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The next 100 years – applying megatrends to analyze the future of the Polish economy

Introduction

In 1930, John Maynard Keynes wrote the essay 'Economic Possibilities for our Grandchildren' in which he speculated about the long-term development of economies (Keynes, 1933). The mixed result of this undertaking, attempted at by such a prominent economist, proves the high difficulty of such forecasts. 50 years later, in 1982, John Naisbitt stated that the most reliable way to anticipate the future was by understanding the present, which means that the observation of tendencies and trends could serve as a key tool for studying the foreseeable future (Naisbitt, 1982). He popularized the concept of megatrends that has since been applied to the analysis of economic and social changes in the contemporary world, and has been adopted by researchers (e.g. Goldstone, 2010; Hajkowicz, 2015; Naisbitt and Aburdene, 1990; Naisbitt and Naisbitt, 2018; Pęciak, 2016; Kelly, 1996; Eckert, 2014; Palacios-Huerta, 2016; Buckley et al., 2015), consulting companies, (e.g. EY, 2015; EY, 2017; PWC, MegatrendsWatch, 2013; Frost&Sullivan, 2014; KPMG, 2014) and other research institutions and public bodies (e.g. Boumphrey and Brehmer, 2017; Gros and Alcidi, 2013; National Intelligence Council, 2012).

The objective of this article is to contribute to the analyses about the future of the Polish economy. We would like to verify the extent to which the most powerful global, social and economic changes will impact the Polish economy in the future. Our intention is to apply a long-term perspective of up to 40 years and indicate even

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longer timeframe. To do so we operationalize the megatrends most frequently cited in the literature, with the use of existing indexes and foresight studies to estimate the exposure of the Polish economy to these global shifts. The outcome of the research is the creation of megatrend exposure indicators which can be applied to other economies worldwide for comparability studies and the assessment of the strategic position of the Polish economy towards the selected megatrends.

The paper is structured as follows: in the first part we summarize the use of megatrends by contemporary scholars in research articles and the most frequently cited megatrends are selected for a further application in our analysis. The second section is dedicated to discussing the methods of determining the exposure of a country's economy to megatrends and crafting indicators to measure such exposure. In the third part we operationalize the metrics for the selected megatrends. In the fourth section we use these metrics to assess the exposure of the Polish economy to each megatrend. In the final part we summarize the results and discuss the strategic position of the Polish economy in light of forthcoming changes and propose directions for further studies.

Megatrends in economic analyses

The abundance of definitions of megatrends (von Groddeck and Schwarz, 2013) constitutes the main challenge for the application of the concept in foresight analyses. For instance, Naisbitt defined them as 'large social, economic, political, and technological changes [that are] slowly formed and once in place, they influence us for some time – between seven or ten years, or longer' (Naisbitt and Aburdene, 1990), whereas Hajkowicz pointed out that megatrends were 'gradual yet powerful trajectories of change that [would] at some point express themselves with explosive force and throw companies, individuals and societies into freefall' (Hajkowicz, 2015). Regardless of the approach chosen, megatrends are frequently defined by three basic characteristics: a considerable length of duration, the size and scale of their impact, as well as by their evolution cycle resembling that of a product's life-cycle, namely emergence, spread, domination and decline (Gajewski et al., 2015). These features determine their usefulness as tools for speculating about the characteristics of the economies and societies of the future. Despite the diverse terminology and typologies, the leading authors tend to identify similar megatrends as instrumental in exerting influence on the contemporary world and in the foreseeable future. They also recognize that the concept of megatrends can be applied as a valuable tool to address complex discourses, as well as that "prediction about the future is often a vehicle for clarifying the challenges ahead" (Palacios-Huerta, 2016).

Based on the results of a structured literature review covering research articles published between 2010 and 2018, the reference frequency and thematic application of megatrends have been established (Malik and Janowska, 2018). In

the studied set of research papers, the concept of megatrends was frequently used to analyze the impact of the most profound ones on selected research areas, whose thematic scope can be divided into three general categories: foresight studies of selected industries, analyses of existing and anticipated changes in management and business practices, as well as other socio-economic topics.

Megatrends are inconsistently defined and named by the authors, which increases the difficulty of selecting the most influential or more appropriate ones out of those related to the analysis of the evolution of the Polish economy. For that reason, it is necessary to cluster these trends on the basis of their content rather than on the naming conventions adopted in the literature. The content of the most frequently used megatrends includes: technology development, environmental changes, demographic shifts, urbanization and changes in geopolitics. The results of the literature review (Malik and Janowska, 2018) made it possible to single out the seven preeminent megatrends most frequently referred to and relatively coherently defined by the authors, they are:
1) digitalization and development of ICT technologies (later digitalization),
2) resource scarcity,
3) climate change,
4) world population growth (later population growth),
5) population aging,
6) urbanization growth.

The seventh megatrend which surfaced in the research is the power shift in global politics from the West to the East. As our current analysis is predominantly rooted in economic and social research, we exclude from the scope of this article the topic of geopolitics, which leaves us with the 6 powerful trends mentioned above. These megatrends are repeatedly and consistently expected to exercise substantial influence on the contemporary world and can be envisaged to continue to do so in the future. As a result, we choose to rely on this set to estimate the exposure of the Polish economy to the megatrends referenced in this article.

How to measure the exposure of a country's economy to a megatrend

To determine the extent to which megatrends will impact a particular economy in the future, it is necessary to operationalize these trends. Allocating metrics to a megatrend and creating on their basis a megatrend indicator enables an international comparison of economies' exposure to these forthcoming changes. In this section of the article we introduce a method to create indicators which facilitate the megatrend's impact assessment for a country's economy.

The procedure for creating a megatrend indicator consists of four steps. Firstly, metrics are selected to synthesize the impact of megatrends. Secondly, coun-

tries are classified in a ranking according to their performance per metric. Thirdly, the position of the Polish economy in a ranking is established and a score is allocated depending on the decile in the distribution. Fourthly, the megatrend indicator is calculated as a weighted average of scores per metrics used.

To create an indicator for a given megatrend we propose up to 2 key metrics. As a metric, whenever possible, we use existing synthetic indexes combining the number of factors available based on previous comparative international research rather than a single, stand-alone measurement of our own choice. The latest available version of an index and country ranking is used and a released date is provided. We opt for using forward looking indexes which attempt to forecast the future state of affairs in a long-term perspective to reflect the predictive nature of megatrends. At the absence of such indexes we rely on in-depth research providing insight into the current situation and try to extrapolate it for the future.

Once the metrics are selected, we check the position of the Polish economy in comparison to the rest of the researched population (usually all countries worldwide). We allocate the points on a scale of 1 to 10 depending on the decile in which the Polish economy is ranked, with 10 points given to the top decile indicating the most exposed position of a country's economy or the highest readiness to embrace a megatrend. To calculate the megatrend exposure indicator we use weighted average scores from the metrics (usually 2 metrics) in order to provide the final indicator (scale of 1 to 10). Whenever possible we use dynamic metrics which accounts for various scenarios and include interconnectivity of a given state with the rest of the global economy. The final indicator synthesizes the exposure of the Polish economy to a given megatrend relative to other countries worldwide. Comparing the final indicators for all analyzed megatrends produces a strategic profile of the country's susceptibility to the most transformative shifts in the contemporary world. The profile is presented in the form of a graph.

The analysis is prepared for the Polish economy only. The same evaluation can be performed for all other economies worldwide. It is not our intention to suggest that the value of the indicator should be interpreted as ultimately positive or negative, rather it offers an indication of the extent to which megatrends will be important for a given economy and the degree to which the economy is prepared for the forthcoming changes. Moreover, we understand that in increasingly interconnected world no state should be analyzed in isolation. We would welcome similar studies performed for other economies as well as cross-country research.

Indicators of countries' megatrend exposure

Digitization and the development of ICT technologies is the most frequently analyzed megatrend in research articles and the authors tend to view this phenomenon from various perspectives. To reflect the multifaceted nature of this trend

and its vast impact on modern economies we have decided to use two complex metrics to assess the exposure of the countries' economies to this trend: The Networked Readiness Index 2016 by the World Economic Forum and The Technological Readiness Ranking 2018 by the Economist Intelligent Unit. The Networked Readiness Index, which is structured with the aim to assess countries' preparedness to benefit from emerging technologies and to capitalize on the digital revolution, covers a total of 53 factors arranged into four pillars: environment (political, regulator, business and innovation), readiness (infrastructure, affordability, skills), usage (individual, business, government) and impact (economic and social) (Dutta, 2016). The Technological Readiness Ranking by the Economist Intelligent Unit assesses a country's readiness for technological disruption with the use of three distinctive categories: access to the internet, which covers internet usage and mobile phone subscriptions; digital economy infrastructure, encompassing e-commerce, e-government and cyber-security; and openness to innovation, which explores the international patents granted, research and development (R&D) spending, and research infrastructure (The Economist Intelligence Unit, 2018).

Climate change attracts the attention of scholars from various fields and there are already elaborate analyses available which investigate the impact of this trend on economies worldwide. For our research we use the Global Climate Risk Index 2018 and Global Adaptation Index 2017. The Global Adaptation Index captures 45 factors for 181 countries to assess climate change related vulnerabilities and readiness for improvement. In order to research climate change vulnerability, the predisposition of human societies to be negatively impacted by climate hazards with regard to six life-supporting sectors (food, water, health, ecosystem services, human habitat, infrastructure) is considered. Moreover, the index includes the assessment of the economic, governance and social readiness to make effective use of investments for adaptation actions (ND-GAIN, 2017). The more specialized Global Climate Risk Index looks into extreme weather events and, based on historic data going back to 1995 (Eckstein et al., 2017)**,** indicates the level of exposure and vulnerability to extreme events being based on the growing confidence among scholars that the probability of such an event could be linked to climate changes (Coumou and Rahmstorf, 2012). As we have combined the general and the far more specialized indexes in this indicator, we are using a weighted average of 0,75 for the Global Adaptation Index and 0,25 for the Global Climate Risk index to calculate the final score.

As far as resource scarcity is concerned, we have decided to look into this megatrend through the lenses of energy resources and water supply as two crucial and complementary dimensions of the resource-hungry world of the future. To estimate the degree to which countries are prone to energy resource scarcity, we used the World Energy Trilemma Index 2017 by the World Energy Council, and for water deficiency – the results of the Aqueduct Projected Water Stress Country Rankings 2015 by the World Resources Institute. The World Energy Trilemma

Index includes the assessment of 125 economies worldwide and rates the countries' energy performance based on three core dimensions: energy security, energy equity, and environmental sustainability, with the aim to provide insight into their ability to provide a secure, affordable, and environmentally sustainable energy system (World Energy Council, 2017). The Aqueduct Projected Water Stress Country Ranking surveys future water demand and provides long-term scenarios (as far forward as 2040) to deliver country-level water stress projections, including water use for agricultural, industrial and domestic activities (Luo et al., 2015).

Megatrends concerning demographic changes consist of two intertwined global trends, overall increase in world population and population aging. Especially the population increase, provides considerable methodological challenges due to significant differences in outcomes of the analysis on the country level, namely a rapid and uncontrolled increase of population in a number of countries combined with accelerated depopulation in others. Using data from UN Probabilistic Population Projections based on the World Population Prospects, revised in 2017, accounting for changes in birth rate, life expectancy, migration and others, we ranked countries on a scale from those with the highest sensitivity to population-increase to the most inclined towards depopulation. We compared the UN 2060 country population projection to the population in 2015 (UN, 2017). In this particular case it seems that both extremes, population explosion and accelerated depopulation, constitute a significant challenge for economies and both should be assumed as adverse conditions. We have decided, however, to follow methodological consistency and allocate the top decile to the country the most exposed to population increase.

The related, but distinctive, megatrend concerning demographic change is the overall aging of the world population. The economic interpretation of this megatrend is easier than the total population increase and its unique consequences and possible remedies (e.g. increase of retirement age, adaptation of the workplace to accommodate more employees) justify its distinction as an independent dimension of the analysis. To calculate this metric and rank countries worldwide we use data from the World Population Aging Report 2015 by the United Nations providing insight into the baseline scenario of the expected percentage of population aged 60 or over in 2050 accounting for changes in birth rate, life expectancy, migration and others (UN, 2015).

Projections about the demographic changes encapsulated in megatrends not only indicate growth in the world population and population aging but also signal that an increased percentage of the world population will consist of city-dwellers. This megatrend will have considerable and complex economic repercussions as urban population tends to be significantly more productive compared to rural. Moreover, large metropolitan areas are considered a magnet for commercial, cultural and social activities of any kind. In order to capture these two dimensions we have decided to use two metrics: the growth in percentage points of the proportion of the population living in urban areas in 2050 compared to 2015, based on data from

the World Urbanization Prospects 2018 by the United Nations (UN, 2018), and the future competitiveness of cities based on Hot spots 2025, benchmarking the future competitiveness of cities by The Economist Intelligence Unit in which we compared only the top competitive city in a country with other globally-important metropolises (The Economist Intelligence Unit, 2013). Although there seems to be a plethora of various rankings investigating the economic power of cities, there is a limited amount of forward-looking research on the competitiveness of large metropolitan areas, hence the use of the ranking in which we only consider the top city in a country. This index includes a mixture of qualitative (27) and quantitative (5) indicators covering eight categories: economic strength, physical capital, financial maturity, institutional character, social and cultural character, human capital, environment and natural hazards, and global appeal. To reflect the complexity of both metrics a weighted average is used, 0,75 for urban populations and 0,25 for top city competitiveness.

Polish economy's exposure to megatrends in a long-term perspective

The estimation of the megatrend exposure indicators for the Polish economy, based on the metrics characterized in the previous section, provides a diversified and sometimes unexpected set of results, summarized in the following set of tables and a graph.

Table 1. Megatrend susceptibility of Polish economy – Metric 1

	Place of Poland	Items in analysis	Place of Poland (decile)	Inverted scale	Exposure (1-least, 10-most)
Digitalization	42	139	4	yes	7
Climate change	22	191	2	no	2
Resource scarcity	37	125	3	no	3
Population growth	223	232	10	yes	1
Population aging	12	201	1	yes	10
Urbanization growth	133	232	6	yes	5

Source: own calculation based on: (Dutta, S. (2016). *The Networked Readiness Index 2016*. World Economic Forum; Eckstein, D., Künzel, V., Schäfer, L. (2017). *Global Climate Risk Index 2018*. GermanWatch; World Energy Council, (2017). World Energy Trilemma Index 2017. World Energy Council; UN (2017). World Population Prospects. UN; UN (2015). World Population Ageing, UN; UN (2018). World Urbanization Prospects: The 2018 Revision. UN).

Table 1. shows the exposure of the Polish economy to the selected megatrends based on the first metric described in the methodology section above. The place of Poland and number of items in the analysis are derived from the indexes used as

metrics in our study. A relative place of the Polish economy to other states is shown as a decile position. As described above the inverted scale is often used to establish the connection between the exposure of the Polish economy to a given megatrend and the content of the index applied in our study, providing the original set of data justifies such an approach (e.g. Poland is in the bottom decile in terms of the expected number of population growth which means that is the least exposed to that trend of booming population, hence the inverted scale is used and exposure is graded 1 – meaning the lowest susceptibility to rapid population growth).

Table 2. Megatrend susceptibility of Polish economy – Metric 2.

	Place of Poland	Items in analysis	Place of Poland (decile)	Inverted scale	Exposure (1-least, 10-most)
Digitalization	27	82	4	yes	7
Climate change	61	183	4	yes	7
Resource scarcity	74	167	5	yes	6
Population growth	n/a	n/a	n/a	n/a	n/a
Population aging	n/a	n/a	n/a	n/a	n/a
Urbanization growth	43	120	4	yes	7

Source: own calculation based on: The Economist Intelligence Unit, (2018). Preparing for Disruption. Technological Readiness Ranking. The Economist Intelligence Unit; ND-GAIN (2018). *Global Adaptation Index 2017* [online]. Available: http://gain.nd.edu/our-work/ [Accessed] 14.07.2018; Luo, T., Young, R., Reig, P. (2015). Aqueduct Projected Water Stress Country Rankings. World Resources Institute; The Economist Intelligence Unit, (2013). Hot Spots 2025. Benchmarking the Future Competitivness of cities. The Economist.

In the above table the exposure of the Polish economy is shown on the basis of the calculation described in the methodology section above. In 4 out of 6 megatrends the second metric is used to provide more fain-grained results of the study.

Table 3. Megatrend susceptibility of Polish economy – summary

	Metric 1		Metric 2		Exposure Indicator
	Exposure (1-least, 10-most)	Weight	Exposure (1-least, 10-most)	Weight	(1-least, 10-most)
Digitalization	7	0,5	7	0,5	7
Climate change	2	0,75	7	0,25	3,5
Resource scarcity	3	0,5	6	0,5	4,5
Population growth	1	1	n/a	n/a	1
Population aging	10	1	n/a	n/a	10
Urbanization growth	5	0,75	7	0,25	5,5

Source: own calculation.

Table 3. summarizes the results of both metrics and provides the final exposure indicator calculated as a weighted average of exposure described by both metrics. The final exposure indicator to a given megatrend is for clarity presented in the form of the graph below.
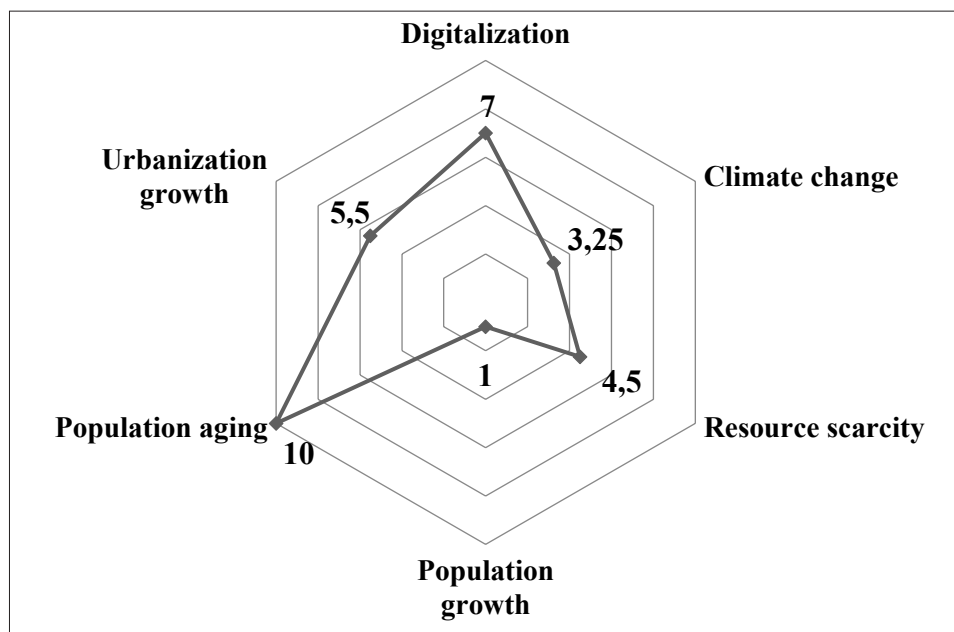

Figure 1. Megatrend exposure indicators for the Polish economy relative to other countries worldwide. Scale 1–10, 10 – the most susceptible, 1 – the least susceptible

Source: own research.

In terms of digitalization, both metrics provide a consistent outcome placing the Polish economy in the 4th decile of the distribution of the most digitalization-ready economies which translates into a high susceptibility relative to the analyzed group of countries worldwide and to the indicator value of 7. Similar consistency of partial results occurs within the urbanization growth megatrend indicator which, with the final score of 6, indicates moderate exposure to urbanization advancement in the Polish economy. This result is driven by the slightly below-average growth of the population living in cites, 10 percentage points, between 2015 and 2050, and the above-average expected future competitiveness of Warsaw – 43rd place out of 120 analyzed cities worldwide.

As far as the climate change megatrend is concerned, the Polish economy seems relatively the least prone to these changes with the total value of the indicator being 3,5. This is, however, the outcome of the mixed results in two considered metrics and it is driven mostly by a low vulnerability to overall climate changes

(2nd decile of the least vulnerable countries – 2 points), meaning low exposure to this megatrend in contrast to the relatively high vulnerability to extreme weather conditions (3rd decile of the most vulnerable countries – 7 points), meaning high exposure to the megatrend.

An analogical development is observed in the resource scarcity megatrend indicator with the overall score of 4,5, driven by the relatively sustainable energy resource system (3rd decile of the most sustainable systems – 3 points), meaning low exposure to the megatrend and a comparably high position in the most water stressed countries (5th decile of the most stressed countries – 6 points), meaning above-average exposure to this megatrend.

The megatrend indicator for population growth equals 1, as Poland is one of the least susceptible countries worldwide for population increase in the future. The population of Poland is expected to shrink by 22% to just around 30 million in 2060 compared to 2015. In fact, only 9 countries out of 233 analyzed are forecasted to experience more dramatic depopulation in the four decades to come. This score is interlinked with the substantial exposure to the population aging megatrend with the estimated value of the indicator being 10, as in 2050 the percentage of population in Poland aged 60 and over is anticipated to reach 39,3% which would translate into the 12th highest percentage worldwide out of the sample of 201 countries.

Summary

Because of the complexity of the influence and power of megatrends, their impact can hardly be overlooked and can only be mitigated to a certain extent. Only rarely can the impact of a megatrend on a country's economy be dubbed as entirely positive or negative. Depending on their content, interest groups and assumptions, megatrends can be considered potential threats or opportunities whose magnitude hinges upon a country's exposure discussed in this article. Knowledge of forthcoming changes and the degree of exposure to these shifts can be used as input for strategic, long-term, analyses in various areas ranging from public policy to corporate investment.

The exposure to megatrends can be calculated providing the megatrends are operationalized. In this article, metrics have been allocated to the most frequently cited megatrends to create indicators of a countries' economic exposure to the future changes. The exposure of the Polish economy to the top six megatrends has been assessed relative to other countries in the world. The outcome of the analysis shows that the exposure of the Polish economy is very high for population aging and high for digitalization. The exposure to urbanization growth and resource scarcity can be described as moderate with a limited diversion from the mean of the analyzed countries. The exposure to climate changes has turned out to be low and to population growth very low.

Overall, it seems that the susceptibility to rapid depopulation and population aging highlighted during the course of the analysis creates a challenge of paramount importance for the Polish economy in the next 30 to 40 years and beyond. The conclusion that there is the relative insignificant exposure of the Polish economy to climate changes and resource scarcity is an unexpected outcome of the research.

The clear limitation of the study is the number of megatrends used in the research and the number of metrics applied to estimate the impact of a given trend. Moreover, our indicators show total, generalized exposure to the megatrend relative to other economies without providing insight on exogeneity and endogeneity of the trends' origin. Therefore, on the basis of our study one cannot conclude to what extent the value of an indicator is a result of internal factors and how the world-connectivity of a given economy impacts the results. Moreover, we have refrained from debating the extent to which the exposure to the megatrend could be mitigated by public policies, leaving it for further research.

Possible development of this study may also include considering a larger number of metrics to provide more complex megatrend exposure indicators. Enhancing the research by including a greater number of trends should result in a more complex overview of the exposure to long-term changes. Our study focuses on the Polish economy but similar analyses can be performed for other markets. Moreover, extending the study to a comparative analysis of economies from a given region or countries on a similar level of economic development should provide an especially insightful outcome.

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Summary

The objective of the article was to assess a long-term exposure of the Polish economy to megatrends – key global changes influencing economies and societies worldwide. On the basis of the results of a structured literature review, the most cited global megatrends have been identified: digitalization, climate change, resource scarcity, population growth, population aging, urbanization growth. We operationalized these trends by selecting metrics based on existing indexes, forecasts and foresight studies. With the application of the metrics we created megatrend exposure indicators to measure a relative susceptibility of country economies to these trends. We used this tool to assess a relative exposure of the Polish economy to six megatrends and to create a country strategic profile. We applied a long-term perspective of up to 40 years and beyond. The outcome of the analysis shows that the exposure of the Polish economy is very high to population aging and high to digitalization. The exposure to urbanization growth and resource scarcity can be described as moderate. The exposure to climate changes has turned out to be low and to population growth very low. The novelty of our research is the structuring of megatrend exposure indicators and their application to foresight study for a country economy which, up to our knowledge, has not been attempted thus far. Knowledge of forthcoming changes and the degree of exposure to these megatrends can be used as input for strategic, long-term, analyses in various areas ranging from public policy to corporate investment.

Keywords: megatrend, foresight, Polish economy, digitalization, demographics, climate change.

Perspektywa kolejnych 100 lat – zastosowanie megatrendów do analizy przyszłości polskiej gospodarki

Streszczenie

Celem artykułu była ocena długoterminowej ekspozycji polskiej gospodarki na megatrendy – istotne globalne zmiany wpływające na gospodarki i społeczeństwa na świecie. Na podstawie przeglądu literatury zidentyfikowano najczęściej cytowane globalne megatrendy: digitalizację, zmiany klimatyczne, niedobór zasobów, wzrost liczby ludności, starzenie się społeczeństwa, wzrost urbanizacji. Następnie dokonano operacjonalizacji tych trendów, wybierając mierniki oparte na istniejących indeksach, prognozach i badaniach foresight. Na tej podstawie stworzono wskaźniki ekspozycji na megatrendy do pomiaru względnej podatności gospodarek krajowych na te przemiany. Narzędzie to zostało wykorzystane do oceny względnej ekspozycji polskiej gospodarki na sześć megatrendów i stworzenia krajowego profilu strategicznego. W badaniu zastosowano długoterminową perspektywę do 40 lat. Wyniki analizy pokazują, że ekspozycja polskiej gospodarki jest bardzo wysoka i wyższa niż innych gospodarek na przemiany związane ze starzeniem się społeczeństwa i wysoka w przypadku cyfryzacji gospodarki. Podatność na przemiany związane ze wzrostem urbanizacji i niedoborem zasobów jest umiarkowana. Ponadto ekspozycja na zmiany klimatyczne okazała się niska, a na wzrost populacji bardzo niska. Nowością badania jest opracowanie wskaźników ekspozycji na megatrendy i ich zastosowanie do analizy przyszłości gospodarki krajowej. Takie ujęcie tego zagadnienia nie było dotychczas podejmowane w znanych nam pracach naukowych. Znajomość nadchodzących zmian i stopień ekspozycji na megatrendy można wykorzystać jako wkład w strategiczne, długoterminowe analizy w różnych obszarach, od polityki publicznej po inwestycje przedsiębiorstw.

Słowa kluczowe: megatrend, foresight, polska gospodarka, digitalizacja, demografia, zmiany klimatyczne.