.1	**7**
Greece	0.52752	**19**	–	–	89.2	**19**
Hungary	0.489703	**23**	0.468898	**21**	85.6	**24**
Ireland	0.788836	**3**	0.79889	**2**	94.5	**6**
Italy	0.754382	**5**	0.709103	**9**	92.4	**13**
Latvia	0.277151	**27**	0.307776	**24**	84.2	**26**
Lithuania	0.356025	**26**	–	–	85.3	**25**
Luxembourg	0.71311	**10**	0.706108	**10**	95.3	**4**
Malta	0.668834	**14**	–	–	92.0	**14**
Netherlands	0.79151	**2**	0.780372	**3**	95.4	**3**
Poland	0.513932	**21**	0.474144	**20**	87.7	**21**
Portugal	0.495464	**22**	0.508636	**19**	90.9	**18**
Romania	0.251356	**28**	0.252084	**25**	81.3	**27**
Slovakia	0.584522	**17**	0.567351	**16**	87.5	**22**
Slovenia	0.668134	**16**	0.636908	**15**	91.8	**15**
Spain	0.742381	**7**	0.727702	**8**	93.8	**8**
Sweden	0.870838	**1**	0.880102	**1**	96.7	**1**
UK	0.739549	**8**	0.742292	**5**	93.3	**10**

Source: 1st and 2nd rankings results: own calculations. The results for Sachs' score and ranking are presented for comparison following Sachs et al. (2018).

We found that correlation between the synthetic variable in our 1st ranking (without the two indices of air-pollution I11) with Sachs' score is high – the Pearson correlation coefficient is equal to 0.9122. Sweden has the best position in all rankings, followed by the Netherlands, Denmark, and Ireland. Comparing our two rankings with Sachs' score, we found that it ranks Finland much higher, in 2nd place. The final positions in our rankings are occupied by Eastern European countries: Romania, Latvia, Lithuania, and Bulgaria. In the group second from the end of the list, we can find other Eastern European countries, as well as Portugal and Greece.

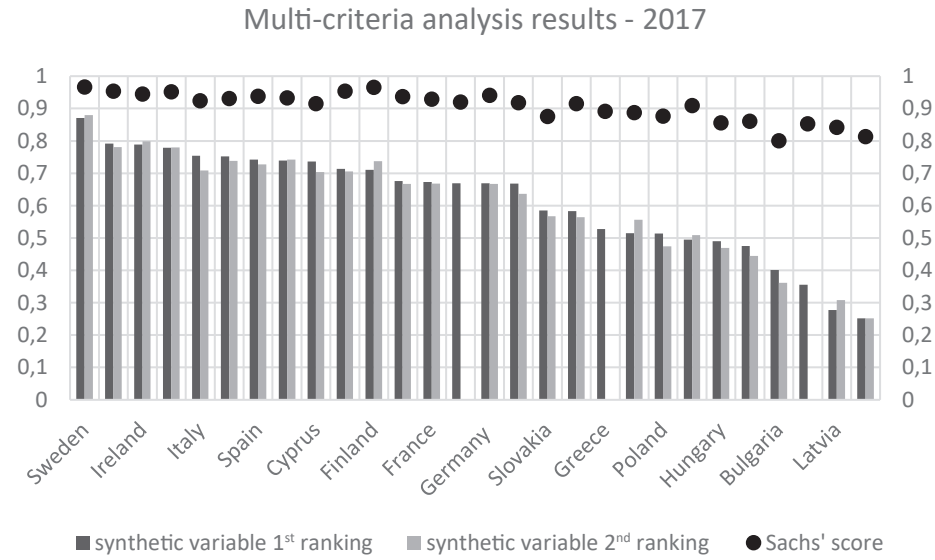

Figure 5. Multi-criteria analysis results for 28 EU countries for Goal 3: synthetic variables for the rankings 1st, 2nd, and also Sachs' score values divided by 100. The ordering of countries is based on descending values of the synthetic variable for the 1st ranking.
Source: own calculations.

Conclusions

Our research aimed to compare the situation in European Union countries from the point of view of how far they are from the targets of the 2030 Agenda for Sustainable Development formulated for Goal 3 – Ensure healthy lives and promote well-being for all at all ages. The data and choice of indices we used were taken from the EUROSTAT database. The main result of the multi-criteria analysis is that the closest to these targets are Sweden, the Netherlands, Ireland, and Denmark. The worst are Romania, Latvia, Lithuania, and Bulgaria. The group of countries second from bottom contains Poland, Portugal, and Hungary, while the situation in Estonia and Greece is slightly better.

The optimistic conclusion from our research is the increasing life expectancy in EU countries; in 2017, it was 81.6 years. Nevertheless, recently we have observed that the rate of this increase is declining. The share of the population with good health is at a moderate level – 70%. We observe very high diversification of countries regarding unmet needs for medical examinations and care – the quartile deviation is 71.3%. It is the symptom of many unsolved systemic problems in health care organizations. The data about air pollution are worrying, and achieving the Agenda targets in this area are at risk.

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Streszczenie

Realizacja celu zrównoważonego rozwoju: „Dobre zdrowie i jakość życia" w krajach Unii Europejskiej w roku 2017

We wrześniu 2015 r., Zgromadzenie Narodowe ONZ przyjęło dokument: "Przekształcanie naszego świata: Agenda na Rzecz Zrównoważonego Rozwoju – 2030". Zawarto w nim 17 Celów Zrównoważonego Rozwoju (SDGs). Jednym z nich jest Cel 3., zdefiniowany w następujący sposób: Zapewnić zdrowe życie oraz promować dobrobyt dla wszystkich ludzi w każdym wieku. W niniejszej pracy przeanalizowano

12 wskaźników proponowanych przez EUROSTAT dla celów pomiaru poziomu realizacji tego celu. Pokazano dynamikę wartości wskaźników dla Unii Europejskiej na przestrzeni lat 2002–2017. Przeprowadzono porównania dla 28 krajów Unii Europejskiej dla roku 2017 wykorzystując metody jedno- i wielowymiarowej analizy statystycznej. Zaprezentowano rankingi pokazujące różną sytuację krajów Unii Europejskiej na drodze do osiągnięcia zdrowego życia i dobrobytu swoich obywateli. Wyniki zostały porównane z sub-indeksem globalnym SDG dla Celu 3., opracowanym przez Sachs i in. (2018).

Słowa kluczowe: cele zrównoważonego rozwoju, SDG, rankingi wielokryterialne, zdrowie i dobrobyt

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Sustainability Reporting Practices in the Healthcare Products Sector – the Case of Europe and North America

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Abstract

The Paper's goals: For the last two decades, sustainability reporting has increasingly been gaining the attention of managers, and consequently, academicians, too. This is due to the growing interest of a wide range of stakeholders, such as governments, investors, and customers, in non-financial information disclosed by business and public organisations. However, designing and implementing a sustainability report that fits the needs of these different stakeholder groups is a challenge. The differences between the various sectors make this challenge even greater. The focus of this paper will be on the healthcare products sector. The aim of this paper is to investigate the scope and quality of sustainability reporting practices of companies operating in the European and North American healthcare products sector. Research methods: The study is based on the current literature on sustainability reporting and non-financial (NFI) reporting. The empirical part of the paper will be based on a qualitative descriptive research design. Content analysis will be conducted on sustainability reports issued in 2018 and 2019, by 11 European and 8 North American organisations in the healthcare products sector. The nature of the study will be descriptive and based solely on information from secondary data sources. Expected results of the research: This paper will contribute to the international health management literature and to the existing research of sustainability reporting. Based on the findings, the health sector's sustainability reporting practices will be carefully identified. The authors will also compare the practices of North American and European organisations', and subsequently, they will define the trends and best practices in this field.

Keywords: sustainability reporting, CSR reporting, non-financial reporting, GRI, health sector, content analysis

JEL: M14, M42

Introduction

As reflected by Allen White, founder and co-chair of the Global Initiative for Sustainability Ratings, "in the late 1990s, corporate sustainability reporting was virtually unknown. However, in little more than a decade, it has evolved from the extraordinary to the exceptional to the expected. By the standards of major innovations in business practices, it ranks among the most remarkable in recent years" (White 2013). Sustainability reporting has been gaining in terms of increasing attention among academics and business practitioners, for over two decades. This attention is fuelled by the dynamically growing needs of stakeholders, especially customers, investors, business partners, employees, and local communities. Companies wishing to answer those needs develop a wide range of sustainable activities and report on them, following numerous and standards and guidelines that grow more complex every year. However, the scope of the reported issues and the quality of reporting vary between firms and industries.

Seeing the potential in the sustainability concept and sustainability reporting, Fabrizio Russo (2016) expressed a collective wish to have an interest in healthcare in the future, especially if it is able to improve and diffuse an ethic of work. As highlighted by Senay and Landrigan (2018, e180975), "There is natural synergy between the mission of health care delivery, sustainability, and CSR activities. All seek to improve human well-being, the health care enterprise directly through the provision of medical care, sustainability by improving the environment, and CSR, by including efforts to improve the social welfare of employees, consumers, and communities." However, the advancement of sustainability reporting of the healthcare industry is just beginning to attract the attention of researchers. So far, only a small number of research papers have been published. Thus, the aim of this paper is to investigate the scope and quality of sustainability reporting practices of companies operating in the European and North American healthcare products sector.

Literature review

According to the Global Reporting Initiative (GRI 2018), a sustainability report is a document published from within an organisation about the economic, environmental, and social impacts caused by its everyday operations (whether positive or negative). It aims to help organisations measure, understand, and communicate their economic, environmental, and social performance, and to manage change more effectively. Sustainability reporting is the first, but critical step, in implementing a strategy that reveals an organisation's impact on its stakeholders, and possible ways to mitigate a negative impact on the economy, society, and the environment. In other words, a sustainability report is the link between an organisation's strategy and its commitment to a sustainable global economy. However, reporting on business sustainability

in a way that fits the needs of diverse stakeholder groups is still a challenge (Freundlieb & Teuteberg 2012).

Sustainability reports are published under a number of different names, including social reports, corporate social responsibility reports, social and community reports, corporate social disclosure (CSD), corporate environmental reporting (CER), triple bottom line (TBL) reporting, and many others (see, e.g., Kolk 2010; Owen et al. 2001; Buniamin and Ahmad 2015). Together with the variety of the sustainability report names comes a range palette of reporting standards, which have been developed to provide guidance on what and how to report. Examples include the Global Reporting Initiative (GRI) guidelines, the UN Global Compact Communication on Progress, the AA1000 Standard, ISO 26000 – International Standard for Social Responsibility, OECD Guidelines for Multinational Enterprises, CERES Principles, the ESG Framework, The United Nations Global Compact (UNGC), International Finance Corporation (IFC) principles, and many others. More and more companies are also adopting Sustainable Development Goals (SDGs). From those mentioned above, the GRI Sustainability Reporting Guidelines are currently the set used most by many organisations around the world. According to the GRI (2018), 74% of the world's 250 largest companies report using their standards.

According to José and Lee's (2007) research on sustainability, reporting can be divided into four different streams. The first stream of research addresses the content of the sustainability reports (e.g. José and Lee 2007). The second stream investigates the corporate characteristics of the reporting companies (e.g. Wanderley et al. 2008). The third stream analyses the reporting medium (e.g. Tench & Jones 2015). The fourth stream considers the relationship between sustainability performance and sustainability reporting (e.g. Clarkson et al. 2008). This paper can be placed in the first stream, as the content of sustainability reports is examined by focusing on the reporting scope and quality.

The health care industry is one of the largest and fastest-growing economic sectors, both in Europe and the United States. The European healthcare market is expected to exceed more than US$ 224 billion by 2022. The USA market represented 17.7% of GDP in 2015, with projections to reach 20% by 2025. Global healthcare spending is projected to increase at an annual rate of 5.4% in the period 2018–2022, a considerable rise from 2.9% in the years 2013–2017 (MRE 2018). This growth dynamic reflects the expansion of healthcare coverage in developing markets, the growing care needs of elderly populations, advances in treatments and health technologies, and rising health care labour costs (Deloitte 2018). It also reflects the potential of the sector in reaching the SDGs.

Healthcare organisations are now among the largest corporations, and they generate enormous revenues. For example, the Hospital Corporation of America Holdings, the largest for-profit health system in the United States, had more than $44 billion in revenue in 2016 and was ranked 63rd on the Fortune 500. Kaiser Permanente, the nation's largest non-profit health system, generated more than $64 billion in rev-

enue in 2016. If the organisation had been eligible for the Fortune 500 list, it would have ranked 39th, ahead of Pepsi and Disney (Senay and Landrigan 2018). This scale of business situates them as key actors of the global sustainability strategy development and implementation. The last two decades proved that it is not the legal acts, but voluntary practices that are the most successful in making individual companies and whole industries more sustainable.

The healthcare products' sector represents a part of healthcare that is focused on the development and implementation of innovative medical products. Companies in the sector are pharmaceutical, medical device, and diagnostic device producers. The medical device and diagnostic part of the sector includes more than 20,000 companies worldwide. The biopharmaceutical part of the sector is much more consolidated, with 200 pharmaceutical companies, 400 publicly traded biotechnology companies, and 1,400 privately held biotechnology companies worldwide. As stated by Peter Juhn (2009), the healthcare product sector, as the supplier of healthcare products, can add far more value to healthcare delivery, and the appropriate use of medications and devices, than has yet been realised. The sector has demonstrated broad experience in the development of evidence on the safety and efficacy of medications and devices, and it has been involved in the promotion of the safe and effective use of therapeutics. However, this experience should be used in a much broader and more effective way.

Having said that, knowledge of the healthcare industry's sustainability practices is very limited and fragmented (Blowfield and Frynas 2005; Hopkins 2007; Russo 2016). A number of papers focused on pharmaceutical companies and their respect for human rights (Gruskin and Raad 2010; Ritter 2010). Others focused on evaluating specific sustainability activities (Leisinger 2005), and the creation of economic opportunity (Mahmud and Parkhurst 2007). However, there is a research gap regarding the helicopter view of the sectors' current sustainability practices, from the perspective of scope and quality. Thus, this paper aims to fill this gap and build the foundation for further issue-focused research and research that employs the stakeholders' perspective.

Research methodology

Sample

To develop a fair analysis of the sustainability practices of the healthcare products' sector, the authors have focused on Europe and North America – the two most advanced regions of the world in terms of sustainability reporting. The authors' intention was to present a "snapshot" of the current sustainability reporting practices of the healthcare products' sector. The sample includes 11 European and 8 North American companies that registered sustainability reports in the GRI database in 2018 and 2019 (for the period 1st of January, 2017, to 31st of December, 2018), as the sample should be comparable to allow for a fair assessment of the disclosed information. The GRI database

was chosen as GRI is the most commonly used sustainability reporting framework (Ernst & Young 2016). The sample company reports had to meet the following criteria to be included in the further study: (1) the report must be provided in English or Polish (as both researchers are Polish native speakers), and (2) the report must be for the period 1st January 2017 to 31st December 2018.

Among the registered reports of the sample organisations, the year of the first report's publication varies. In the case of the North American sample, the earliest date of publication is 2014 (Biogen Idec and Johnson & Johnson), and in the case of the European sample, it is 2004 (Novartis). It suggests that for the analysed sector, sustainability reporting is a relatively new practice. Over 70% of the sample companies explicitly referred to the UN's Sustainable Development Goals (SDGs) in the report, while over 40% referred to the UNGDC and CDP standards, and 24% to ISO 26000 and the OECD standards. One sample company referred to the IFC standard. More than half (52%) of the sample reports contained External Assurance.

Methodology

The paper is based on content analysis, which is regarded as "the research method that is most commonly used to assess organisations' social and environmental disclosures" (Milne and Adler 1999, p. 237). According to Krippendorff (2013, p. 24), *content analysis* is "a research technique for making replicable and valid inferences from *texts* (or *other* meaningful matter) to the contexts of their *use*." The authors have chosen this methodology as it allows one to analyse data qualitatively, and at the same time, quantify the data (Gbrich 2007). The primary aim of content analysis is to describe the phenomenon in a conceptual form (Elo & Kyngäs 2008); thus, it requires a well-defined process of data analysis that includes the following stages (Elo & Kyngäs 2008, p. 110):

- Preparation: Being immersed in the data and obtaining the sense of the whole, selecting the unit of analysis, and deciding on the analysis of manifest or latent content.
- Organising: Open coding and creating categories, grouping codes under higher-order headings, formulating a general description of the research topic through the generation of categories and sub-categories as abstracting.
- Reporting: Reporting the analysing process and the results through models, conceptual systems, conceptual maps or categories, and a storyline.

In the case of our research, the data analysis process was performed by two researchers. In the Preparation stage, all sustainability reports of the sample companies registered in the GRI database were collected. Further, the researchers immersed themselves in the collected data, and the major categories of analysis were decided. As noted by Gray et al. (1995), there are four major categories for CSR: marketplace (consumers, creditors); workplace, (employees); community, and environment. At the preparation stage, those basic categories were redefined to become the following categories: customers/patients, employees, community, and environment.

As noticed by Beattie et al. (2004), content analysis offers researchers the choice between the "index" studies (to check for the presence or absence of specific items of information, but it may also incorporate ordinal measures to allow for the quality of the specific disclosure to be assessed) and "amount-volume" studies (to check for the overall volume of the disclosure, most frequently by counting words, sentences, or proportions of an A4 page). In the case of this paper, the index approach was much more suitable from the perspective of the research aim.

In index studies, a simple binary coding scheme is frequently used (where a score of 1 or 0 in the presence or absence of the item is respectively attributed). However, other coding schemes incorporate ordinal measures to allow for the quality of the specific disclosure to be assessed (Beattie et al. 2004). This research adapts Wiseman's (1982) four-level index:

- a score of three (3) is given if a particular item is disclosed and described in monetary or quantitative terms,
- a score of two (2) is assigned to disclosed items with specific information but in non-quantitative terms,
- a score of one (1) is given for items mentioned in general terms only, and,
- a score zero (0) is given if the item is not disclosed.

At the organising stage, the list of issues under each of the four major categories was defined. The researchers read the reports, independently, several times, and listed all themes covered by each previously defined category. The themes were then clustered into issues. The differences in the coding were discussed systematically in order to deliver one final result for analysis. Finally, 25 issues grouped into four major categories, were used to measure the scope and quality of sustainability reporting of the sample of companies. The assessment of each company from the perspective of the defined issues and major categories was conducted. The quality of reporting on the defined issues and categories in the sector was also assessed. All discrepancies between the researchers were discussed, and the agreed assessments are presented in the next section of the paper (the reporting stage).

Results and discussion

During the preparation stage, four basic sustainability reporting categories were developed, namely: customers/patients, employees, community, and environment. The presentation of the results and the subsequent discussion will also be structured that way.

Reporting of customer issues by the healthcare products' sector

When studying the reporting of customer issues in the healthcare products sector, it should be noted that the quality was high, and the scope of the reporting was wide (Tables 1a and 1b). In the case of the European sample, most of the analysed reports

presented in detail, and in high quality on the high standards of products, customer data safety, and compliance (all with a score of 2.4). Also, customer satisfaction and dialogue on customer issues were well presented (2.2 and 2.3, respectively). Only reporting on access to healthcare products by disadvantaged customers was assessed poorly. This severely weakens the reports as access to the medicine, medical technologies, and other healthcare products is a basic human right, but severely limited by the economic conditions and other demographic factors of the current global society. From the reporting organisations' perspective, the average scores ranged from 0.8 to 3.0.

In the case of the North American sample, the scope and quality of the reporting is also well assessed, and ranges from 2.0 in the case of customer satisfaction issues, to 2.9 in the case of the quality of products. Since many of the chemicals used are classified as hazardous substances and mixtures, companies must ensure that they pose no risk to people or the environment. Thus, they report on compliance with an array of national and international regulatory requirements, statutes, and guidelines, an approach that is crucial to the sectors' business activities. Also, reporting on disadvantaged customers' access to healthcare products is assessed positively. Johnson & Johnson, for example, reported on membership in the Access Accelerated partnership, which brings together a broad group of stakeholders, including the World Bank, the Union for International Cancer Control, and pharmaceutical companies. They have a shared vision of working toward the UN's Sustainable Development Goal target to reduce premature deaths from non-communicable diseases by one third by 2030. The initiative will focus on access to primary healthcare, as well as financing, regulatory, and service barriers. From the reporting organisations' perspective, the average scores ranged from 1.3 to 3.0.

Table 1a. Customer issues reporting by European companies in the healthcare products' sector

Issue	ConvaTec	Drägerwerk AG & Co. KGaA	Fresenius Medical Care	Hovione	Krka	Lonza	Merck	Novartis	OPHARDT Hygiene Group	PCC Exol SA	Sonova	AVERAGE
Dialogue with customers	3	3	3	1	3	2	3	1	1	3	2	**2.3**
Customer satisfaction	2	3	3	1	3	2	3	1	1	3	2	**2.2**
Quality of products	3	3	2	1	3	2	3	3	1	3	2	**2.4**
Customer data safety	3	3	2	1	3	2	3	3	0	3	2	**2.4**
Compliance	2	2	2	2	3	2	3	3	1	3	3	**2.4**

Table 1a. (continued)

Issue	ConvaTec	Drägerwerk AG & Co. KGaA	Fresenius Medical Care	Hovione	Krka	Lonza	Merck	Novartis	OPHARDT Hygiene Group	PCC Exol SA	Sonova	AVERAGE
Access to healthcare products by disadvantaged customers	3	1	1	1	1	1	3	3	1	2	1	**1.6**
AVERAGE	**2.7**	**2.5**	**2.2**	**1.2**	**2.7**	**1.8**	**3.0**	**2.3**	**0.8**	**2.8**	**2.2**	**2.2**

Source: own studies (A four-level index: quantitative disclosure = 3, non-quantitative disclosure = 2, general disclosure = 1, disclosure absent = 0 (Wiseman 1982)).

Table 1b. Customer issues reporting by North American companies in the healthcare products' sector

Issue	Agilent Techn.	Amgen Inc.	Bayer	Biogen Idec	Boston Scientific	Johnson & Johns.	Mylan	Varex Imaging	AVERAGE
Dialogue with customers	1	2	2	2	1	3	3	3	**2.1**
Customer satisfaction	1	2	2	2	2	2	2	3	**2.0**
Quality of products	2	3	3	3	3	3	3	3	**2.9**
Customer data safety	1	2	3	3	1	3	1	3	**2.1**
Compliance	2	2	3	3	3	3	3	3	**2.7**
Access to healthcare products by disadvantaged customers	1	3	2	2	2	2	2	3	**2.1**
AVERAGE	**1.3**	**2.3**	**2.5**	**2.5**	**2.0**	**2.6**	**2.3**	**3.0**	**2.3**

Source: own studies (A four-level index: quantitative disclosure = 3, non-quantitative disclosure = 2, general disclosure = 1, disclosure absent = 0 (Wiseman 1982)).

In both samples, customer data safety was presented in a satisfactory way. Companies collect information on patients who participate in clinical trials and those whom they engage through various patient programmes. Thus, companies are very serious about the protection of patients' privacy and safeguard their personal health information, by preventing unauthorised access to, or sharing of their data.

Reporting of employee issues by the healthcare products' sector

In the case of the employee issues reported by the European companies in the sample, the quality should be assessed as satisfactory but diversified (Table 2a), and the scope is wide. Most of the analysed reports covered all defined issues. The highest scores

were awarded to working conditions and occupational health and safety (both 2.6). The lowest scores were given to work-life balance and employee volunteering (both 1.4). From the reporting organisations' perspective, the average scores ranged from 0.7 to 2.9.

Table 2a. Reporting of employee issues by European companies in the healthcare products sector

Issues	ConvaTec	Drägerwerk AG & Co. KGaA	Fresenius Medical Care	Hovione	Krka	Lonza	Merck	Novartis	OPHARDT Hygiene Group	PCC Exol SA	Sonova	AVERAGE
Working conditions	3	3	3	3	3	2	3	3	1	2	3	**2.6**
Occupational health and safety	2	3	2	3	3	3	3	3	1	3	3	**2.6**
Employee development	2	2	2	3	3	2	3	3	1	3	2	**2.4**
Employee satisfaction	2	2	2	3	3	2	3	1	0	2	1	**1.9**
Employee engagement	2	1	3	3	3	2	3	1	1	2	1	**2.0**
Diversity and equal opportunities	1	3	2	3	1	2	3	3	1	2	2	**2.1**
Work-life Balance	1	2	1	3	2	1	2	1	0	1	1	**1.4**
Employee volunteering	1	2	1	1	1	2	3	1	0	3	1	**1.4**
Corruption and unethical behaviour	2	2	3	2	2	2	3	3	1	3	2	**2.3**
AVERAGE	**1.8**	**2.2**	**2.1**	**2.7**	**2.3**	**2.0**	**2.9**	**2.1**	**0.7**	**2.3**	**1.8**	**2.1**

Source: own studies (A four-level index: quantitative disclosure = 3, non-quantitative disclosure = 2, general disclosure = 1, disclosure absent = 0 (Wiseman 1982)).

Employee issues reported by the North American companies in the sample, from both the scope and quality perspective, are assessed slightly better (Table 2b). All of the issues were given average scores above 2.0. The highest scores were given to diversity and equal opportunities (3.0), and employee development (2.7). The lowest scores were again given to work-life balance and employee volunteering (both 2.1). From the reporting organisations' perspective, the average scores ranged from 2.2 to 3.0.

In both samples, but especially in the North American sample, one can observe that companies realise that their success is based, to a large extent, on the knowledge, skills, engagement, and satisfaction of employees. Thus, as employers, they develop and implement a number of standardised tools to attract and retain the best talents on the market (like fair treatment at work, a transparent and equitable compensation system, company pension plans, the ability to combine working with family commitments, flexible worktime arrangements), but they also offer additional solutions to show society and current and potential employees that they are not only socially responsible

but also socially engaged, establishing a dialogue-oriented corporate culture based on common values and trust. Additionally, companies are trying to adjust to the digital environment by offering numerous innovative digital options to perform their tasks or offer various flexible and innovative working models.

Table 2b. Reporting of employee issues by the North American companies in the healthcare products sector

Issues	Agilent Techn.	Amgen Inc.	Bayer	Biogen Idec	Boston Scientific	Johnson & Johns.	Mylan	Varex Imaging	AVERAGE
Working conditions	3	2	3	2	2	3	3	3	**2.6**
Occupational health and safety	3	2	3	3	3	3	3	3	**2.9**
Employees' development	3	2	3	2	3	3	3	3	**2.7**
Employees' satisfaction	1	1	3	3	3	3	3	3	**2.5**
Employees' engagement	1	2	2	3	2	3	3	3	**2.4**
Diversity and equal opportunities	3	3	3	3	3	3	3	3	**3.0**
Work-life Balance	1	2	2	2	1	3	3	3	**2.1**
Employee volunteering	1	3	2	3	3	3	1	1	**2.1**
Corruption and unethical behaviour	2	3	2	3	3	3	3	3	**2.7**
AVERAGE	**2.2**	**2.5**	**2.5**	**2.7**	**2.5**	**3.0**	**2.8**	**2.8**	**2.6**

Source: own studies (A four-level index: quantitative disclosure = 3, non-quantitative disclosure = 2, general disclosure = 1, disclosure absent = 0 (Wiseman 1982)).

The reporting of community issues by companies in the healthcare products' sector

When studying the European companies in the sample, it should be noted that in the case of community-related issues, the quality of the reporting was low, and the scope was very narrow (Table 3a). The support of culture and sports issues is very low (0.5 and 0.7, respectively). Social activities and charity (1.7), the development of science (1.5), and support for education (1.2) were reported slightly better. The reporting organisations' perspective revealed that the average scores were extremally diverse, ranging from 0 to 3.0.

The quality of the North American companies' sustainability reporting of community issues was slightly better, but the scope was similar to the European sample (Table 3b). Again, the weakest reported issues were support of culture and sports (0.5 and 0.4, respectively). The best-reported issue was the development of science (2.2), and supporting education and social activities, as well as charity (all 2.1). The reporting organisations' perspective revealed that the average scores were less diverse, ranging from 0.6 to 2.6.

Table 3a. Reporting of community issues by European companies in the healthcare products sector

Issue	ConvaTec	Drägerwerk AG & Co. KGaA	Fresenius Medical Care	Hovione	Krka	Lonza	Merck	Novartis	OPHARDT Hygiene Group	PCC Exol SA	Sonova	AVERAGE
Promotion/ Sponsorship of culture	0	0	0	1	3	1	3	0	0	0	0	**0.5**
Promotion/ sponsorship of sport	2	0	0	1	1	1	3	0	0	0	0	**0.7**
Supporting education	2	3	0	1	1	1	3	1	0	1	0	**1.2**
Development of science	2	2	0	2	3	1	3	1	0	1	0	**1.5**
Social activities and charity	2	2	0	1	3	1	3	3	1	1	2	**1.7**
AVERAGE	**1.6**	**1.4**	**0**	**1.2**	**2.2**	**1.0**	**3.0**	**1.0**	**0.2**	**0.6**	**0.4**	**1.1**

Source: own studies (A four-level index: quantitative disclosure = 3, non-quantitative disclosure = 2, general disclosure = 1, disclosure absent = 0 (Wiseman 1982)).

The strong support for the development of education and science seems to be a typical form of community engagement for companies in the healthcare product sector. Usually, this support is given by dedicated foundations. For example, the Biogen Foundation is committed to supporting non-profit organisations that focus on four areas: providing access to hands-on science education, teacher development in science, college readiness, plus support and basic social needs (child hunger, poverty, and social mobility).

Table 3b. Reporting of community issues by the North American companies in the healthcare products sector

	Agilent Techn.	Amgen Inc.	Bayer	Biogen Idec	Boston Scientific	Johnson & Johns.	Mylan	Varex Imaging	AVERAGE
Promotion/Sponsorship of culture	1	0	3	0	0	0	0	0	**0.5**
Promotion/sponsorship of sport	0	0	3	0	0	0	0	0	**0.4**
Supporting education	1	3	3	3	3	3	0	1	**2.1**
Development of science	1	3	3	3	2	3	1	2	**2.2**
Social activities and charity	1	3	1	1	3	3	2	3	**2.1**
AVERAGE	**0.8**	**1.8**	**2.6**	**1.4**	**1.6**	**1.8**	**0.6**	**1.2**	**1.5**

Source: own studies (A four-level index: quantitative disclosure = 3, non-quantitative disclosure = 2, general disclosure = 1, disclosure absent = 0 (Wiseman 1982)).

Even though culture and sport are not widely supported, we can find a few interesting examples of the sector's engagement. For example, Bayer Arts & Culture promotes artistic diversity through music, dance, theatre, and art events. Additionally, Bayer has expanded the stARTacademy, which offers highly talented young artists comprehensive support – such as by bringing solo artists together with orchestras and providing financial assistance.

Reporting of environment issues by companies in the healthcare products sector

Looking at the European sample's sustainability reporting of environmental issues, both the scope and quality were assessed rather poorly (Tables 4a). The weakest reported issues were environmental education campaigns (0.9), pro-environmental products (1.6), and introducing environmentally-friendly solutions (1.7). The best-reported issue was environmental sustainability covering a wide range of aspects like water, energy, and fuel, carbon, paper and waste management/recycling. The reporting organisations' perspective shows that the average scores were rather low, ranging from 1.0 to 2.7.

Table 4a. Environmental issues reporting by European healthcare products' sector companies

	ConvaTec	Drägerwerk AG & Co. KGaA	Fresenius Medical Care	Hovione	Krka	Lonza	Merck	Novartis	OPHARDT Hygiene Group	PCC Exol SA	Sonova	AVERAGE
Environmental sustainability	3	3	3	3	3	2	3	3	2	3	2	**2.7**
Introducing environmentally friendly solutions	1	2	1	3	3	2	3	1	1	1	1	**1.7**
Pro-environmental products	1	2	1	3	2	2	3	1	1	1	1	**1.6**
Environmental education campaigns	1	1	1	1	1	1	2	1	0	1	0	**0.9**
AVERAGE	**1.5**	**2.0**	**1.5**	**2.5**	**2.2**	**1.7**	**2.7**	**1.5**	**1.0**	**1.5**	**1.0**	**1.7**

Source: own studies (A four-level index: quantitative disclosure = 3, non-quantitative disclosure = 2, general disclosure = 1, disclosure absent = 0 (Wiseman 1982)).

Considering the North American sample's sustainability reporting of environmental issues, both the scope and quality were assessed much better (Table 4b). The weakest reported issue was environmental education campaigns (1.0). The other three issues were assessed over 2.0. The best-reported issue was environmental sustainability (3.0) and introducing environmentally friendly solutions (2.7). From the reporting organisations' perspective, the average scores ranged from 1.5 to 3.0.

The very good assessment of the environmental sustainability issue in the case of both samples suggests that the sector realises that meeting the global challenge of climate change requires that businesses undertake actions that go beyond the regulatory requirements. What is unique for the analysed sector is the continual innovations being made in the design, development, and production of biologics. This includes the emergence of green chemistry, an approach aimed at reducing or eliminating the use of toxic chemicals and the generation of hazardous materials. There are other environmental benefits that can result from green chemistry – such as more efficient processes, and/or reduced energy, and/or water use.

Table 4b. Environmental issues reporting by North American companies in the healthcare products sector

	Agilent Techn.	Amgen Inc.	Bayer	Biogen Idec	Boston Scientific	Johnson & Johns.	Mylan	Varex Imaging	AVERAGE
Environmental sustainability	3	3	3	3	3	3	3	3	**3.0**
Introducing environmentally friendly solutions	3	3	3	3	3	3	1	3	**2.7**
Pro-environmental products	2	3	3	3	3	3	1	1	**2.4**
Environmental education campaigns	0	0	1	0	2	3	1	1	**1.0**
AVERAGE	**2.0**	**2.2**	**2.5**	**2.2**	**2.7**	**3.0**	**1.5**	**2.0**	**2.3**

Source: own studies (A four-level index: quantitative disclosure = 3, non-quantitative disclosure = 2, general disclosure = 1, disclosure absent = 0 (Wiseman 1982)).

In the reports, we can also meet company-specific projects, as in the case of Merck and its Clean Meat – which focus on the biotechnology required to produce meat in laboratories so that it is healthier, more efficiently produced, ethical, and environmentally sustainable. There is also or Liquid Biopsy. These are technologies that are focused on non-invasive alternatives to traditional tissue-based diagnostics, such as liquid biopsy, thereby reshaping methods of detecting and managing various diseases.

Conclusions

The healthcare products sector is one of the world's largest and fastest-growing. Due to the indispensable nature of healthcare at all levels of society, there are also high expectations of the sustainable practices of the sector. Those practices can be acknowledged from the sustainability reports, which are supposed to present the social and environmental impacts of the company – both positive and negative. Even though sustainability reporting has been dynamically developing for almost three decades,

it is only one decade ago that the healthcare products sector joined this phenomenon. However, there is very limited research on the scope and quality of those reports. The aim of this research was to contribute to the international health management literature, and to the existing research into sustainability reporting. The authors compared the practices of North American and European healthcare product organisations, and based on that approach, characterised the trends and best practices in this field.

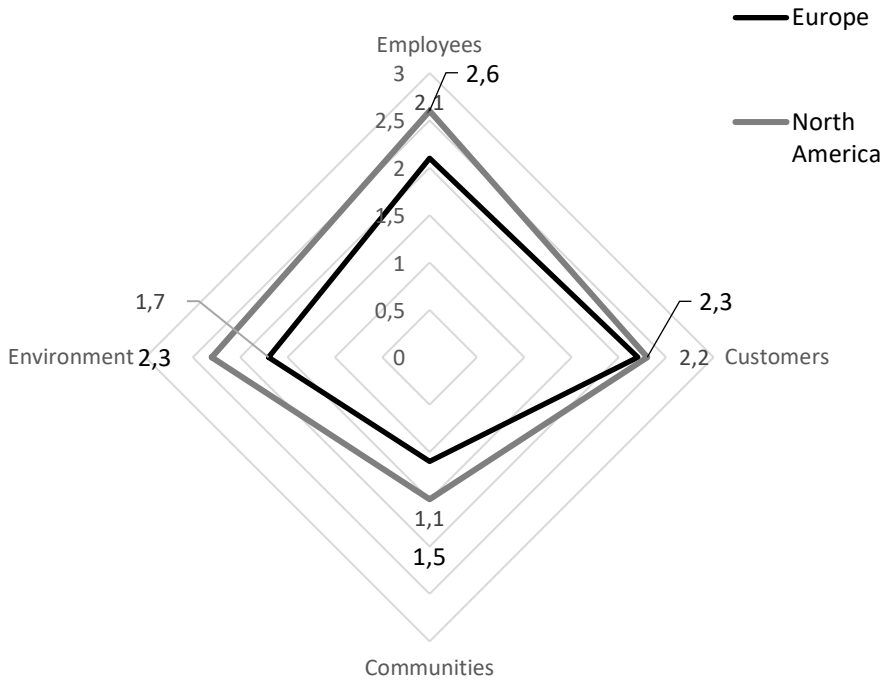

Figure 1. European and North American healthcare product sector – assessment of CSR reporting
Source: own study.

The analysis focused on the scope and quality of sustainability reporting in four categories: customers/patients, employees, community, and environment. The radar chart presented in Figure 1 shows the average assessment of each category, based on the four-level index presented in the methodology section.

In the case of the European sample, the highest quality of sustainability reporting is represented by the customer (2.2) and employees categories (2.1). The lowest scores were awarded to the environment (1.7) and community (1.1) categories. For the North American sample, the highest scores were given to the employees (2.6) and customers and the environment (both 2.3) categories. The weakest category is community (1.5).

In general, the North American sample organisations were assessed better than the European sample in all categories. It is surprising, as the analysed American companies registered their first reports in the database much later than the analysed European companies, which suggests less experience in sustainable reporting.

In terms of each of the analysed categories, the key conclusions are as follows:

- Customers' issues are well reported, and the scope is wide. Companies report on the quality dialogue with customers/patients, and the activities focused on customer satisfaction. Due to the very sensitive relations of the sector's companies and patients, significant attention is given to the issue of customer data safety. Very special attention is given to product quality and innovativeness, in relation to the compliance issues (as the sector is subject to a number of national and international regulations).
- The employee category analysed in the sustainability reports covers a wide range of issues, which are well presented. Companies focus a great deal on employee development programmes, diversity, and equal opportunities issues. Two issues are slightly neglected by the sector, namely 'work-life balance' and volunteering. It can be assumed that companies realise that their success is based on the talents they can attract, engage, and retain. The analysed organisations develop and implement a number of standardised social responsibility activities, such as fair treatment at work, a transparent and equitable compensation system, company pension plans, the ability to combine working with family commitments, and flexible worktime arrangements, but they also make much effort to convince society, along with current and potential employees, that they are socially engaged, by establishing a dialogue-oriented corporate culture based on common values and trust.
- In the case of community issues, the sample companies focus mostly on education at all levels (from pre-school level to medical doctors), and science development. However, a significant number of reports cover charitable activities aimed at supporting less developed parts of the world in getting access to pharmaceutical products and modern medical equipment. A very limited number of companies report on support for sports and cultural development.
- Taking into consideration the reporting of the environmental category, both the scope and quality are rather good. The sector realises its impact on the environment, and its potential in meeting the global challenge of climate change. What is specific for the analysed sector is continual innovations being made in the design, development, and production of biologics. This includes the growing emergence of green chemistry, an approach aimed at reducing or eliminating the use of toxic chemicals and the generation of hazardous materials.

However, this evaluation has certain limitations, as the sample refers only to the European and North American sectors, and it contains only a small number of reports. As our sample is restricted to only two regions, samples drawn from other regions might have produced different results. Secondly, as we are drawing from only two years of reporting, this analysis will not reveal changes in the reporting scope and quality over a longer time. Analysing trends across several reporting years may reveal different patterns in sustainability reporting practices due to business environment dynamics or maturity along the stages of sustainability.

Despite these limitations, the authors believe that the study makes a significant contribution to the existing literature. The results of the research are, to the best of the authors' knowledge, the first that present a content analysis and review of the healthcare product sector's sustainability reports. The characteristics of the sector's practices in this paper may support other healthcare products companies in sustainability reporting, and encourage them to follow the recognised practices. From the theoretical perspective, the paper adds to the current body of knowledge and presents a snapshot of the healthcare sector's reporting practices, showing the strong and weak points in this field. The research results reveal that the healthcare sector's reporting practices are advanced, but it still has many areas to work on.

In future research, the authors plan to research in-depth each of the four defined categories, to define the sectors' metrics and best practices. It would also be interesting to analyse the sector's reporting practices for the last decade, to see its dynamics and define key trends and challenges. There is also a need to research consumer responses to sustainability practices.

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Streszczenie

Analiza praktyki raportowania zrównoważonego rozwoju w sektorze ochrony zdrowia na podstawie Europy i Ameryki Północnej

W ciągu ostatnich dwóch dekad wśród naukowców i praktyków zarządzania toczy się ożywiona dyskusja na temat raportowania w obszarze zrównoważonego rozwoju. Wynika to z rosnącego zainteresowania informacjami niefinansowymi ujawnianymi szerokiej grupie interesariuszy. Jednak już samo opracowanie raportu zrównoważonego rozwoju, który odpowiada potrzebom różnych grup interesariuszy, stanowi nie lada wyzwanie. Różnice między różnymi sektorami sprawiają, że zadanie to jest jeszcze trudniejsze. Celem artykułu jest zbadanie zakresu i jakości raportów zrównoważonego rozwoju firm działających w sektorze produktów medycznych w Europie i Ameryce Północnej. W badaniu tym zostanie przeprowadzona analiza treści raportów zrównoważonego rozwoju wydanych w 2018–2019 przez 11 europejskich i 8 północnoamerykańskich organizacji sektora produktów medycznych. Charakter badania będzie opisowy i oparty wyłącznie na informacjach pochodzących ze źródeł wtórnych.

Słowa kluczowe: raportowanie zrównoważonego rozwoju, raportowanie CSR, raportowanie niefinansowe, GRI, sektor ochrony zdrowia, analiza treści

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Comparative Analysis of the Practice of Internet Use in the Marketing Activities of Higher Education Institutions in Poland and Ukraine

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Abstract

In the information age, the role of higher education as a factor of social progress is increasing. The competition among higher education institutions is also growing. This requires higher education institutions' (HEIs) marketing policies to be diversified, digitalized, and integrated into the virtual space. In order to find out the role and importance of Internet tools and in marketing activities, a questionnaire survey was conducted among managers and specialists of HEIs in Ukraine and Poland. The data served as the basis to study the level of variation, structure similarity, and consistency of the generalized responses of the respondents of the two countries. We verified hypotheses about (1) the absence of significant differences between the estimates of the role of the Internet in the marketing activities of HEIs in Poland and Ukraine; (2) the consistency of answers of the respondents of the two countries regarding the use of the Internet in market activites of HEIs; (3) HEIs' use mostly geo-targeting potential consumers of higher education online.

The dominant feature of the Internet – quick access to information – enables effective marketing activities. The management of HEIs should increase the awareness of their marketing staff in using the Internet to expand the delivery of educational services, intensify interviewing practices for obtaining feedback from customers, attract sponsors, promote their own brands, do market research, and so on.

Keywords: higher education institution, marketing activity, Internet-marketing, marketing communications, structure similarities, variations, rank correlation

JEL: I23, M3, P52

Introduction

In the 21st century, world-leading institutions have recognized the growing role of higher education in socio-economic transformations. That is why scientists are now positioning a country's higher education system country as the main driver of national economic and social progress. The effectiveness of the higher education influence on these socio-economic changes depends from an array of prerequisites. Among these prerequisites, we can distinguish three significant positive social roles performed by the higher education environment:

- the realization of the mission of the main source of knowledge;
- the promotion of economic innovations through the formation of human capital and intellectual potential;
- ensuring that social systems are highly competitive and sustainably developed.

The formal providers of higher education services are traditionally higher education institutions (HEIs). HEIs should be understood as institutions of a particular kind with the following characteristics:

- it is a legal entity under private or public law;
- it implements activities at certain levels of higher education;
- it disseminates and generates new knowledge to achieve individual and institutional development goals of social systems;
- it develops the intellectual potential of the recipients (consumers) of its services and prepares them for sustainable employment and active citizenship.

The leading measure of HEIs' performance efficiency is how they interact with internal and external stakeholders. In particular, the production of necessary impact on the target consumer in the process of communication is essential for improving their efficiency. HEIs can produce the necessary impact not only with public relations tools, training courses and program offers, promotion of their teaching personnel but also through promoting the institution's values, in particular, students' or graduates' successes (e.g., grants that have been awarded, completed projects, career progress, socially responsible behavior, etc.).

The new economy of the information age puts new demands on digitalizing the communication tactics and strategies of HEIs. There is no doubt that today, the problem of improving the efficiency of marketing communications of HEIs cannot be solved without considering their marketing activities on the Internet. The key benefits of Internet marketing include interactivity, quality targeting, lack of territorial restrictions, accessibility, and the possibility of post-click analysis, among others.

These global trends also suggest that a comparative analysis of the practice of using e-marketing by HEIs in different countries will not lead to radically different estimates (results). The similarity of the neighboring countries in the size of the population and the number of HEIs made it expedient to implement a research project on the example of Poland and Ukraine, some results of which are presented in this article.

Analysis of recent research and publications on the selected topic

An analysis of a selection of Ukrainian electronic scientific periodicals available on the V. Vernadsky National Library website revealed that among the main topics of marketing HEIs via the Internet, the following have been brought up:

- research into the characteristics of electronic marketing tools use by Ukrainian universities and the rationale for reorganizing marketing departments through the creation of an informational and analytical sector and marketing communications sector (Petrunya & Petrunya 2018);
- a description of the advantages provided by the building a university's image on the Internet (mass and geographic scale; continuous access; feedback; flexibility; efficiency and completeness of information; minimum expenses), and characteristics of the main Internet technologies and tools to create and manage a university's image on the Internet: Websites, website search engine optimization; thematic groups; viral Internet-marketing; direct Internet-marketing; advertising and publishing information on informational web sites, blogs, and forums (Beztelesna & Vasyliv 2016);
- identifying marketing tasks in the process of implementing distance learning in Ukrainian HEIs and describing tools worth using for distance learning promotion: targeted advertising on social networks, targeted advertising on educational websites, contextual advertising, banner advertising, web-analytics (Zabolotskiy 2016);
- an assessment of the capabilities of Internet marketing tools and methods, and the rationale for their complex application by higher education institutions in order to promote their scientific and educational services according to differences between on-line and off-line marketing communications – the new set of knowledge, skills, experience, beliefs, personell behavior and relationships, their readiness and ability to apply Internet-technologies effectively in various aspects

of scientific and educational activities in order to gain economic or other benefits (Illiashenko 2014);
- the use of the smartphone application "Instagram" as an Internet marketing tool for social communications to promote the brands of HEIs and their subdivisions (Mozgova & Kolosovska & Onishchenko 2017);
- digital communication strategies in marketing higher education services (Daynovskyy & Semak & Boychuk 2018; Prosovych & Botsman 2018);
- identifying the non-systemic implementation of a business model in higher education that is based on Marketing 4.0, and the development of an organizational and management mechanism for social media marketing strategy formation and implementation in HEIs (Zhehus 2018).

The latest scientific research in the field of HEIs' marketing communications in Poland mainly concerns the use of social media. Integration into the virtual space, which involves the provision of services via the Internet, electronic advertising, and positioning in search engines, has become an integral element of university marketing strategies (Buchnowska 2013). Generation Z (post-Millennials), which significantly affects the make-up of the modern cohort of students, forces the management of higher education institutions to more actively use IT-technologies in marketing communications to benefit the following: "the possibility of 'closer relationship' of individual stakeholder groups and their deeper relationship with the university; rapid flow of information (opinions, experiences, advice, and recommendations) between the university and different staholders, particulary important for the candidates seeking information about studies on the first year and second level of study and for choosing a major of study" (Hall & Peszko 2016). Based on research of 403 higher education institutions available on the Ministry of Science and Higher Education of Poland website in 2018, the highest popularity of the Facebook website has been proven against the backdrop of the increased use of several profiles on other social networks: YouTube; Twitter; Google+; Instagram; LinkedIn (Wojciechowska 2018).

The issue of marketing communication with the use of the new media is inscribed in the concept of 360° marketing, which comprises several means of communication, e.g., websites, search engine marketing, direct marketing, social media marketing, and Internet advertising. These instruments have been researched by 320 companies in the B2B sector in both Polish and foreign markets (Bartosik-Purgat 2018). The same sector of the new media, this time with reference to the market of higher education, is presented in the monograph edited by the researchers from the University of Economics in Katowice (Smyczek & Matysiewicz 2015).

Leading international scientists and sociologists recognize the importance of the Internet in improving the information provided to prospective students and in the personnel recruitment process at universities (Table 1). At the same time, trends that contribute to the greater efficiency of HEIs' activity on the Internet and which are used in marketing include:

- simplifying the user interface by using a website that is intuitive and accessible on different devices or platforms;
- search engine optimization (SEO), which puts the institution higher up the list of search results;
- initiating communication in the form of online lectures, real-time chats with university representatives and bloggers, and guest posts in discussion forums;
- improving the analysis of the marketing activities results, based on a wide range of available information and Internet-analytics;
- developing communication by expanded investment in banner advertisements, promotional articles, robo-calls, and apps for mobile Internet users on markets of educational, training, informational, innovative and other services;
- improving content-management by means of the personalization pyramid (1 – search engine optimization; 2 – segmentation; 3 – content orientation to a specific person).

Table 1. The main digital marketing strategies of higher education institutions

Strategy	Facts
Video Advertisements	It is estimated that 65% of the population learn better by seeing images rather than reading words
Personal Voice Assistants	It is estimated that about 60% of households use Voice Assistants in USA
Accessibility on mobile devices	It is estimated that 60% of all internet traffic comes from mobile devices
SMM	It is estimated that a billion people use social media. There is a need to reorient strategies from well-known news feeds and focus on capturing the attention in "Stories".
SEO	It is estimated that 93% of people use a search engine to begin surfing the web
Email	On average, more than 2% of promotional emails are read in their entirety

Source: authors' own elaboration based on the data of e-resources (The 7 hottest higher ed digital marketing trends for 2019. Retrieved from: https://www.higher-education-marketing.com; The Most Important 2019. Higher Education Marketing Trends. Retrieved from: https://linchpinseo.com (accessed: 10.07.2019).

Characteristics of HEIs and the array of empirical data

Higher education institutions use a wide range of Internet possibilities in their operational activities. In order to identify the role of Internet tools and their importance in the marketing activities of higher education institutions, a questionnaire survey was carried out on the following subject: "Internet in the activities of higher education institutions." This research project was implemented in Ukraine and Poland between 2015 and 2017. It covered 123 and 62 higher education institutions in each country,

respectively (more than 10% of higher education institutions in each country). The issues of data collection techniques and tools are described in a few publications, e.g., Kisiołek 2018; Kisiołek & Karyy & Prokopenko 2018.

The research project was based on a questionnaire method (one questionnaire corresponded to one higher education institution) and a sampling observation method to justify the representativeness of the sample. The target group comprised managers and specialists of higher education institutions whose activities focused on marketing. The questions provided from three to seven answer options (depending on the essence of the question). The empirical data obtained in the course of the project was used to ascertain the level of structural similarity and consistency of the respondents' responses in both countries, and to identify ties between individual factors.

Hypotheses of the research

The authors hypothesize: 1 – there are no significant differences in structural responses between the assessments of the Internet in marketing activities of Polish and Ukrainian higher education institutions; 2 – there is consistency between HEIs in the two countries regarding Internet use in marketing activities, and therefore there are strengths and weaknesses in these practices: 3 – there is an order of preferable criteria (geographic, demographic, behavioral) of targeting the audience of HEIs.

Research methodology

Within this article, the similarity coefficient of structures was used for the two arrays of data in order to assess the level of similarity of structural responses of respondents in Poland and Ukraine:

$$P = 1 - \frac{1}{2}\sum_{j=1}^{m}\left|d_j^U - d_j^P\right|, \tag{1}$$

where d_j^U – is the share of *j's* response of respondents of Ukraine; d_j^P – is the share of *j's* response of respondents of Poland.

The following indicators were used to assess the variation of individual indicators: Coefficient of variation:

$$\nu_\sigma = \frac{\sigma}{\tilde{o}} \times 100 \tag{2}$$

Interquartile range of variation:

$$R_Q = Q_3 - Q_1 \tag{3}$$

where $\overline{\bar{o}}$ – is the average characteristic value in the range; σ – is the standard deviation of the characteristic value in the range; Q_3 and Q_1 – are the values of the third and the first quartiles of the characteristic distribution in the range, respectively.

If the value of the coefficient of variation exceeds 33%, the sample is considered heterogeneous, and the average value is considered atypical. If the characteristic value is outside the interquartile range, it is considered an "outlier."

The Spearman coefficient was used to estimate the rank correlation:

$$\rho = 1 - \frac{6\sum d^2}{n \times \left(n^2 - 1\right)}, \tag{4}$$

where n – is the number of positions; d – is the difference between the position ranks by country.

The value of ρ varies from -1 to +1, characterizing the direction and density of the tie. The tie is considered significant (at the significance level of *1-α),* if the observed value of ρ exceeds the critical value $\rho_{1-}\alpha(n)$.

The Chuprov correlation coefficient (*C*) was used to assess ties between categorical characteristics:

$$C = \sqrt{\frac{\chi^2}{n\sqrt{(m_x - 1)(m_y - 1)}}} \tag{5}$$

where m_x and m_y are the numbers of the groups according to the factor and efficiency characteristics, respectively; χ^2 – is the Pearson chi-squared test:

$$\chi^2 = n\left[\sum_i \sum_j \frac{f_{ij}^2}{f_{i\Sigma} \cdot f_{\Sigma j}} - 1\right] \tag{6}$$

f_{ij} – is the frequency of the characteristic of the *i-th* row (of the *i-th* factor group) on the *j-th* column (*j-th* efficiency groups); $f_{i\Sigma}$ and $f_{\Sigma j}$ – are total frequencies by groups of factor and efficiency characteristics; n – is the sample size.

The value of *C* varies from 0 to 1, characterizing the density of the tie. The tie is considered significant (at the significance level of *1-α),* if the observed value of the Pearson chi-squared test (χ^2) exceeds the critical value $\chi^2_{1-\alpha}\left(k = (m_x - 1) \times (m_y - 1)\right)$.

To summarize the respondents' estimates in the form of rank scales, the indicator of the average centred rank was used:

$$\bar{R}_o = \bar{R} - \frac{R\max + R\min}{2}, \tag{7}$$

where $R_{max,}$ $R_{min,}$ $\bar{R}$ – are the maximum, minimum, and average values of the ordinal ranks.

If the average centred score is positive, the phenomenon is generally positive.

The contents and description of the comparative analysis

The first question of the research project was related to clarifying the role of the Internet in the marketing activities of an HEI. The question comprised 12 items concerning the role of the virtual environment as a certain tool, which: 1 – substantially supports the creation of the image of an HEI; 2 – is cheaper compared to traditional mass media tools that are used in marketing activities; 3 – makes it possible to reach the target groups of potential students in market segments where an HEI operates; 4 – provides an opportunity for clear access to new market segments; 5 – provides an opportunity for quick access to information on the educational services market; 6 – is used to enhance positive interactive communication with students; 7 – helps to improve services for students; 8 – contributes to a better understanding of students' needs; 9 – strengthens the feeling of interaction between an HEI and students; 10 – makes it possible to obtain detailed information about existing and potential students; 11 – helps to implement new elements of the educational offer by an HEI; 12 – supports the implementation of educational services. For each item, one of the three possible answers was offered (see Table 2).

Table 2. Structure and level of similarity of Polish and Ukrainian respondents' responses to the role of the Internet in the marketing activities of higher education institutions

Number of the item	Share of answers, %						*P*
	agree		disagree		Difficult to say		
	Poland	Ukraine	Poland	Ukraine	Poland	Ukraine	
1	82.1	95.2	0.0	0.0	17.9	4.8	0.869
2	66.7	79.1	22.0	16.1	11.4	4.8	0.875
3	75.6	64.5	4.1	21.0	20.3	14.5	0.831
4	61.0	50.0	5.7	8.1	33.3	41.9	0.891
5	100.0	98.4	0.0	0.0	0.0	1.6	0.984
6	93.5	88.7	0.8	3.2	5.7	8.1	0.953
7	95.1	85.5	1.6	6.4	3.3	8.1	0.901
8	41.5	59.7	11.4	21.0	47.2	19.3	0.722
9	40.7	46.8	15.4	22.6	43.9	30.6	0.865
10	48.0	53.2	21.1	21.0	30.9	25.8	0.948
11	84.6	77.4	1.6	11.3	13.8	11.3	0.905
12	95.1	66.2	0.0	3.2	4.9	30.6	0.712

Source: compiled and calculated by the authors according to their own survey.

The overwhelming majority of the respondents in both countries chose a positive answer in each item. The maximum value for "I agree" (100.0% of the respondents in Poland and 98.4% in Ukraine) concerned the statement of the possibility of having quick access to information on the educational services market via the Internet.

For the ninth item – i.e., the Internet strengthens the feeling of interaction between an HEI and students – the scores of Poland and Ukraine were low and quite similar,

with only 40.7% and 46.8% agreeing, respectively. The results were also quite similar when it came to those who disagree with the statement – 15.4% of Polish respondents and 22.6% from Ukraine.

The absolute values of the P coefficient indicate the similarity of the response structures of Polish and Ukrainian respondents. The coefficient of variation calculated on the basis of these values was 9.2%, and the interquartile range of variation was 0.117. Such values point to (1) the homogeneity of the set of P values in the context of the 12 considered items; (2) the typicality of the average P value (0.871); (3) the absence of significant "outliers" of its values. The greatest discrepancy between the experts' estimates in the two countries (0.712) is observed in the statement of the role of the Internet in implementing educational services. This discrepancy may hypothetically depend on the ownership form of an HEI. To test the hypothesis, we created a table of mutual correlation. According to the table, 84 out of the 88 respondents who represented private higher education institutions from both countries assessed the Internet's role in implementing education services positively.

On the other hand, 25 of the 97 respondents who represented state higher education institutions in Poland and Ukraine did not agree with the the statement of the role of the Internet in implementing educational services. Based on these data, the value of the Chuprov coefficient ($C = 0.332$) and the value of the Pearson chi-squared test ($\chi^2 = 20.444$) were calculated. The observed value of the Pearson chi-squared test ($\chi^2 = 20.444$) is significantly higher than its critical (table) value observed value χ^2 rather than critical one ($\chi^2_{1-0,01}(1=(2-1)\times(2-1))=6.635$). This shows with 0.99 significance level that private higher education institutions are more likely to agree on of the positive Internet's role in the delivery of educational services than state ones. The Spearman coefficient was used to estimate the tie density between approval responses for the 12 items between the respondents of Ukraine and Poland. Its estimated value ($\rho = 0.773$) exceeded the critical one ($\rho_{1-0,01}(12) = 0.73$) at the significance level of 0.99. This demonstrates the consistency of the opinions of the experts from both countries, who highly agree with the ninth, eighth, fourth, and tenth items, and evaluated the fifth one at the lowest level.

The next step was to clarify the question, "What marketing activities do HEIs use the Internet for, and how often?". The activity system within this question comprised nine items (Table 3). The respondents were offered one of six responses: 1 – "is not used," 2 – "low level of use," 3 – "average level of use," 4 – "high level of use," 5 – "very high level of use," 6 – "I do not know." The last answer was recorded by the respondents for four activities: "Marketing research" (4% in Poland and 8% in Ukraine), "Sponsorship" (4% in Poland and 32% in Ukraine), "Additional promotion" (27% in Ukraine), and "E-Commerce" (7% in Poland). These shares of responses, as well as 2% of responses of Ukrainian respondents who did not mark any of the six proposed options of answers for "Sponsorship" activities, were not considered in the calculation of the average centred rank. The value of ordinal ranks varied from 1 to 5 (as the Likert scale suggests), and the theoretical value $\bar{R}_o$ within the selected rank system ranged from

-2 to 4. Significant differences between $\bar{R}_o$ for certain items serve as an indicator of reserves of activity improvement, and the maximum value of their sum for two countries ($\bar{R}_o{}^{P} + \bar{R}_o{}^{U}$) is an indicator of the highest level of activity spread.

Table 3. Average centred ranks and similarity levels of response structures of the respondents in Poland and Ukraine concerning the use of the Internet for higher education institutions' marketing activities

Activities	$\bar{R}_o$				$\bar{R}_o{}^{P} + \bar{R}_o{}^{U}$		*P*	
	Poland ($\bar{R}_o{}^{P}$)		Ukraine ($\bar{R}_o{}^{U}$)					
	score	rank	score	rank	score	rank	score	rank
Marketing research	–0.258	7	0.098	7	–0.160	7	0.785	4
Student services	0.980	1	0.750	1	1.730	1	0.880	1
Communication with students	0.940	2	0.630	3	1.570	2	0.850	2
Advertising	0.450	4	0.310	5	0.760	4	0.835	3
Sponsorship	0.802	3	–0.515	9	0.287	6	0.640	8
Public relations	0.400	5	0.680	2	1.080	3	0.740	6
Additional promotion	–0.690	9	0.069	8	–0.621	9	0.505	9
E-learning	–0.080	6	0.560	4	0.480	5	0.770	5
E-Commerce	–0.628	8	0.210	6	–0.418	8	0.695	7

Source: compiled and calculated by the authors based on their own survey.

The two highest total scores of positive $\bar{R}_o$ values for both countries (respectively, the highest *P* values) were obtained for activities related to student services and communication with students. The dominance of $\bar{R}_o$ for Poland is due to the fact that none of the respondents from this country pointed to the absence of the Internet use in the processes of providing student services and communicating with them, while a low level for these activities was marked by about 3% and 2%, respectively. On the other hand, in Ukraine, 2% of the respondents pointed to the absence of Internet use in the process of providing student services, 7% – the low level of its use in this process, 8% – a low level of its use in the process of providing student services. The results of the analysis allow us to state the high effectiveness of communicating between the structural units of an HEI, which uses the tools of Internet marketing, and students.

"Public relations" activities were in third place in the total positive $\bar{R}_o$ value for both countries. The $\bar{R}_o$ in Ukraine exceeds by 70% – the same value for Poland – as the share of Ukrainian respondents who indicated the level for this activity as "high," "very high," and "average" was 8%, 55%, and 38%, respectively. The share of Polish respondents was 9%, 29%, and 25%, respectively.

Advertising took fourth place according to the overall assessment indicator ($\bar{R}_o{}^{P} + \bar{R}_o{}^{U} = 0{,}760$) for the two countries. A similar position was given to advertising by respondents from Poland. Here is the value of the average centred rank ($\bar{R}_o{}^{P} = 0{,}450$) exceeds by 45.2% the corresponding value for Ukraine ($\bar{R}_o{}^{U} = 0{,}310$), where advertising is in fifth place. However, the value of the coefficient of similarity of response structures concerning Internet use in advertising activities took third place. Maximum

differences in response structures represented were observed in the assessment of additional promotion (9th position) and sponsorship (8th position). In this case, the maximum negative assessment by respondents get the "additional promotion" in Poland and "sponsorship" – in Ukraine.

The values of the coefficient of variation (14.9%) and the interquartile range of variation (0.270), which were calculated on the basis of the *P* values in Table 2, indicate the homogeneity of the set of 9 values of the similarity coefficient, the typicality of the average value of the coefficient of structure similarity (0.744), and the absence of significant "outliers" of its values. The observed value of ρ, that is calculated based on the values R_0 Table 3 (0.850), exceeds the table value ($\rho_{1-0,01}(9) = 0.83$) in terms of the significance level of 0.99. This allows us to confirm the consistency of the opinions of the respondents of Poland and Ukraine concerning HEIs marketing activities with the use of the Internet.

The third question was to clarify the extent to which higher education institutions use certain activities within online marketing research. The activity system considered within this question comprised 14 items: 1 – market information analysis with the help of search engines and business directory websites; 2 – market information analysis with the help of specialized websites; 3 – market information analysis from external Internet databases; 4 – market information analysis with the help of discussion forums; 5 – public opinion research through monitoring student activity on social media; 6 – analysis of websites of competing HEIs; 7 – questionnaires on their own webpages (publicly available); 8 – questionnaires on their own webpages (restricted access); 9 – mini-surveys on their own webpages (publicly available); 10 – questionnaires sent via e-mail; 11 – on-line interviews; 12 – interviews in real time via software-communicators; 13 – interviews on discussion forums; 14 – analysis of statistical data from webpages of higher education institutions. They provided a set of answers similar to the previous question (Table 4). Compared to the previous question, here, the respondents chose the answer "I do not know" more often. In particular, more than 10% of the respondents chose this answer regarding items #1, #4, #10, and #11.

The highest total positive value for both countries was obtained for the activity related to analyzing the competitive environment (#6), and the most similar response structures were for the activity related to the monitoring of student activity on social media (#5). The greatest differences in responses were observed in the questions related to interviewing (#10–#13). Activities #12–13 gained maximum negative estimates in both countries.

The values of the coefficient of variation, calculated on the basis of the *P* values in Table 4 (8.9%) and the interquartile range of variation (0.183), indicate the homogeneity of the set of 14 *P* values, the typicality of the average value of the coefficient of structure similarity (0.698), and the absence of significant "outliers" of P values. The observed value ρ, which is calculated based on the values in Table 4 (0.789), exceeds the table value (ρ1–0.01(14) = 0.68) at the significance level of 0.99. This allows us to confirm the consistency of the opinions of Polish and Ukrainian respondents concerning the activities of HEIs in the framework of online marketing research.

Table 4. Average centred ranks and similarity levels of response structures of the respondents in Poland and Ukraine concerning the use of certain activities within online marketing research

Activities	Percentage of respondents who said "I don't know"			$\bar{R}_o$				$\bar{R}_o^P + \bar{R}_o^U$		P	
				$\bar{R}_o^P$		$\bar{R}_o^U$					
	Poland	Ukraine	total	score	rank	score	rank	score	rank	score	rank
1	7	15	10	0.430	2	0.306	7	0.736	3	0.760	5
2	2	10	5	0.224	3	0.544	2	0.768	2	0.800	2
3	7	10	8	–0.140	6	0.278	8	0.138	8	0.715	8
4	15	8	13	–0.212	7	0.478	4	0.266	6	0.720	7
5	7	4	6	0.156	5	0.548	1	0.704	4	0.810	1
6	0	2	1	0.760	1	0.357	6	1.117	1	0.665	10
7	0	10	3	–0.230	8	0.439	5	0.209	7	0.790	3
8	2	8	4	–0.590	10	–0.222	11	–0.812	11	0.775	4
9	0	7	2	–0.439	9	0.13	10	–0.309	9	0.735	6
10	7	18	11	–0.950	11	0.172	9	–0.778	10	0.510	14
11	18	39	25	–1.439	12	–0.59	12	–2.029	12	0.600	11
12	0	23	8	–1.630	13	–1.156	13	–2.786	13	0.585	13
13	10	15	12	–1.911	14	–1.212	14	–3.123	14	0.600	11
14	0	8	3	0.160	4	0.511	3	0.671	5	0.710	9

Source: compiled and calculated by the authors based on their own survey.

The next step was to clarify the role of the Internet in marketing research. The analysis of responses revealed high P values for primary and secondary research (0.925 and 0.880, respectively) and their positive values of the $\bar{R}_o$ indicator: for Poland – 0.720 and 0.840, respectively; for Ukraine – 0.874 and 0.876, respectively.

A separate part of the research project focused on evaluating forms of advertising HEIs on the Internet. They were represented within 11 groups (Table 5), each of which forecast a set of answers with six options for their use: 1 – "were not used"; 2 – "were used poorly"; 3 – "were used neither well not badly"; 4 – "were used well"; 5 – "were used very well"; 6 – "I do not know." It is noteworthy that in the answers to this part of the research project, the option "I do not know" appeared for all positions.

The value of the coefficient of variation, which is calculated on the basis of the P values according to Table 5 (14.6%), indicate the homogeneity of the set of P values within the 11 options and the typicality of the average value of the coefficient of structure similarity (0.724). The value of the "Direct e-mail" item (0.470) exceeds the threshold of the interquartile range of variation (R_Q = 0,820 – 0.675 = 0.145). This can be explained by the attraction of the respondents from Poland to neutral (44%) and negative assessments (29%), in return from Ukraine – to positive assessments (58%) and a high share of missing affirmative answers (23%).

The observed value of ρ, which is calculated based on the R_0 values in Table 5 (0.901), exceeds the table value ($\rho_{1-0,01}(11) = 0.76$) at the significance level of 0.99. This allows us to confirm the consistency of the opinions of the respondents of Poland and Ukraine concerning their assessment of forms of advertising HEIs on the Internet.

Table 5. Average centered ranks and similarity levels of response structures of the respondents in Poland and Ukraine concerning the evaluation of forms of advertising higher education institutions on the Internet

Activities	Percentage of respondents who said "I don't know"			$\bar{R}_o$				$\bar{R}_o{}^P + \bar{R}_o{}^U$		P	
				$\bar{R}_o{}^P$		$\bar{R}_o{}^U$					
	Poland	Ukraine	in total	score	rank	score	rank	score	rank	score	rank
Traditional banners	2	10	5	0.816	3	0.856	2	1.672	2	0.845	1
Derivative forms of traditional banners (e.g., skyscraper, billboard, other non-standard size billboards)	7	18	11	–0.495	8	–0.329	8	–0.824	8	0.815	4
Pop-up banners	7	18	11	–0.968	10	–0.610	11	–1.577	10	0.710	7
Interstitial, superstitial	11	23	15	–1.169	11	–0.597	10	–1.766	11	0.765	5
Top layer	2	11	5	–0.908	9	–0.551	9	–1.459	9	0.820	3
Video ads	5	5	5	0.842	2	0.674	4	1.516	3	0.620	10
Sponsored article	0	10	3	–0.150	5	0.456	5	0.306	5	0.720	6
Website sponsorship	22	40	28	0.423	4	–0.183	7	0.240	6	0.710	7
Advertising on social media	0	5	2	1.390	1	1.168	1	2.558	1	0.835	2
Amplifying on internet-forums	11	37	20	–0.382	7	0.032	6	–0.350	7	0.675	9
Direct e-mail	7	23	12	–0.215	6	0.792	3	0.577	4	0.470	11

Source: compiled and calculated by the authors based on their own survey.

Also, the question "Were the advertising activities on the Internet systematically directed (targeted) to a specific audience?" was clarified in the research project. Based on the distribution of answers, we calculated the Chuprov correlation coefficient ($C = 0.357$) and the value of the Pearson chi-squared test ($\chi^2 = 25.446$), which exceeded the critical value in terms of the significance level of 0.99 ($\chi^2_{1-0,01}(2=(2-1)\times(3-1)) = 9.210$). This indicates the predominant direction of the HEIs' activities on the Internet according to the geographical distribution: average – regarding the demographic features, and weak – regarding the behavioral features.

Conclusion

The results of the analysis of the response structures of the respondents from Poland and Ukraine verified the main hypotheses of the article. There are practically no differences between the countries regarding the assessments of the Internet role marketing of higher education institutions in Poland and Ukraine. We found consistency in the respondents' answers regarding how much the Internet is used in the marketing activities of HEIs. The same case is for the order of preferable criteria of the audience of higher education by HEIs, i.e., geographic, demographic, behavioral are placed in descending order, respectively.

The representatives of HEIs state that the greatest advantage of the Internet is the quick access to necessary information, which provides higher quality cooperation with students, and improves public relations and the effectiveness of promotional activities. It is widely used for secondary and primary marketing research of HEIs. Most often, the analysis of the competitive environment is carried out online. Opinions were least divided concerning the existing practice of tracking student activities in social media.

The most widespread advertising activities are social media, traditional banners, and video advertising. Advertising activities were the most targeted on a geographical basis.

The study also allows us to outline some ways to improve the marketing activities of HEIs on the Internet. Since private higher education institutions use the Internet more often in marketing activities related to providing educational services, it is advisable for state higher education institutions to expand their activities on the provision of educational services on the Internet. The low level of marketing activity during online interviewing, interviewing with the help of communicator programs, interviewing on discussion forums, and implementing questionnaires via e-mail can serve as a guide to make higher education institutions work more efficiently. The Ukrainian universities should work more for getting sponsors. Polish higher education institutions should focus on Internet-based activities to promote their own brands. They should also focus on e-commerce, market research, and e-learning. It is also advisable to increase the awareness of HEI employees who are involved in marketing, in terms of using the Internet to analyze market information through discussion forums, search engines, and business directory websites; in matters of interviewing and in advertising in the following forms: website sponsorship: amplifying on internet-forums, direct e-mails, derivative forms of traditional banners (e.g., skyscraper, billboard, other non-standard size billboards); pop-up banners.

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Streszczenie

Analiza porównawcza praktycznego wykorzystania internetu w działaniach marketingowych uczelni wyższych w Polsce i na Ukrainie

W warunkach ery informacyjnej zwiększa się rola szkolnictwa wyższego w systemie czynników stymulujących postęp społeczny, wzrasta też poziom konkurencji w środowisku dostawców tych usług. Wymaga to dywersyfikacji polityki marketingowej instytucji szkolnictwa wyższego, jej digitalizacji i integracji w przestrzeni wirtualnej. W celu zbadania roli narzędzi internetowych i ich znaczenia w działaniach marketingowych przeprowadzono badania ankietowe wśród menedżerów i specjalistów instytucji szkolnictwa wyższego na Ukrainie i w Polsce. Uzyskane dane posłużyły jako podstawa do badania poziomu zmienności, podobieństwa struktur i ogólnej spójności odpowiedzi respondentów z tych dwóch krajów. Zweryfikowano hipotezy dotyczące braku istotnych różnic między przewidywaną rolą Internetu w działalności marketingowej instytucji szkolnictwa wyższego w Polsce i na Ukrainie, spójności odpowiedzi respondentów z tych dwóch krajów na temat poziomu rozpowszechnienia praktyk korzystania z Internetu w działaniach marketingowych instytucji szkolnictwa wyższego oraz docierania przez Internet do potencjalnych studentów przez szkoły wyższe z uwzględnieniem czynników geograficznych.

Dominująca cecha Internetu – szybki dostęp do informacji – umożliwia skuteczne działania marketingowe. Osoby zarządzające szkołami wyższymi powinny zwiększyć świadomość pracowników działów marketingu w zakresie korzystania z Internetu w celu rozszerzenia świadczenia usług edukacyjnych, zintensyfikowania interakcji z klientami, przyciągnięcia sponsorów, promowania własnych marek, badań rynku i tym podobnych.

Słowa kluczowe: instytucja szkolnictwa wyższego, działania marketingowe, marketing internetowy, komunikacja marketingowa, podobieństwa strukturalne, wariacje, korelacja rang

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Biosimilars in the French and Polish System: Chosen Aspects of Reimbursement and Access

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Abstract

The EU approved the first biosimilar drug in 2006. By 2017, the EU had authorized the highest number of biosimilars worldwide, acquiring considerable experience in their use and safety. In May 2019, the European Medicines Agency (EMA) search engine showed 54 authorized biosimilars. Biosimilars reduce public expenditure; however, the discussion about their potential disadvantages is still ongoing.

Each country adopts different regulations on the interchangeability, switching, and substitution of a reference medicine by its biosimilar, since the EMA does not regulate this issue. Additionally, each nation has a unique reimbursement system, which results in significant differences in patients' access to biosimilars. The importance of securing a higher availability of these cheaper versions of biological drugs is well-recognized.

The better the access to these biosimilars is, the lower the overall drug expenditure and need for rationing would be, and therefore the better treatment results.

The aim of this paper is to compare selected aspects of reimbursement and access to the EMA authorized biosimilar medicines in two countries – France and Poland. The stated drug policy goal of both countries is to significantly improve biosimilar implementation in the coming years.

The research is based on an analysis of four main sources: the EMA biosimilars database, the Polish reimbursement list published by the Polish Ministry of Health, and two French reimbursement databases published by the French Ministry of Health. An additional literature review was conducted. The expected results concentrate on differences in the number of reimbursed biosimilars, the average time between EMA authorization and country reimbursement decision date, and the availability

of biosimilars registered outside of the centralized (EMA) procedure. These findings could identify areas of improvement and help with discussions on how to optimize the reach of biosimilars, as well as improve French-Polish collaboration on this matter.

Keywords: biosimilars, biosimilar medicines, healthcare system, reimbursement, access, EMA, Ministry of Health

JEL: H51, H75, I15, I18

Introduction

In April 2006, the European Medicines Agency (EMA) approved Human Growth Hormone Omnitrope (somatropin) by the pharmaceutical company Sandoz. The company convinced the EMA that their biosimilar product is a safe and effective alternative to the original biological product. This opened the doors to other biosimilars representing various therapeutic areas (EMA 2017). Since then, biological medicines have provided effective treatment options in a number of clinical specialties, including dermatology, gastroenterology, rheumatology, and oncology (O'Callaghan et al. 2019).

Innovative drugs are expanding in Europe, and their prices are sometimes reaching vertiginous levels. For instance, in May 2019, the pharmaceutical company Novartis announced the launch of a new drug, which would cost an estimated $2.1million (Reuters 2019). While expenditures on drugs are rising rapidly, countries' budgets are not stretching accordingly. Price and volume are the two basic factors that pharmaceutical expenditures are based on. Consequently, governments have two tools at their disposal – regulations aimed at lowering drug prices or at reducing usage. At the same time, most advanced countries' populations are aging, while there are increasing pharmaceutical options for disease control (Gronde, Uyl-de Groot, Pieters 2017).

Definition

According to the EMA, a biosimilar can be defined as, 'a biological medicine highly similar to another biological medicine already approved in the EU (the so-called 'reference medicine')' (EMA 2017).

The purpose of these biosimilars is then to replicate the original biological medicine similarly to how a generic drug replicates a medicine produced by chemical methods (Gámez-Belmonte et al. 2018).

Method of production and testing

The difference between biosimilars and generics arises from their complex manufacturing process: the molecules are large (unlike small-molecule, chemically produced drugs), their structure is complex, and they come from a unique line of living cells (Si-

moens et al. 2017; Gámez-Belmonte et al. 2018) developed as the patents for original biologicals expire. They are thus developed to replicate an original biological medicine just a generics are intended to replicate a chemically-synthesized medicine; however, there are important technical and regulatory differences between the two. Unlike chemical drugs, molecular identity cannot generally be established for any two biological drugs. Accordingly, their pharmacological properties cannot be assumed to be the same. This is due to the complexity of the production of biologicals and to the presence of minor natural variations in the molecular structure (collectively known as microheterogeneity. Thus, this process does not produce exact copies of the original drug but will include slight differences between the structure of the original and the copy molecules (EMA 2017). They end up being highly similar, but not identical to the originator biologic (Yelena Y Janjigian et al. 2018)

Testing the biosimilar starts with analytical studies that aim to show similarity in the structure of the molecule, meaning the amino acid sequence and the higher-order structure, as well as the functional similarity. Animal studies might follow in order to evaluate in vivo toxicity and bioactivity. Finally, a clinical trial program with head-to-head comparison might be done in order to assess the pharmacokinetics, clinical safety and efficacy, as well as the immunogenicity of the biosimilar vs. the original biologic drug (Yelena Y Janjigian et al. 2018). If the original biologic has multiple indications, testing one indication and extrapolating to the rest should be possible, just as it is after major changes to a biologic's manufacturing process (EMA 2017).

Cost

It is estimated that the cost to develop a new biologic is close to $800 million, whereas the cost to develop a biosimilar ranges from $75 to $250 million (Kiss, Fine, and Krawitz 2018). Biosimilars end up reducing payer costs by 20 to 30% when compared to the reference product. This cost reduction can vary widely between countries within the EU, as seen with the infliximab biosimilar costs in Norway (Trifirò, Marcianò, Ingrasciotta 2018).

More competition generally equals reduced healthcare costs for payers and patients, and this remains the case for treatment classes with the introduction of a biosimilar. This reduction in cost is not only due to the biosimilar's smaller price tag, but also to a decrease in the price for the original biologic. Price variation between different classes also seems to be largely dependent on the length of time a biosimilar has been on the market. The longer a treatment class has had a biosimilar, the cheaper it gets.

A notable issue with biosimilar cost assessments is a blind spot due to non-published discounting for countries. This has the effect of overstating the real cost of drugs. Prices are not the only factor impacting patient access – other factors include new indications or restrictions, changes in the economic conditions of the country, or changes in the prevalence of the disease (IQVIA 2018).

Volume

The price reduction brought on by biosimilars is often accompanied by an increase in patient access, which can vary widely, and which is partly dependent on the initial volume of treatment in the country. Examples of these changes in patient access are a massive increase of ~1900% in 'volume treatment days' in Bulgaria for GCS-F drugs, and increases of ~400% for Austria and Poland in anti-TNF and EPO classes, respectively (IQVIA 2018).

The question of interchangeability (difference vs. switching and substitution)

Three terms are important in order to understand how biosimilars are used in practice: interchangeability, switching, and substitution. These three terms are often confused for one another and misunderstood.

Interchangeability refers to the option of exchanging two drugs while keeping the expected treatment effect. This could be exchanging an original biologic with a biosimilar, a biosimilar with its original biologic, or a biosimilar with another.

Switching is when the prescriber decides to exchange one drug for another with the same therapeutic intent.

Substitution is when the pharmacist dispenses one drug instead of another one (both being interchangeable) without consulting the prescriber (EMA 2017).

Richer countries are generally careful about allowing automatic substitution of biologics due to the question of immunogenicity, which will be discussed further below, whereas lower-income countries might encourage substitution in order to reduce healthcare costs (Trifirò, Marcianò, Ingrasciotta 2018).

There have been numerous debates about the interchangeability of biosimilars with reference products based on concerns of immunogenicity caused by switching between biological products. This immunogenicity could cause a reduction in efficacy and an increase in toxicity (Trifirò, Marcianò, Ingrasciotta 2018). It will vary depending on the characteristics of both the product (changes to the protein structure), the method of administration (intravenous versus subcutaneous, for example), as well as patient and illness factors (concomitant treatments, age, etc.).

However, harmful immunogenicity is unlikely after switching. A patient might be treated by a biologic drug for a long time, and switching or even manufacturing changes to the biologic are unlikely to trigger harmful reactions.

Long term data is lacking, though, and post-marketing monitoring by regulatory authorities is invaluable to know more about these rare immune reactions (EMA 2018).

Methodology

All 54 biosimilars that are intended for human use and registered on the official EMA website (EMA 2019) through their centralized procedure are accounted for in this study. Biosimilars which were refused authorization by the EMA, or whose application was withdrawn by the company, were excluded. Biosimilars and biologics were included only once; any redundancies were excluded. Data were last checked on May 1st, 2019. The research was done by each of the authors independently. The final tally was 54 unique biosimilar drugs corresponding to 16 original biologics studied in this article.

In order to gather data about the reimbursement situation in both countries, official government websites were used. The main websites for the French part were two search engines:

- http://www.codage.ext.cnamts.fr/codif/bdm_it/index.php?p_site=AMELI (cnamts.fr, accessed: 1.05.2019) and
- http://base-donnees-publique.medicaments.gouv.fr/ (medicaments.gouv.fr, accessed: 1.05.2019).

The final check of those databases was done on May 1st, 2019.

In Poland, reimbursement lists have been published every two months since 2012 on the official website of the Polish Ministry of Health (MZ 2019). Data were collected by checking relevant lists. In order to collect data about biosimilars potentially reimbursed before 2012 (7 out of 54 registered drugs), older versions of the Polish Ministry of Health website were consulted. The last consulted list was the one valid from May 1st, 2019.

The reimbursement dates presented in this publication are the dates when the reimbursement decisions came into force, not the dates of the decisions themselves; If multiple dates were found (for example, for different indications), only the earliest date was kept. Also, in the case of multiple reimbursement levels, only the highest was included.

The average time between the EMA registration dates and the country reimbursement decision dates was measured in two ways. This was in order to reduce measuring errors induced by the less transparent and accessible pre-2012 Polish data. In 2012, the Polish "Act on Reimbursement of Medicines, Foodstuffs Intended for Particular Nutritional Purposes and Medical Devices" came into force. The first of two sets of calculations were done using all reimbursed biosimilars (35 out of 54). In the second set of calculations, the seven pre-2012 drugs were excluded.

Some other parameters, such as the lack of willingness of a pharmaceutical company to introduce a generic drug in a given market due to promotion costs or entry costs, market size, demand for the given drug, pricing strategy, or available quantities of biosimilars can play an important role in the usage and reimbursement of generics. However, access to this data is limited and often confidential, which is why the authors focused only on available and verified data presented in this article – the num-

ber of reimbursed biosimilars, the average time between EMA authorization and the country reimbursement decision date, and the availability of biosimilars registered outside of the centralized (EMA) procedure.

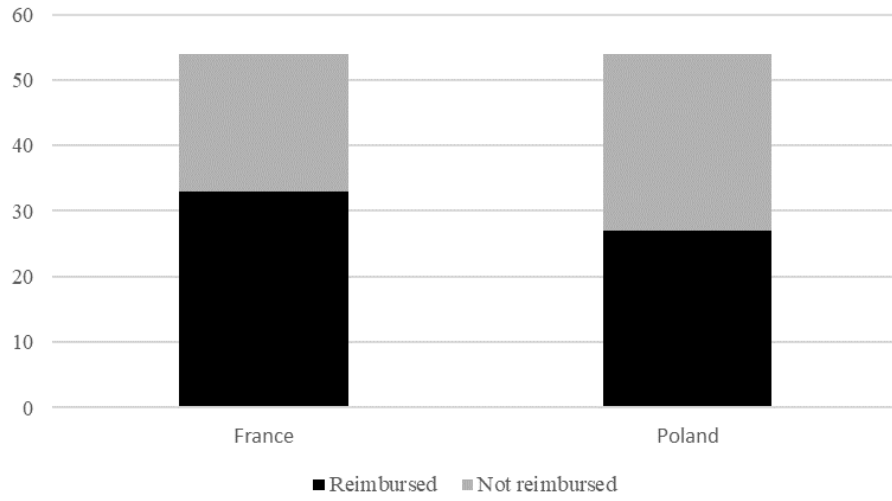
Results

Based on the criteria listed above, 54 unique biosimilar medicinal products registered by the EMA through its centralized procedure and until May 2019 were accounted for. The biggest manufacturer by the sheer number of unique biosimilars was Sandoz GmbH, with 11 biosimilars out of the 54 (20%). The next manufacturers were: Celltrion Healthcare Hungary Kft (6 drugs), Pfizer Europe MA EEIG (5), Mylan S.A.S (4) and Samsung Bioepis NL B.V. (4).

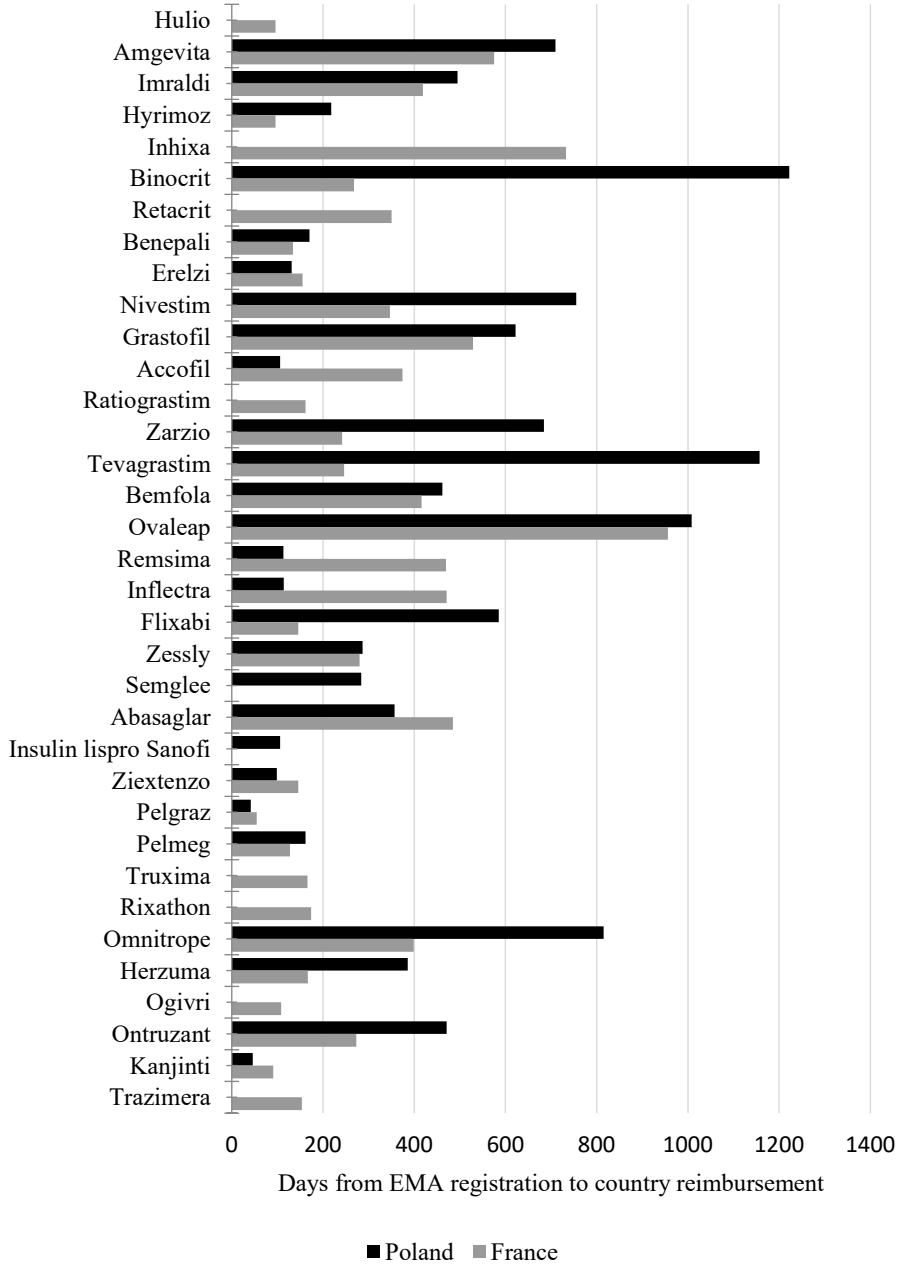
Around 60% were registered by the EMA between the beginning of 2017 until the end of 2018, so in only a 2-year period.

The 54 biosimilars represented 16 different original biologics. All the original drugs were reimbursed in France. In Poland, there were two exceptions. Forsteo (teriparatid) is not reimbursed, and Eprex (epoetin alfa) is no longer present on the reimbursement list.

Not all the biosimilars are reimbursed. The French healthcare system covers costs of 33 out of the 54 (61%) registered biosimilars, whereas in Poland, 27 (50%) of the 54 biosimilars are reimbursed (Graph 1).



Graph 1. Number of reimbursed vs. non-reimbursed biosimilars in France and Poland
Source: Polish and French health ministries' websites.



Graph 2. Number of days from EMA registration to reimbursement in Poland and France
Source: websites of the Polish and French health ministries and the official EMA website (data last checked May 1st, 2019).

Most of the time (in over 90% of cases), there were no other biosimilars reimbursed in either country and that were registered through a different procedure than the European centralized one.

In both countries, almost all the biosimilars are fully reimbursed, with no co-payment. In the Polish system, there were some exceptions where patients needed to pay a standard lump sum of 3.20 PLN (less than 1 EUR). As mentioned, the highest possible reimbursement percentage was collected in this research.

In 17 cases, France made reimbursement decisions faster than Poland did. The opposite was true for eight examples. Eight biosimilars were reimbursed in France but not in Poland, and 2 in Poland but not in France.

The average time between the EMA registration date and the reimbursement date in France was 297 days, which was 133 days shorter than in Poland, where the average time was 430 days. In the second set of calculations (without the seven pre-2012 drugs reimbursed in Poland), the results change to an average time of 300 days for France and 317 days for Poland (Graph 2). The trend is preserved in favor of France; however, the difference is only 17 days in this set of calculations.

Discussion

Biosimilar market penetration varies across European countries, going from 5% for the share of biosimilar anti-tumor necrosis factor (anti-TNF) inhibitors in Ireland and Belgium to 90% in Denmark (O'Callaghan et al. 2019).

Of the 54 biosimilars representing 16 original biologics, only around 50 to 60% are reimbursed in France and Poland. Surprisingly, however, the percentage of drugs reimbursed is quite similar between the two countries despite the difference in the size of the two economies. Interestingly also for the patients, most biosimilars could be fully reimbursed.

The EMA registered 54 unique biosimilars representing 16 different original biologics. Meanwhile, France and Poland use 50–60% of them. Reimbursement uptake seems equal in both countries. The percentage of reimbursed drugs might further increase since 60% of the reimbursed drugs were registered only recently, between January 2017 and December 2018. From the patients' perspective, the most interesting outcome was that in both countries, almost all of the biosimilars were reimbursed at 100%.

The main difference that was found between the two countries was the average time between the EMA registration date and the reimbursement date. In 17 cases, France made reimbursement decisions faster than Poland, and in only eight examples was the Polish decision faster. In France, the average time equaled 297 days (300 days in the set of calculations excluding drugs registered before 2012) and was shorter by 133 days (17 days in the second set of calculations) than the average Polish time, which equaled 430 days. The French reimbursement system seems to be slightly faster.

A review of the press, literature, and legislation shows that both countries present similar and generally positive attitudes towards biosimilars. France and Poland are two of the few European countries that allow for the substitution of biologics by the pharmacist without the consent of the provider.

In Poland, biosimilar substitution can be applied in practice in most cases, despite some reservations by the national Polish pharmaceutical association, INFARMA (INFARMA 2019), regarding the treatment of biologics as if they were chemical drugs.

In France, on the other hand, some legislation has been introduced but not yet implemented. For now, this allows for substitution at treatment initiation, but not afterward, while informing the prescriber of the biosimilar name written on the prescription (data from 2017) (Rémuzat et al. 2017; O'Callaghan et al. 2019).

Policy on biosimilars – France

With Omnitrope (somatotropin) in 2006, France was the first country in Europe to authorize biosimilars. One of the goals of the 2018–2022 National Health Strategy established by the French Ministry of Health was the promotion of the correct use of medicines and the development of generics and biosimilars. Among the detailed actions listed in this plan, France aims for 80% biosimilar penetration by 2022. This plan does not define what steps will be taken to achieve this goal, as the document only mentions developing digital tools to aid providers. The French 2014 budget pushed for pharmacy-level substitutions. The substitution policy was revamped in 2017. Another big step in 2017 was the creation of the biosimilar registry (Ministère des solidarités et de la santé 2018a, 2018b).

Policy on biosimilars – Poland

There is no separate definition of a biological medicine in the Polish legislation, which leads to interpretative ambiguities. Despite the clear EMA guidelines, biosimilars follow basically the same rules as generic medicines, particularly when it comes to substitution. Reducing costs is a major reason for this. This might have a negative impact on doctors' autonomy and patients' rights (DemosEUROPA 2015).

Two of the six strategic objectives presented in the Drug Policy of Poland for 2018–2022 are indirectly related to biosimilars. These include: (1) providing safe and effective medicines, available at the right place and at the right time, and (2) constantly improving the health of the population, by optimizing public expenditure, and ensuring the widest possible access to effective, safe and cost-effective therapies.

In order to achieve these strategic objectives, ten specific priorities have been set, of which one is "*increasing the safety and stability of drug supplies by increasing the market share of drugs manufactured in Poland, including bioequivalent drugs*" (Ministerstwo Zdrowia 2018). The topic of substitution was also widely discussed in the

subsection concerning the reduction of patient co-payment. However, these parts do not specify whether it only refers to generics or also to biosimilars. This goal is to be achieved, among others, by conducting a coherent policy of substitution based on increasing the number of available therapeutic options; and strengthening educational activities (Ministerstwo Zdrowia 2018).

The Polish healthcare system aims to support innovation in the Polish medical industry. One of the ideas is the establishment of the Virtual Institute of Medical Biotechnology. The idea of this institute is to finance the best research teams in a selective and stable manner and then commercialize their research results (Ministerstwo Zdrowia 2018).

Proposed solutions and examples

Increasing market penetration means putting policies in place that encourage interchangeability with original biologics. Such policies involve tendering, incentivizing healthcare professionals, encouraging substitution, and improving awareness and perception of biosimilars among healthcare professionals.

Tendering: Multiple European countries have seen great success in reducing costs through their national tendering processes for biologicals. The Norwegian Drug Procurement Cooperation, for example, succeeded in reducing their costs for anti-TNF biologics by 39% in 2014 and increasing it to 69% in 2015 (O'Callaghan et al. 2019).

Incentivizing healthcare professionals and gainsharing: Prescription quotas for biologicals can be very successful for increasing biosimilar market penetration, with the example of epoetin biosimilars reaching 67% of total sales in Germany in 2014–2015. In Sweden, the money saved in a hospital by switching pediatric patients to biosimilar somatropin was reinvested in its clinic. In France, a system of compensation on public health goals called ROSP includes the ratio of use of insulin glargine biosimilars for outpatients, but no other biologics. Extending the ROSP system to other biosimilars could increase market penetration as well.

Gainsharing: in France, the difference between the reimbursement tariff and the actual price paid is divided between hospitals and the social security system. Hospitals can avail these benefits only in particular circumstances (O'Callaghan et al. 2019).

On the Polish side, one idea which was particularly stressed during an experts' workshop in 2016 was the introduction of a definition for biological and biosimilar medicine on a statutory level. Another was the need for clarification on the conditions for substitution, recommending possible automatic substitution for patients initiating treatment but less so for those that have already started treatment, while insisting on the importance of consent by doctor and patient (EY Life Sciences 2018).

An active approach to education and information sharing was recommended, for example, by creating a post-registration evaluation system that focuses on the needs of doctors without adequate information. Other strategies were increased training of patients and physicians about medicines using EMA best practices and building

a communication platform with information about biosimilars. Another suggestion is to create a registry of medical problems in the context of the use of biological medicines. There was a general consensus on the need to expand the information delivered by the Registration Office, including via social media (EY Life Sciences 2018).

Conclusion

Biosimilars do not just reduce costs for payers; they also have an effect on increased treatment access for patients. Currently, 50–60% of biosimilars registered by the EMA are reimbursed in France and Poland. The research showed that the average time from EMA registration to reimbursement date is shorter in France. Both countries have expressed an interest in improving access to biosimilars by defining it as one of the goals in their national healthcare strategies. Further efforts in terms of discussion, education, and legislation in this field are required.

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Streszczenie

Leki biopodobne we francuskim i polskim systemie: wybrane aspekty refundacji i dostępu

Pierwszy lek biopodobny został zarejestrowany już w 2006 r. Od tego czasu, EMA zdobyła znaczne doświadczenie w ich wykorzystaniu oraz tworzeniu odpowiednich standardów bezpieczeństwa. W maju 2019 r., wyszukiwarka znajdująca się na oficjalnej stronie EMA, pokazała 54 unikatowe leki biopodobne zarejestrowane przez tę instytucję. Substancje biopodobne efektywnie zmniejszają wydatki publiczne, jednak dyskusja na temat ich potencjalnych wad wciąż trwa.

Ponieważ EMA nie reguluje tego zagadnienia, każdy kraj w Europie może przyjmować inne przepisy dotyczące zastępowalności, zamiany i zamienności leku referencyjnego przez odpowiadający mu biosymilar. Ponadto każdy kraj ma unikalny system refundacji, który powoduje znaczne różnice w dostępie pacjentów do leków biopodobnych. Potrzeba i korzyści związane ze zwiększeniem dostępności biosymilarów są dobrze rozpoznane przez decydentów i promowane przez wiele europejskich państw. Im lepszy dostęp do tych leków, tym niższe całkowite wydatki na leki i mniejsza potrzeba ich reglamentacji, a zatem lepsze wyniki leczenia.

Celem niniejszej publikacji jest porównanie wybranych aspektów refundacji i dostępu leków biopodobnych zatwierdzonych przez EMA w dwóch krajach – Francji i Polsce. W obu omawianych krajach, decydenci postawili sobie jako cel zintensyfikowanie wykorzystania biosymilarów w kolejnych latach. Francja została wybrana jako komparator do polskich standardów jako przykład bogatszego i bardziej rozwiniętego kraju europejskiego.

Przeprowadzone badania opierały się na analizie czterech głównych źródeł: bazy danych EMA, polskiej listy refundacyjnej opublikowanej przez polskie Ministerstwo Zdrowia oraz dwóch francuskich baz danych refundacyjnych opublikowanych przez francuskie Ministerstwo Zdrowia. Dodatkowo przeprowadzono przegląd literatury. Otrzymane wyniki koncentrują się na różnicach w liczbie refundowanych leków biopodobnych, średnim czasie między rejestracją EMA a datą rozpoczęcia refundacji oraz dostępności leków biopodobnych zarejestrowanych poza procedurą scentralizowaną (EMA). Wyniki mogą pomóc w identyfikacji potencjalnych obszarów do poprawy, a także wesprzeć dyskusję na temat optymalizacji dostępu do leków biopodobnych. Jest to również dodatkowy krok w stronę francusko-polskiej współpracy w zakresie biosymilarów.

Słowa kluczowe: biosymilary, leki biopodobne, system ochrony zdrowia, refundacja, dostęp, EMA, ministerstwo zdrowia

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Trends in Tobacco Consumption – a Comparative Analysis of WHO European Region Countries

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Abstract

Tobacco consumption, as well as the consumption of any other psychoactive substances, lead to addictions, which is a serious problem that modern societies have to face. To reduce the negative consequences of nicotine consumption and to provide sustainable development, many governments, in both developed as well as developing countries, adopt policies to reduce tobacco production and consumption. For example, they implement various health programs to combat addiction, and they also provide appropriate financial and fiscal resolutions. Any actions taken at different decision-making levels are often bounded with economic and financial policies of a particular state, including fiscal policy.
State interventionism concerning tobacco is most visible in developed countries such as the US, Canada, and European Union countries. Developing countries and Asian countries have also started to introduce regulations concerning tobacco consumption on a large scale in response to the negative effects of nicotinism.
The main aim of the paper is to show consumption trends as well as the fiscal and price policies of tobacco products. The theoretical part is supplemented by data from reports and analyses presented by the World Health Organization (WHO).

Keywords: Tobacco, Tax, public policy

JEL: H71, I18

Introduction

Nowadays, smoking is one of the biggest problems of public health and one of the greatest threats to civilization. It is connected with the prevalence of smoking as well as losses incurred by society, and also indirectly by the economy, which has to bear the costs of treating people suffering from illnesses that result from smoking. Smoking is generally considered an addiction, and the mechanism of nicotine effects is similar to the effects of highly addictive substances such as cocaine or heroin (Tubek 2003, pp. 33–34).

Nicotinism is an addiction in which two types of addictions – pharmacological and behavioral – overlap. Pharmacological addiction is related to the need to maintain a specific concentration of nicotine in the blood serum. By contrast, behavioral addiction is an effect of psychological, environmental, cultural, and social factors. What plays a crucial role in someone starting to smoke is the example of parents, teachers, and peers who smoke, as well as advertisements for cigarettes. Additionally, social acceptance of such behavior in the family, closest friends, or place of work foster smoking (Samochowiec, Rogoziński, Hajduk, & Skrzypińska 2001, p. 327).

A significant social and economic problem is not just the fact that smoking is harmful to the smoker, but it also leads to the secondary addiction of people inhaling tobacco smoke as a result of passive smoking. Smoking, both active and passive, has a negative effect on health and health-related costs (costs of treatment) as well as on the financial status of smokers (there is a bigger financial burden for smokers and their families) and the economy (a decrease in productivity and employment, absence of working-age people who smoke due to illnesses and premature deaths).

Smokers are not only exposed to the effects of nicotine but also to the effects of over 4000 other chemical substances. Tobacco smoke can cause cancer in 14 locations in the body. A strong cause and effect relationship is observed in the occurrence of malignant neoplasms of the lungs, pharynx, throat, mouth, renal pelvis, urinary bladder, and pancreas. A weak cause and effect relationship was confirmed in the occurrence of malignant neoplasms of the stomach, nose, lips, liver, kidney, and also with leukemia. What is more, smoking markedly increases the risk of cardiovascular diseases and respiratory diseases, and it has a negative influence on fertility, the weight of newborn babies and can also be a cause of sudden infant death syndrome (Samochowiec, Rogoziński, Hajduk, & Skrzypińska 2001, p. 324).

All of the abovementioned factors confirm that tobacco is a substance that can be considered socially undesirable, and its distribution and consumption should be restricted by implementing appropriate public policies. In the majority of countries, it is the state that has a monopoly on the production and distribution of tobacco products. It results in a conflict of interest as, on the one hand, consuming tobacco products has devastating effects on public health and the economy; on the other hand, the profits from distribution are a significant source of budget income (Rosiński 2014, p. 91). However, in the long run, restricting the consumption of tobacco products results

in reduced costs of tobacco-related illnesses as well as prolonged economic productivity of society along with the extended active professional life. Therefore, a restriction on smoking is in the public interest.

In order to restrict the consumption of socially undesirable goods, the public sector can take advantage of a number of tools. They include imposing excise tax, a ban on tobacco advertising, as well as restricting sales and consumption of tobacco products to specific legally designated places (Folland et al. 2011, p. 933).

A review of the literature

The main aim of the paper is to show how particular economic instruments, such as pricing policy and fiscal instruments, influence the consumption of legal tobacco products as well as the development of illegal sources of their distribution. Similar studies were conducted in various parts of the world in countries that differed in terms of economic development and culture. This type of research is of particular importance for less developed countries as it is in these countries where a large part of the global market for tobacco goods is concentrated. According to a report by Tobacco Atlas concerning the global consumption of tobacco products, although the number of cigarettes smoked is falling, many tobacco companies expand into densely populated Asian countries (about 40% of all cigarettes in the world are smoked in China). The biggest increase in the number of cigarettes smoked connected with this expansion is observed in Africa and in countries of the Eastern Mediterranean Basin (https://tobaccoatlas.org/, accessed: 20.07.2019).

One Asian country that has battled to combat the nicotinism epidemic among its citizens is Thailand, where the excise duty on cigarettes was raised in 2009. Husain et al. published an article in which they present the results of studies concerning the effects of the tax increase there in two selected years: 2009 and 2011. In the study, a logit regression model was used to examine the correlation between the change in the price of cigarettes in specific pricing categories and their consumption in two regions of Thailand. The results clearly show that, together with an increase in cigarette price due to the tax raise, the number of cigarettes smoked did not fall. This was mainly because consumers gave up smoking expensive brands of cigarettes whose prices increased most in order to buy cheaper ones (Jami et al. 2017, pp. 4–9).

A similar study was conducted in Spain in 2018. Unfortunately, the results from this study are similar to the ones mentioned above – an increase in cigarette price connected with a tax increase on tobacco goods does not markedly influence the number of smokers because together with a fall in cigarette consumption, the consumption of cheaper substitutes increases, including cut tobacco (Burguillo, Romero-Jordán, & Sanz-Sanz 2019, pp. 1–8).

In contrast to the abovementioned results, Blecher describes high taxes on alcohol and tobacco as an effective method to reduce the consumption of these substances

in society. He suggests that similar solutions should also be used for sweetened beverages, which is the reason for the obesity epidemic in developed and developing countries (Blecher 2015, pp. 175–179). He explains the effectiveness of fiscal changes introduced in South Africa to reduce the number of smokers with a form of imposed tax. In this case, we are dealing with a rate assigned to every cigarette, not a percentage of their price. So, it limits the possibility of finding a cheaper substitute in the form of other, cheaper cigarette brands or cut tobacco. Such a solution is also less profitable from a fiscal point of view, as taxes with such rates are generally simpler to collect and thus are an effective source of budget income.

In turn, in the article by Hu and Mao, one can find an interesting analysis of the problem of consuming tobacco products in China from the perspective of the state budget. The authors, based on research, claim that increased cigarette prices resulting from an increased tax rate from 40% to 50% between 1980 and 1997 meant that state budget losses doubled in respect of tax income from tobacco growers and local taxes. On the other hand, increasing the tax rate by 10% could help save between 1.44 million and 2.66 million lives (Hu & Mao 2002, pp. 105–108).

Slightly different conclusions are presented in the report concerning nicotinism in Poland (Czart Ciecierski, Cherukupalli, & Weresa 2011). It shows that increasing the average excise tax to PLN 9.76 for a packet of cigarettes in Poland might cause 618,000 adults to give up smoking, and 215,000 young people might be discouraged from starting smoking. It would result in a decrease in the number of premature deaths by 7.2%. Additionally, income from excise tax would increase by PLN 7.1 billion. Similar problems of the taxes on tobacco products have been investigated by the scientists all over the world (Koch 2018, pp. 12–28; Motnyk, Chrobot, & Zemła 2016, pp. 184–190; Rosiński 2014, pp. 91–102; Salti & Brouwer 2016, pp. 161–169; Riahi, Rohani & Rajabi 2018, pp. 767–774).

In June 2004, Poland signed the WHO Framework Convention on Tobacco Control, which was then ratified in September 2006. Pursuant to the provisions of the convention, a higher excise tax on tobacco products is one of the most effective tools to limit the distribution and usage of tobacco products. The European Union acknowledged that accepted rules concerning excise tax are the framework policy whose effect is a tax raise, which is tantamount to an increase in prices. Therefore, Poland is obliged to impose excise tax on cigarettes, and it consists of two elements: a fixed rate for 1000 cigarettes and a rate that is dependent on the value of sales, which is a percentage of the maximum retail price placed by a producer on every packet of cigarettes. The European Union also determined a minimum level of tax expressed both in a nominal form (euro) as well as a percentage of the price (Czart Ciecierski et al. 2011, p. 5).

Smoking is a phenomenon whose volume is geographically and culturally diverse. The WHO uses its own division into regions, which is used in this paper to illustrate the differences.

On average, the biggest number of cigarettes smoked per capita in 2017 was in the European WHO Region – 24.50. The Western Pacific Region comes second – 22.20.

Third place goes to countries included in the South-East Asia Region – 19. For this reason, the territorial range of the study is limited to countries in the European Region.

Table 1. Number of cigarettes smoked daily per capita in 2017 by WHO region

WHO region	Number of cigarettes smoked daily per capita
Africa	7.8
Americas	12.6
Eastern Mediterranean	13.70
Europe	24.50
South-East Asia	19.00
Western Pacific	22.20

Source: own study based on WHO data, https://www.who.int/tobacco/global_report/2015/en/ (accessed: 20.07.2019).

Tobacco consumption – the main trends

In the countries of the European Region, where the number of cigarettes smoked daily is the biggest, smokers account for about 30% of the whole population (data from 2014). Smokers in the European Union constitute about 24% of the population, of whom 19% are heavy smokers, and 4.7% are occasional smokers. The highest percentage of smokers in 2014 was noted in Bulgaria (about 35%), Greece (about 33%), and Turkey (about 33%). In these countries, the biggest number of addicted smokers was also noted – 28% in Bulgaria, and 27% in Greece and Turkey. The largest proportion of non-smokers in the population of above 80% was noted in 2014 in Sweden, Great Britain, Iceland, Finland, and Portugal. On the other hand, the number of occasional smokers is the biggest in Ireland (7.4%), Czechia, and Denmark (7.1%).

Table 2. Smoking of tobacco products in 2014

GEO/SMOKING	Non-smoker	Daily smoker	Occasional smoker
EU 28	76.1	19.2	4.7
Belgium	77.0	18.9	4.1
Bulgaria	65.2	28.2	6.5
Czechia	71.3	21.5	7.1
Denmark	79.1	13.8	7.1
Germany	78.3	15.9	5.8
Estonia	72.4	23.5	4.2
Ireland	78.0	14.6	7.4
Greece	67.4	27.3	5.3
Spain	74.7	23.0	2.4
France	71.7	22.4	5.8

Table 2. (continued)

GEO/SMOKING	Non-smoker	Daily smoker	Occasional smoker
Croatia	71.3	25.0	3.7
Italy	77.3	17.8	4.9
Cyprus	70.9	25.7	3.4
Latvia	70.5	24.6	4.9
Lithuania	75.0	20.4	4.6
Luxembourg	79.5	14.6	5.8
Hungary	72.5	25.8	1.7
Malta	75.9	20.1	4.0
Netherlands	74.8	19.1	6.0
Austria	70.0	24.3	5.7
Poland	73.9	22.7	3.4
Portugal	80.0	16.8	3.2
Romania	74.3	19.8	5.8
Slovenia	75.8	18.9	5.4
Slovakia	70.5	22.9	6.7
Finland	80.8	12.6	6.7
Sweden	83.3	9.8	6.9
United Kingdom	82.7	14.2	3.0
Iceland	81.2	12.0	6.8
Norway	79.9	12.9	7.2
Turkey	67.5	27.3	5.2

Source: own study based on the WHO data, https://www.who.int/tobacco/global_report/2015/en/ (accessed: 20.07.2019).

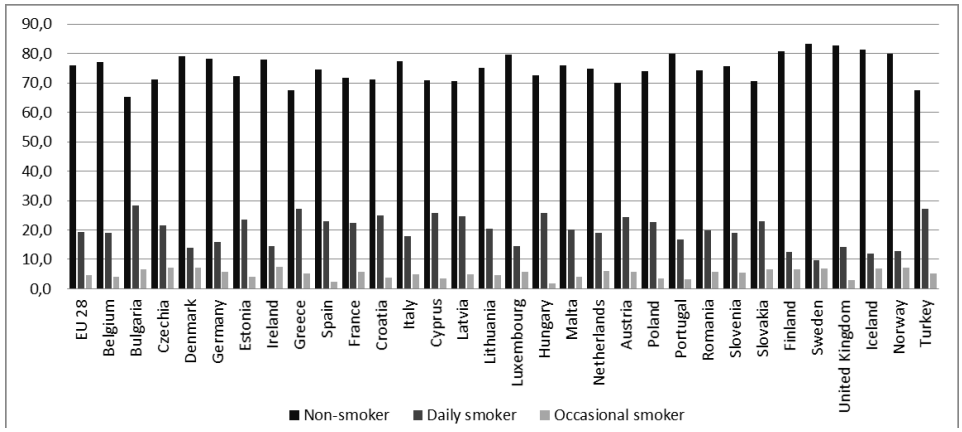

Figure 1. Smoking of tobacco products in 2014
Source: own study based on the data from Table 2.

Smoking is also a phenomenon that takes different forms, depending on the age of the smoker. According to the WHO data for 2014, the fewest addicts were noted in the age group of between 15–19. The average for the EU countries is 9.4%, while the big-

gest number of smokers was observed in Austria where up to 20% of that age group are smokers. The proportion of smokers rises with age, which is related to legal regulations concerning the availability of tobacco products for minors. In the European Union, the proportion of smokers in the 15–24 age group amounts to 15.5%, for 15–29 – 18.8%, for 18–24 – 19.3%, for 20–24 – 21.3% and for 25–29 – 24.6%. The biggest proportion of smokers in the oldest age group was noted in Bulgaria and Cyprus.

Table 3. Smoking of tobacco products by age in 2014

GEO/AGE	From 15 to 19 years	From 15 to 24 years	From 15 to 29 years	From 18 to 24 years	From 20 to 24 years	From 25 to 29 years
EU 28	9.4	15.5	18.8	19.3	21.3	24.6
Belgium	11.7	15.9	17.5	18.1	20.6	20.4
Bulgaria	9.5	20.5	27.0	27.0	32.0	37.1
Czechia	10.1	15.5	20.0	18.7	19.9	27.5
Denmark	6.1	9.8	10.3	12.0	13.5	11.4
Germany	6.8	12.1	15.0	15.1	17.3	19.7
Estonia	9.3	21.0	22.9	28.0	29.5	25.6
Ireland	7.0	12.7	15.1	14.7	17.6	19.5
Greece	8.5	17.9	23.5	22.7	27.2	34.7
Spain	10.2	18.1	23.4	23.9	25.5	32.4
France	14.7	22.2	25.4	27.3	30.4	31.5
Croatia	14.2	20.4	22.8	26.1	26.5	27.5
Italy	7.1	13.2	16.7	17.3	19.1	23.2
Cyprus	11.8	21.3	27.2	27.4	29.4	37.7
Latvia	9.8	19.6	24.1	24.2	26.6	30.7
Lithuania	7.3	13.7	18.7	18.6	20.9	29.3
Luxembourg	10.4	14.0	14.4	17.3	17.5	15.1
Hungary	19.9	27.2	30.2	30.5	33.7	35.7
Malta	11.8	15.2	18.9	18.1	18.1	26.1
Netherlands	11.2	17.3	18.9	21.6	23.0	22.1
Austria	20.0	26.8	29.9	31.2	32.5	35.5
Poland	6.6	13.4	16.4	17.4	19.5	21.0
Portugal	8.0	15.0	18.2	19.7	22.0	24.3
Romania	4.1	10.3	17.4	14.3	16.4	29.8
Slovenia	9.7	15.4	19.5	19.7	20.3	25.8
Slovakia	12.0	18.2	21.5	21.2	22.8	27.3
Finland	10.8	11.6	13.7	13.9	12.3	17.9
Sweden	5.7	7.4	7.3	8.9	9.8	7.1
United Kingdom	8.8	13.4	15.9	15.3	16.7	20.3
Iceland	3.2	7.7	8.6	10.6	13.6	10.5
Norway	1.6	5.1	6.1	6.8	8.4	8.0
Turkey	11.0	18.5	23.6	24.1	27.1	33.2

Source: own study based on WHO data, https://www.who.int/tobacco/global_report/2015/en/ (accessed: 20.07.2019).

The number of smokers differs depending on their education. In the group of people with the lowest education level in the EU, the proportion of smokers amounted to 19.5% in 2014. The biggest percentage of people who smoke every day in that age group was noted in Estonia – 30.9%, in Hungary – 29.2%, and in Turkey – 28.7%. The smallest group of smokers with the lowest education level is observed in Romania – 13.5%, Finland – 14% and Sweden – 14.6%.

Table 4. Smokers and non-smokers with less than primary, primary and lower secondary education in 2014

GEO/SMOKING	Non-smoker	Daily smoker	Occasional smoker
EU 28	77.0	19.5	3.4
Belgium	73.2	23.0	3.8
Bulgaria	71.5	24.0	4.6
Czechia	72.5	19.9	7.6
Denmark	73.3	20.0	6.7
Germany	78.2	16.7	5.1
Estonia	65.7	30.9	3.5
Ireland	76.1	18.2	5.7
Greece	73.6	23.2	3.2
Spain	75.6	22.7	1.7
France	75.5	20.6	3.9
Croatia	77.8	19.9	2.4
Italy	78.7	17.5	3.8
Cyprus	79.5	19.1	1.4
Latvia	71.5	24.1	4.4
Lithuania	83.0	14.0	3.0
Luxembourg	78.0	18.2	3.8
Hungary	69.9	29.2	0.9
Malta	74.4	22.9	2.7
Netherlands	72.3	23.2	4.5
Austria	69.4	26.7	3.9
Poland	78.5	19.5	2.0
Portugal	81.7	16.1	2.2
Romania	82.7	13.5	3.8
Slovenia	79.8	17.2	3.0
Slovakia	72.2	21.8	6.0
Finland	81.0	14.0	5.0
Sweden	79.2	14.6	6.3
United Kingdom	78.2	19.3	2.5
Iceland	77.2	15.3	7.5
Norway	72.0	19.1	8.9
Turkey	66.1	28.7	5.1

Source: own study based on the WHO data, https://www.who.int/tobacco/global_report/2015/en/ (accessed: 20.07.2019).

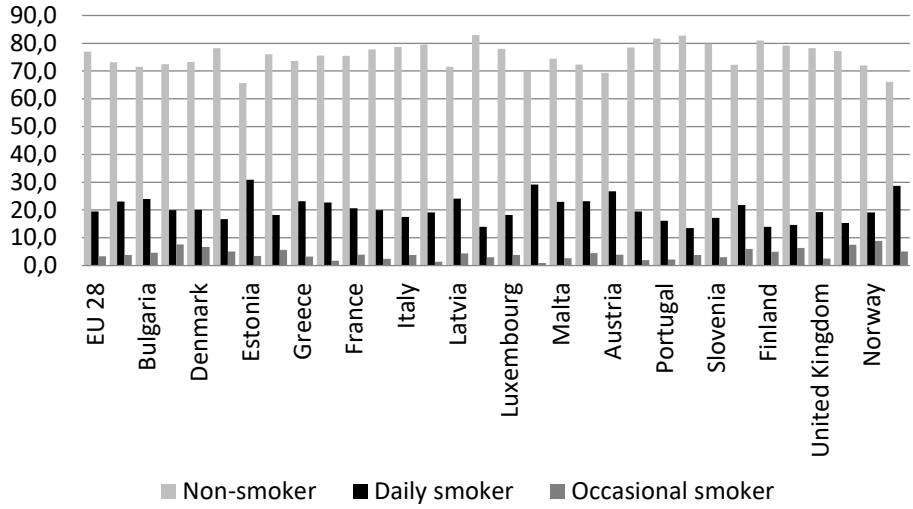

Figure 2. Smokers and non-smokers with less than primary, primary and lower secondary education in 2014
Source: own study based on the data from Table 4.

In the EU, the proportion of people who smoke every day in the group of people with secondary or higher education is greater than in the group of people with the lowest education level, and amounts to 22.7%. In 2014, the biggest proportion of smokers with that level of education was noted in Bulgaria – 33.1%, Greece – 33.1%, and Turkey – 34.1%. The country that can boast the lowest proportion of smokers in that group is Sweden, where it amounted to 10%.

Table 5. Smokers and non-smokers with upper secondary and post-secondary, non-tertiary education in 2014

GEO/SMOKING	Non-smoker	Daily smoker	Occasional smoker
EU 28	72.1	22.7	5.2
Belgium	70.6	25.1	4.3
Bulgaria	59.3	33.1	7.6
Czechia	68.3	24.9	6.8
Denmark	77.3	15.8	7.0
Germany	75.4	19.0	5.6
Estonia	68.0	28.0	4.0
Ireland	73.2	18.5	8.2
Greece	60.5	33.1	6.4
Spain	69.7	26.9	3.4
France	67.8	26.3	5.9
Croatia	66.3	29.7	3.9
Italy	74.9	19.3	5.8
Cyprus	65.9	30.5	3.6

Table 5. (continued)

GEO/SMOKING	Non-smoker	Daily smoker	Occasional smoker
Latvia	65.3	29.8	4.9
Lithuania	67.6	27.2	5.2
Luxembourg	75.5	17.8	6.7
Hungary	68.5	29.8	1.8
Malta	74.1	18.7	7.1
Netherlands	72.5	21.5	6.0
Austria	66.4	27.7	6.0
Poland	68.6	27.8	3.6
Portugal	74.0	20.2	5.7
Romania	69.7	23.6	6.7
Slovenia	71.8	22.4	5.8
Slovakia	67.6	25.9	6.5
Finland	75.1	16.7	8.2
Sweden	81.5	10.6	7.9
United Kingdom	79.1	17.5	3.4
Iceland	79.6	13.3	7.0
Norway	79.1	14.5	6.4
Turkey	59.9	34.1	6.0

Source: own study based on the WHO data, https://www.who.int/tobacco/global_report/2015/en/ (accessed: 20.07.2019).

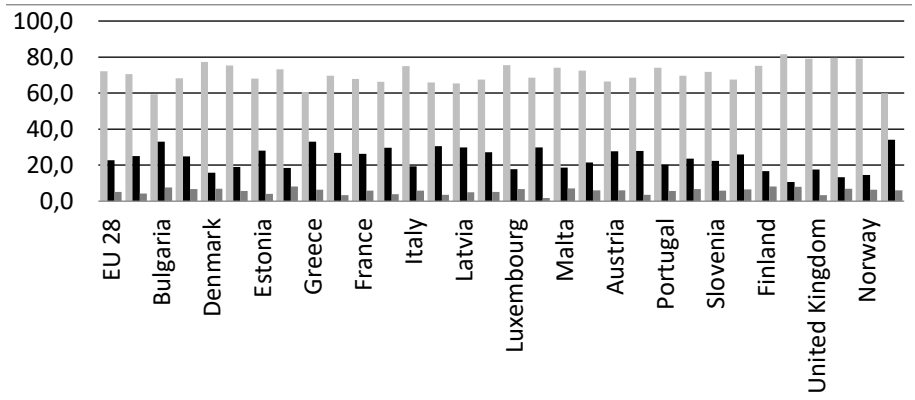

Figure 3. Smokers and non-smokers with upper secondary and post-secondary, non-tertiary education in 2014
Source: own study based on the data from Table 5.

The proportion of smokers is the lowest among people with higher education. The average rate for EU countries is 13.1%. In 2014, the biggest proportion of smokers with higher education was noted in Turkey – 27.2%, Greece – 26.1%, Cyprus – 25.6%, and Bulgaria – 23.2%. Among this group, the lowest proportion of smokers was observed in Sweden – 4.6%, Norway – 6.4%, and Iceland – 6.6%.

Table 6. Smokers and non-smokers with tertiary education in 2014

GEO/SMOKING	Non-smoker	Daily smoker	Occasional smoker
EU 28	81.4	13.1	5.6
Belgium	85.7	10.1	4.2
Bulgaria	69.6	23.2	7.2
Czechia	82.5	9.3	8.2
Denmark	83.4	9.0	7.5
Germany	82.6	10.7	6.6
Estonia	80.9	14.2	4.9
Ireland	83.9	8.3	7.8
Greece	66.4	26.1	7.5
Spain	76.5	20.6	2.9
France	73.3	18.6	8.0
Croatia	76.6	18.5	4.8
Italy	79.1	14.4	6.6
Cyprus	69.3	25.6	5.1
Latvia	80.7	13.9	5.4
Lithuania	82.7	12.7	4.6
Luxembourg	85.7	8.1	6.2
Hungary	84.7	13.2	2.1
Malta	82.2	12.5	5.3
Netherlands	81.3	10.7	8.0
Austria	78.4	14.7	7.0
Poland	83.6	12.3	4.1
Portugal	80.2	15.6	4.2
Romania	71.9	20.5	7.6
Slovenia	81.1	11.6	7.3
Slovakia	78.6	13.8	7.6
Finland	85.9	8.0	6.1
Sweden	89.0	4.6	6.4
United Kingdom	89.9	7.2	2.9
Iceland	87.7	6.6	5.7
Norway	86.8	6.4	6.9
Turkey	66.4	27.2	6.4

Source: own study based on WHO data, https://www.who.int/tobacco/global_report/2015/en/ (accessed: 20.07.2019).

What plays a crucial role in reducing the consumption of tobacco products is an appropriate state policy, i.e., tax and pricing policies. In all countries included in the European region, there are two forms of tax on tobacco products – VAT and excise tax. The latter can simultaneously appear in two forms – on the number of cigarettes sold (in the EU, the tax base is 1000 cigarettes) and as a percentage of their price.

In 2014, the biggest tax burden on tobacco products was noted in Great Britain – 82.16%, Tukey – 82.13%, Finland – 81.59%, and Slovakia – 81.54%. The lowest share of taxes and fees on a packet of the most popular cigarettes in a given country

in 2014 was noted in Iceland, Sweden, and Norway, where, on average, it amounted to 56.40%, 68.84%, and 68.83%, respectively. The average share of taxes on the price of a packet of cigarettes in all European region countries is above 70%, although there are significant differences in the price of a packet of cigarettes. The highest prices in 2014 were found in Norway – $15.59, Great Britain – $12.69, and Iceland – $10.59. At the other end of the scale are countries such as Bulgaria, Czechia, or Lithuania, where a packet of the most popular cigarettes in 2014 cost less than $4.

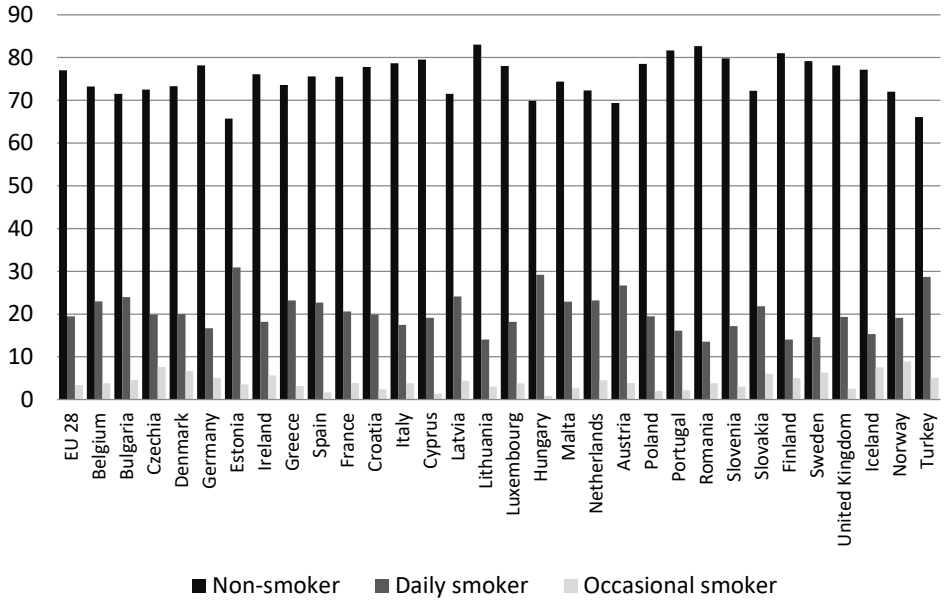

Figure 4. Smokers and non-smokers with tertiary education in 2014
Source: own study based on the data from Table 6.

Table 7. Prices of a packet of the most popular cigarette brand in USD and their taxation (in %) in the European region countries in 2014

	Price in $	Specific excise in %	Ad Valorem excise in %	VAT/Sales Tax in %	Import duties in %	Other taxes in %	Total tax in %
Belgium	7.75	8.15	50.41	17.36	0.00	0.00	75.92
Bulgaria	3.21	42.98	23.00	16.67	0.00	0.00	82.65
Czechia	3.49	33.06	27.00	17.36	0.00	0.00	77.42
Denmark	7.89	53.75	1.00	20.00	0.00	0.00	74.75
Germany	7.32	35.19	21.74	15.97	0.00	0.00	72.90
Estonia	4.68	26.57	34.00	16.67	0.00	0.00	77.24
Ireland	12.84	50.38	8.72	18.70	0.00	0.00	77.80
Greece	5.35	41.25	20.00	18.70	0.00	0.00	79.95
Spain	6.42	10.04	51.00	17.36	0.00	0.00	78.40

	Price in $	Specific excise in %	Ad Valorem excise in %	VAT/Sales Tax in %	Import duties in %	Other taxes in %	Total tax in %
France	9.37	13.93	49.70	16.67	0.00	0.00	80.30
Croatia	4.04	18.26	37.00	20.00	0.00	0.00	75.26
Italy	6.69	5.24	52.41	18.03	0.00	0.00	75.68
Cyprus	5.35	27.50	34.00	15.97	0.00	0.00	77.47
Latvia	4.01	34.53	25.00	17.36	0.00	0.00	76.89
Lithuania	3.65	33.40	25.00	17.36	0.00	0.00	75.76
Luxembourg	6.69	7.10	48.14	15.00	0.00	0.00	70.24
Hungary	4.29	25.00	31.00	21.26	0.00	0.00	77.26
Malta	6.42	34.38	25.00	15.25	0.00	0.00	74.63
Netherlands	8.45	55.09	0.95	17.36	0.00	0.00	73.40
Austria	6.56	16.33	41.00	16.67	0.00	0.00	74.00
Poland	4.41	30.18	31.41	18.70	0.00	0.00	80.29
Portugal	6.02	38.81	17.00	18.70	0.00	0.00	74.51
Romania	4.39	37.06	19.00	19.35	0.00	0.00	75.41
Slovenia	4.62	39.37	23.01	18.03	0.00	0.00	80.41
Slovakia	3.80	41.87	23.00	16.67	0.00	0.00	81.54
Finland	7.31	10.24	52.00	19.35	0.00	0.00	81.59
Sweden	8.55	47.84	1.00	20.00	0.00	0.00	68.84
United Kingdom	12.69	48.99	16.50	16.67	0.00	0.00	82.16
Iceland	10.59	36.08	0.00	20.32	0.00	0.00	56.40
Norway	15.59	48.83	0.00	20.00	0.00	0.00	68.83
Turkey	3.82	1.63	65.25	15.25	0.00	0.00	82.13

Source: own study based on WHO data, https://www.who.int/tobacco/global_report/2017/appendix-ix/en/ (accessed: 20.07.2019).

Comparing the prices of the most popular cigarettes in 2014 and 2018, a significant downward trend can be observed. The biggest reductions in prices were noted in Sweden – $1.11, Norway – $1.08, and Tukey – $1.06. The biggest increases in prices can be observed in countries such as Iceland – $2.39, Ireland – $1.48, and Finland – $1.16. The share of taxes and fees on the price of a packet of cigarettes also decreased. The most significant changes were observed in Hungary, Norway, and Germany, where the share fell by approximately 5% in 2018 compared to 2014.

Table 8. Prices of a packet of the most popular cigarette brand in USD and their taxation (in %) in the European region countries in 2018

	Price in $	Specific excise in %	Ad Valorem excise in %	VAT/Sales Tax in %	Import duties in %	Other taxes in %	Total tax in %
Belgium	7.75	19.58	40.04	17.36	0.00	0.00	76.98
Bulgaria	3.12	41.92	25.00	16.67	0.00	0.00	83.59
Czechia	4.31	31.06	27.00	17.36	0.00	0.00	75.42

Table 8. (continued)

	Price in $	Specific excise in %	Ad Valorem excise in %	VAT/Sales Tax in %	Import duties in %	Other taxes in %	Total tax in %
Denmark	7.01	53.15	1.00	20.00	0.00	0.00	74.15
Germany	7.51	30.69	21.69	15.97	0.00	0.00	68.35
Estonia	4.99	32.71	30.00	16.67	0.00	0.00	79.38
Ireland	14.32	50.66	9.04	18.70	0.00	0.00	78.40
Greece	5.40	35.87	26.00	19.35	0.00	0.00	81.22
Spain	5.87	9.88	51.00	17.36	0.00	0.00	78.24
France	9.39	14.98	50.80	16.67	0.00	0.00	82.45
Croatia	3.95	24.80	34.00	20.00	0.00	0.00	78.80
Italy	6.45	7.01	51.00	18.03	0.00	0.00	76.04
Cyprus	5.28	24.44	34.00	15.97	0.00	0.00	74.41
Latvia	4.11	42.63	20.00	17.36	0.00	0.00	79.99
Lithuania	4.40	31.47	25.00	17.36	0.00	0.00	73.83
Luxembourg	6.22	7.13	46.65	14.53	0.00	0.00	68.31
Hungary	4.54	26.02	25.00	21.26	0.00	0.00	72.28
Malta	6.45	38.91	23.40	15.25	0.00	0.00	77.56
Netherlands	8.22	49.46	5.00	17.36	0.00	0.00	71.81
Austria	6.45	21.09	37.50	16.67	0.00	0.00	75.26
Poland	4.25	26.68	31.41	18.70	0.00	0.00	76.79
Portugal	5.87	37.96	15.00	18.70	0.00	0.00	71.66
Romania	4.43	38.60	14.00	15.97	0.00	0.00	68.57
Slovenia	4.34	38.55	22.61	18.03	0.00	0.00	79.19
Slovakia	3.87	37.45	23.00	16.67	0.00	0.00	77.12
Finland	8.47	16.06	52.00	19.35	0.00	0.00	87.41
Sweden	7.44	47.38	1.00	20.00	0.00	0.00	68.38
United Kingdom	12.37	46.22	16.50	16.67	0.00	0.00	79.39
Iceland	12.98	36.13	0.00	19.35	0.00	0.00	55.49
Norway	14.51	43.97	0.00	20.00	0.00	0.00	63.97
Turkey	2.76	3.11	63.00	15.25	0.00	0.00	81.37

Source: own study based on WHO data, https://www.who.int/tobacco/global_report/2017/appendix-ix/en/ (accessed: 20.07.2019).

Conclusion

In most countries, the consumption and trading of tobacco products are subject to public sector control. This control aims to provide an appropriate amount of the state budget income, but it also involves reducing the consumption of tobacco as an undesired good. These two objectives are mutually exclusive, yet, having taken into consideration the costs of treatment of illnesses caused by smoking (both active and passive), they are much higher than the budget income achieved from sales of tobacco

products. State interventionism concerning tobacco is most visible in developed countries such as the US, Canada, and European Union countries. Developing countries and Asian countries also have also started to introduce regulations concerning tobacco consumption on a large scale in response to the negative effects of nicotinism.

What seems to be the primary economic tool used to combat nicotinism is price control. Any type of regulation that should increase the price of a packet of cigarettes, such as introducing a uniform structure of excise tax in the EU, or raising VAT rates on tobacco products, at least in theory, reduces their consumption. Analysis suggests that levels of tax rates and the price of a packet of cigarettes do not affect the percentage of tobacco addicts. This is because of the substitution effect – consumers switch to cheaper substitutes, such as cut smoking tobacco ("roll-your-own"), as confirmed by studies conducted in Spain, or tobacco products from illegal sources. Increasing cigarette prices through appropriate legal-economic regulations have the most significant impact on anti-nicotine preventive measures among young people by creating a kind of economic barrier. As can be seen from other studies, the biggest number of nicotine-addicts was noted in the group of people of working age with secondary or post-primary education.

Apart from the abovementioned intervention methods, the public sector can also affect the situation through other legislative actions such as a total ban on smoking in public places outside designated areas, which is becoming very common. This type of restriction, along with pricing and tax policies concerning tobacco products, as well as educational and preventive programs, are probably the only effective methods to combat nicotinism. A problem related to using these solutions can be the cultural roots of smoking that are particularly visible in the countries of Sothern Europe. The increasing trend in the consumption of tobacco products, mostly in developed countries, is the rising popularity of cigarette alternatives, such as hand-rolled cigarettes. This could be the reason why tobacco consumption did not fall in the European region, although prices were rising.

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Streszczenie

Wpływ instrumentów ekonomicznych na popyt, podaż i konsumpcję wyrobów tytoniowych – analiza porównawcza dla krajów regionu europejskiego WHO

Konsumpcja tytoniu podobnie jak innych substancji psychoaktywnych prowadzi najczęściej do uzależnienia stanowiąc poważny problem zdrowotny współczesnych społeczeństw. W licznych badań prowadzonych na świecie wskazuje się, iż długotrwałe palenie papierosów lub tytoniu jest odpowiedzialne za wiele chorób niezakaźnych, między innymi raka płuc, raka krtani prowadząc do przedwczesnych zgonów. Z tego powodu rośnie również ryzyko zgonów z powodu chorób kardiologicznych oraz układu trawiennego. Uzależnienie od nikotyny może również prowadzić do inwalidztwa (w wyniku tracheotomii) lub znacznego obniżenia odporności organizmu. W celu ograniczenia negatywnego wpływu konsumpcji tytoniu zagwarantowania zrównoważonego rozwoju rządy poszczególnych państw, zarówno tych rozwiniętych jak i rozwijających się prowadzą dwukierunkową polityką ograniczającą produkcję i konsumpcję wyrobów tytoniowych poprzez stosowanie odpowiednich instrumentów finansowych jak i wdrażanie różnych programów zdrowotnych przeciwdziałających

uzależnieniu. Wszelkie działania podejmowane na różnych szczeblach decyzyjnych związane są często z polityką ekonomiczną, finansową, w tym fiskalną danego państwa. Upowszechnienie się poglądów, iż uwarunkowania nieracjonalnych zachowań konsumentów podlegają działaniu praw ekonomicznych i można je odnosić do analiz dotyczących ograniczania konsumpcji i produkcji wyrobów tytoniowych. Przedmiotem szeroko zakrojonych badań światowych są ekonomiczne analizy wpływu opodatkowania tytoniu na ceny wyrobów tytoniowych, podaż i popyt.

Zasadniczym celem artykułu jest prezentacja wykorzystania takich instrumentów jak cena (nie tylko w wyrażeniu) oraz różne formy opodatkowania wyrobów tytoniowych (podatek akcyzowy, podatek ad valorem) na kształtowanie się konsumpcji, nierówności dochodowych ludności oraz na ograniczenia produkcji koncernów tytoniowych i rozwój nielegalnych źródeł dystrybucji tych produktów. Rozważania teoretyczne zostaną uzupełnione wynikami badań prezentowanymi m.in. przez World Health Organization – WHO.

Słowa kluczowe: tytoń, podatek, polityka publiczna