Resilience and Transformation in the Global Economy

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Resilience and Transformation in the Global Economy

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Dariusz Tłoczyński

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Editorial note

The present volume of IBAGE – International Business and Global Economy, entitled "Resilience and Transformation in the Global Economy", brings together six scholarly articles that collectively address key challenges and opportunities shaping contemporary economic and social systems.

The contributions span a wide thematic spectrum while maintaining a common focus on the processes of adaptation, sustainability, and innovation. The opening article examines the historical role of energy as a fundamental driver of economic growth and development, highlighting successive energy transformations as milestones of global progress. This is followed by a study on the spillover effects of pro-environmental practices from the workplace into household behaviour, underscoring the importance of multi-level cooperation in addressing sustainability challenges. Another contribution focuses on the revitalisation of European trade unions, with particular emphasis on generational change and the embrace of progressive values.

The second part of the volume turns to issues directly related to global business and markets. An analysis of the financial consequences of the coronavirus pandemic for leading e-commerce companies sheds light on corporate resilience in times of crisis. The subsequent contribution explores internationalisation strategies of the Polish cosmetics industry, with innovative use of six-digit tariff codes to identify the most promising export markets. Last but not least, the closing article addresses the financial risks of corporate investment in cryptocurrencies, assessing the implications of such strategies for both firm-level stability and systemic resilience.

In concert, the articles provide a multifaceted picture of resilience and transformation in the global economy, combining historical perspectives with contemporary empirical research. This volume is intended not only to enrich academic debate but also to offer insights relevant to policymakers, businesses, and institutions seeking to navigate a rapidly changing global landscape.

Dariusz Tłoczyński

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Energy as a driving factor of economic growth and development: History of energy transformations

This article presents energy as a factor with a huge impact on economic growth and development, which is one of the factors of production, examines energy transformations throughout history, and shows the role of energy in growth and development processes and highlights its key role in breakthrough moments of the world's economic development and transformation. Statistical public data analysis, historical data analysis, document analysis, logical reasoning, and drawing conclusions were employed. Data are presented in tables and figures. The article demonstrates that energy plays a significant role in economic and social growth and development; it is a factor of production. Historical analysis of human energy use, statistical data and case studies show that breakthrough moments that marked milestones in the world's economic development were based on successive energy transformations, while technical and technological development based on new forms of energy use and new energy carriers has driven the economic and social transformation of the world.

Keywords: energy, transformation, growth and development, energy transition

JEL classification: O1, O3, Q0, Q4

Introduction

The emergence and popularisation of the use of ever newer sources of energy and power drives is the basis of economic, social and environmental change. Human activity is inextricably linked with energy. It enables all kinds of work to be performed and is essential for the formation and implementation of various natural and anthropogenic processes. Energy development significantly affects the direction of global economic development. The current direction of global development, a turn towards the so-called "green economy", requires the replacement of fossil fuels with more environmentally friendly energy carriers such as renewable energy sources and nuclear power.

The aim of the article is to present energy as a factor with a huge impact on economic growth and development as one of the factors of production. The article examines energy transformations throughout history, shows the role of energy in growth and development processes and highlights its key role in breakthrough moments of the world's economic development and transformation.

1. Energy – basic information

The use of energy allows for the existence of humans and animals on Earth. It ensures economic and social growth and development. Energy accompanies all human activities and is an indispensable part of daily life. It is a factor of economic transformation, facilitating the growth of prosperity.

The term "energy" comes from Greek (gr. *energeia*), from the word *ergon* ("work") and means action, mobility or activity. In physical terms, energy is a measure of the movement of matter [Niedziółka, 2010], and characterises a body, matter, or physical system capable of doing work. Energy comes in different forms due to the different motion of matter, such as electrical, thermal, chemical, electromagnetic (radiation), mechanical and nuclear energy. Energy transformations occur in animate and inanimate nature [Gradziuk, 2019] and are the focus of interest in many fields of science, including physics, astronomy, biology, chemistry, medicine, geology, environmental protection, and economics. Energy carriers include coal, wood, oil natural gas, and electricity. Energy can be divided into primary and secondary (which is a primary energy that underwent a transformation process). Non-renewable and renewable energy resources make up the primary energy sources. Energy in the form of organic and nuclear fuels are non-renewable resources. Renewable resources include those derived from mechanical energy (flowing water, energy of the Earth's interior, gravity, wind, sun, biomass). Secondary energy is represented by electricity, heat and secondary fuels. Table 1 includes sources of renewable primary energy, as well as the possible energy transformations that produce different types of secondary energy.

In 2022, the world's total energy supply (by sources) was as follows [IEA, 2024]:

- oil: 187902349 TJ,
- biomass: 54482802 TJ,
- wind, solar, etc.: 19018259 TJ,
- hydro energy: 15660642 TJ,
- nuclear energy: 29320058 TJ,
- natural gas: 143897186 TJ,
- coal: 171902932 TJ.

Table 1. Renewable energy sources and technical capabilities of energy conversion

Primary energy sources		Natural energy conversion processes	Technical energy conversion processes	Form of energy obtained
Sun	water	evaporation, melting of ice and snow, precipitation	hydroelectric power plants	electricity
	wind	movement of the atmosphere	wind power plants	electric and thermal energy
		wave energy	wave power plants	electricity
	solar radiation	ocean currents	power plants using ocean currents	electricity
		heating of the earth's surface and atmosphere	ocean heat power plants	electricity
			heat pumps	thermal energy
		sun rays	collectors and thermal solar power plants	thermal energy
			photovoltaic cells and solar power plants	electricity
			photolysis	fuels
	biomass	biomass production	heating and thermal power plants	electric and thermal energy
			processing devices	fuels
Earth	isotope decay	geothermal springs	geothermal heating and power plants	electric and thermal energy
Moon	gravitation	the tides of water	tidal power plants	electricity

Source: [Ligus, 2019, p. 17], translation by the author.

Hydrogen and ammonia are energy sources that are the focus of interest for scientists, politicians and businesspeople around the world. They can play a significant role in the ongoing global energy transformation.

Hydrogen is the most common chemical element known to humans, found in the universe. It is referred to as the "fuel of the future". Hydrogen combined with oxygen forms water, and with carbon it creates methane, coal, or oil (petroleum). It is present in all forms of biomass. It can be used where the use of electricity becomes problematic. Hydrogen in the form of H_2 gas does not exist freely on Earth; it must be produced. Hydrogen is obtained through a separation reaction from water, biomass, or natural gas resources. The main advantage of hydrogen energy production is its commonness, as hydrogen is found everywhere on Earth and can be extracted from a variety of raw materials. It is mainly used in refining, metal processing, and the food industry. However, construction of hydrogen power plants based on current technologies is not (yet) cost-effective. Hydrogen enrichment of natural gas and oil (also to increase its efficiency) can lead to a reduction in environmental pollution. Storage and transportation of hydrogen is problematic due

to its flammability when mixed with air. Production of hydrogen is expensive and energy-intensive [IEI, 2019].

Ammonia is a substance that is easier to transport and store than hydrogen due to its higher energy density. It is also safer because of its low explosiveness, although it has lower energy efficiency [Szlęk et al., 2023]. Ammonia is produced by converting hydrogen and nitrogen under low pressure into a liquid. It is easy and safe to store as it is hardly flammable and becomes explosive only under strictly defined conditions, though it is very toxic because nitrogen oxides are released during the ammonia oxidation reaction. Ammonia has been used as a fuel since the 1820s. Its main use remains in agriculture as a fertilizer, but it can be used as a fuel for heating (as boiler fuel or to power heat engines) [Szlęk et al., 2023]. The use of ammonia as an energy carrier in a commercial coal-fired power plant began in Japan in May 2021. Ammonia produced from natural gas using carbon capture technology is imported by Japan from countries including Saudi Arabia [Sikora, Sikora, 2022, pp. 76–79].

2. History of energy transition

The process of energy transition has affected many aspects of modern societies. Humans have utilised the energy resources stored in nature for a very long time. In the beginning, energy obtained from the environment was used to meet basic needs and improve living conditions of man. Later, humans began harnessing energy to produce light and subsequently to power devices and machines. The history of humankind, and consequently of economic development, is closely linked to the use and transformation of energy. Successive energy transformations provided stronger and more flexible driving forces of global development and enabled more efficient and effective ways of energy conversion. The milestones of human development became shorter, and the pace of great energy transformations increased [Smil, 2004, p. 549]. Over the past two centuries, the way we produce and consume energy has changed significantly. This change has been both caused by and contributed to further technological progress and economic development.

These changes occurred at different paces depending on the location and were related to structural changes in the world. There are differences not only in the speed of these transformations but also in national and regional timings of the discovery and spread of new fuels and methods of processing them [Smil, 2022, pp. 301–302].

The earliest, prehistoric transformations took place slowly. They were driven by increasingly sophisticated tools, mastery of fire, more efficient hunting methods, and they lasted for thousands of years. Primar energy transformations ensured

the survival and continuity of the human species. For many centuries, human existence – and therefore the economy – was based on farming of the land.

At a later stage, changes accompanied intensified civilisational development. As settled agriculture expanded, population grew rapidly and the processes of social stratification, occupational specialisation, and urbanisation began. With the increasing use of fossil fuels, high-energy societies emerged. They personified change and the constant need for innovation [Smil, 2022, p. 316]. In the 19th and 20th centuries, the development of industry accelerated rapidly thanks to technical and technological discoveries and innovations such as the steam engine, the kerosene lamp, the internal combustion engine, and electrification. The transition from an agriculture-based to an industrial economy required the use of more efficient energy sources. In the 21st century, the main goal of the energy transition appears to be the mitigation of adverse climate change, reduction of greenhouse gas emissions, as well as limitation of environmental pollution.

2.1. Primary energy transformations

The first stage of human development covers the period from the "birth" of the human species (about 5–10 million years ago) to modern times (up to approximately the 16th century). The existence of primitive humans was inextricably linked to the Sun, the first and primary source of energy. The Sun provided light and heat. The activities of primitive humans focused on obtaining food and accessing the energy contained in it, which met the minimum biological needs of existence. By mastering fire, the meal could be more plentiful and nutritious for the body, and heat was also provided during cold weather [Szpilewicz, 1974, p. 5]. Later, early humans began to cultivate the land in a primitive way. The use of animals for labour was a turning point in the first era of human development, while the use of wind power and water movement enabled easier work and faster transportation. Fire was used to produce metals and other durable materials [Smil, 2004, p. 551]. Further changes in the use of energy were brought about by the replacement of muscle work with the work of water wheels and windmills. This increased both the power produced and the energy efficiency.

2.2. Energy transformations in modern times

The second stage of energy change was characterised by the replacement of low-efficiency energy sources with fossil fuels, which became the main means of obtaining high-efficiency energy [Malanima, 2014, p. 5]. This stage began in the 17th century and was marked by the replacement of animals with engines and biomass with fossil fuels. The rate and volume of energy consumption increased

rapidly. Thanks to inventions and technical innovations, coal, oil, natural gas, and biofuels were widely used [Allen, 2013, p. 11].

The first country to make an energy transformation from burning wood to coal was Great Britain in the 16th and 17th centuries [Allen, 2013, pp. 12–13]. The replacement of wood with peat and the massive use of wind power to transport goods by sailing ships via inland canals as well as building windmills took place in the Dutch Republic in the 17th century.

The industrial revolution was fuelled by hard coal, which had higher efficiency than wood. It resulted in a more productive economy, leading to economic progress and urbanisation [Yeager, n.d., p. 390]. The appearance of the steam engine became a milestone in the world's energy transition. The first mechanical drive using coal was a low-power steam engine which pumped water out of coal mines. Invented by Thomas Newcomen, this mechanism became the first steam engine put into operation in 1712, in a mine in Staffordshire [O'Connor, 2010, p. 3].

The steam engine was patented by James Watt in 1769. He transformed and improved the steam engine's condenser, turning it into a machine with a very wide range of applications. In the first half of the 19th century, water turbines were developed and used to build hydroelectric power plants [Smil, 2004, p. 555].

Industry using the steam engine, a hallmark of the Industrial Revolution, required coal. Households used coal for heating and cooking. Over a period of 100 years, comparing the early 19th and 20th centuries, the share of coal production and consumption in the global structure increased from 1.7% to 47%. A comparison of biomass and coal use for energy purposes between 1800 and 1940 is shown in Table 2.

Table 2. The use of biomass and coal in the structure of energy production and consumption in the 19th and 20th centuries

Year	Biomass (% of global share)	Coal (% of global share)
1800	98.3	1.7
1820	97.6	2.4
1840	95.1	4.9
1860	86.8	13.3
1880	73.0	26.7
1900	50.4	47.2
1920	38.4	54.4
1940	31.6	50.7

Source: [Bhutada, 2022].

Within 100 years, coal had become a major energy carrier. As an energy-dense and efficient resource with abundant deposits, it was widely used in industry. The invention of the steam engine reduced the importance of windmills in power

generation (which produced 1TW of energy in the mid-19th century). They were most popular in Denmark and the Netherlands (around 30000 windmills operated in each of those countries).

Discoveries and inventions initiated the process of electrification and the use of hydrocarbons. George Westinghouse patented the transformer [*Westinghouse George*, n.d.], Charles Parsons invented and patented the first steam turbine in 1884 [*Parsons Charles Algernon*, n.d.], while Nikola Tesla developed the first induction motor and electric motors in 1888 [Wielowińska-Pawlak, 2022]. Electricity not only revolutionised industrial production but also helped to reduce the burden of housework (mainly for women).

Fossil fuels and electricity were the driving force behind economic change, the development of mechanisation, industrial production and the service sector, and the decline of the agricultural population. The first coal-fired power plants were put into operation in 1882 in London and New York, and a hydroelectric plant in Appleton, Wisconsin [Igliński et al., 2017, p. 38]. Around 1930, steam and coal-fired power plants were developed. In 2020, fossil fuels accounted for 78% of the world's total energy consumption [WEF, 2022].

The boom in oil use came with the development of electricity. The 1890s were marked by automotive inventions, such as: Gottlieb Deimler's petrol engine, Karl Benz's electric ignition, Wilhelm Maybach's float carburetor, and Rudolf Diesel's new internal combustion engine [Smil, 2004, p. 556]. In the mid-20th century, oil was one of the main energy carriers. After 1960, demand for oil further increased with the spread of gasoline-powered vehicles.

The invention of the gas burner in the mid-19th century by Robert Bunsen popularised the use of natural gas for heating purposes. Table 3 shows the percentage of coal, oil, and natural gas consumption worldwide in the second half of the 20th century.

Table 3. The use of coal, oil, and natural gas in the structure of energy production and consumption in the 20th century

Year	Coal (% of global share)	Crude oil (% of global share)	Natural gas (% of global share)
1950	44.2	19.1	7.3
1960	37	26.6	10.7
1970	25.8	40.2	14.5
1980	23.8	40.6	16.3
1990	24.4	35.5	18.4
2000	22.5	35.1	19.7

Source: [Bhutada, 2022].

Oil was most widely used in the 1970s and 1980s. The popularity of natural gas grew steadily, reaching a peak in 2020.

The popularity of coal for heating purposes has declined in favour of gas and electricity. Oil has displaced coal in transportation. Hard coal continues to play an important role as a fuel for electricity generation, accounting for over 30% of global production.

Nuclear power was developed in the mid-20th century. Atomic energy as a nuclear weapon was used for the first time during World War II. Nuclear power is primarily used to produce electricity. In 1951, the first nuclear research reactor was built in Idaho, USA [U.S. Department of Energy Office of Nuclear Energy, n.d., p. 8], and in 1954, the first nuclear power plant was put into operation in Obninsk, USSR [Chater, 2005, p. 30].

The development of nuclear power has been hampered by the high risk of nuclear reactor accidents, the problem of radioactive waste disposal and resistance from the public [Niedziółka, 2010, p. 17]. In the history of nuclear power, there have been environmental disasters caused by nuclear reactor explosions (such as the 1988 Chernobyl explosion and the 2011 Fukushima reactor accident caused by a tsunami) [Miljanić, Pratt, 2022, p. 7]. Nevertheless, nuclear energy is considered environmentally friendly. Nuclear energy production does not generate carbon dioxide emissions, greenhouse gases, or other pollutants, but leaves radioactive waste that must be properly removed, secured and stored. Construction of nuclear power plants raises objections from residents of the areas where they are to be located due to the possible environmental contamination from malfunctioning reactors or improper storage of waste [Hueting, 1980, p. 47].

The time after World War II marked a period of intense global growth and accelerated economic development. There was a surge in industrial production and an increase in agricultural productivity.

Due to the growing level of economic development and population, the world's energy needs continue to grow. Figure 1 shows world population size from the very beginning to the present, with predictions for 2050.

World population increased over the last 200 years from 1,000 million people in 1800 to 8,160 million in 2024 (in 1850, the population totalled 1,200 million; in 1900 – 1,600 million; in 1950 – 2,580 million; and in 2000 – 6,170 million) [Worldometer, n.d.]. The largest population growth took place in the second half of the 20th century. The world population density (persons per km^2) in 2024 was 55; in 2000 it was 41; in 1970 – 25; and in 1952 it was 17 persons per square kilometre [Worldometer, n.d.]. The top 5 countries whose populations are projected to grow the most by 2050 are: India, Nigeria, Pakistan, the Democratic Republic of Congo, and Ethiopia [WPR, n.d.].

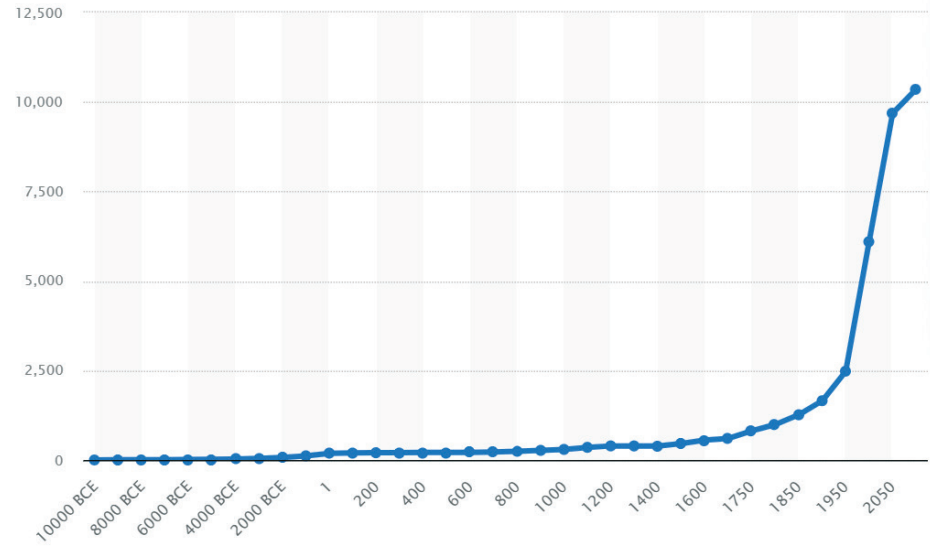

Figure 1. World population in millions
Source: [statista.com 2024].

The most noticeable progress in energy use and the diversity of energy carriers has taken place over the past 220 years (see Figure 2). The biggest increase in energy consumption occurred in the second half of the 20th century. With the growing importance of renewable energy sources in the 21st century, coal, oil, and gas continue to be the world's main energy sources.

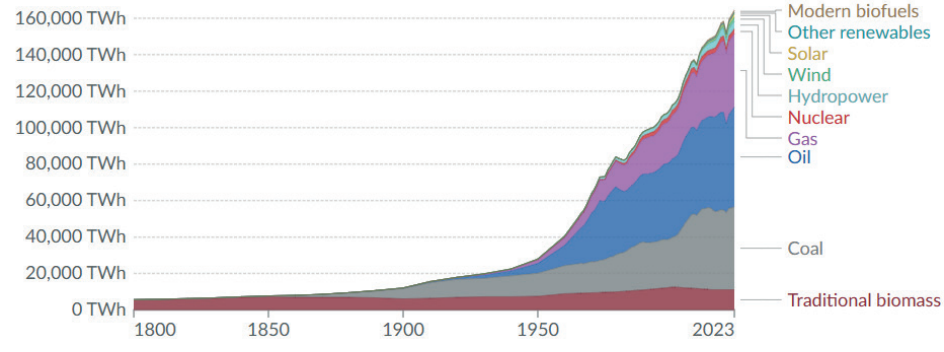

Figure 2. Global direct primary energy consumption during the period 1800–2023
Source: [Our World in Data n.d.].

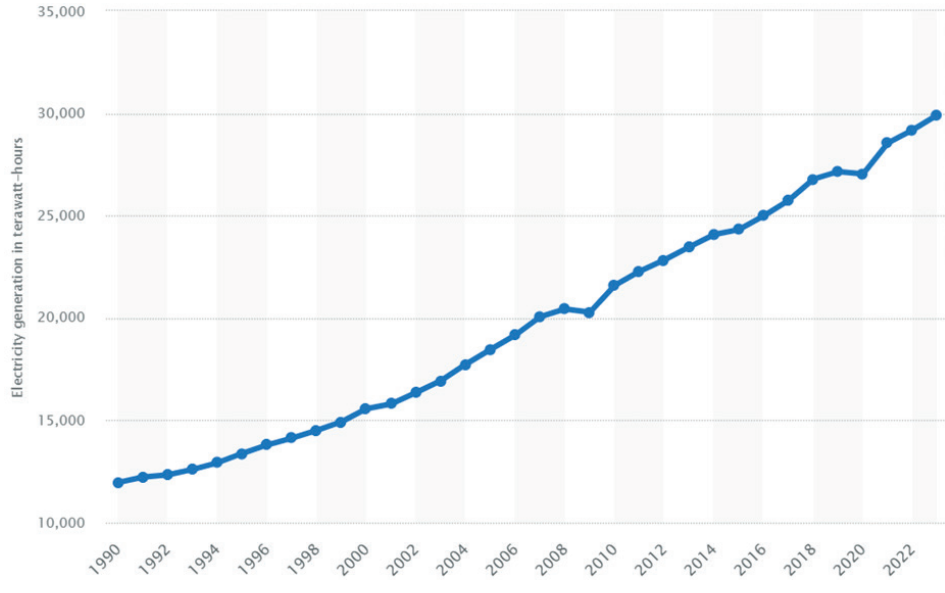

Figure 3. Electricity generation worldwide in terawatt-hours (1990–2023)
Source: [statista.com 2024].

Since 1900, global electricity production has followed an upward trend and has increased from about 12,000 TWh in 1900 to 30,000 TWh today. As shown in Figure 3, there were only two declines in production over that period: the first during the global financial crisis in 2009 and the second during the COVID-19 pandemic in 2020.

The global power generation rose by 2.6% in 2023, in line with its trend of an average annual growth of 2.5%. The world's electricity supply per capita increased from 3,306 kWh in 2015 to 3,620 kWh in 2022 [GUS, 2023, Table 10.11].

2.3. Modern energy – renewable sources of energy

Under the influence of rapid economic development, industrial production, service activities, and a growing population, fossil fuel resources have been rapidly decreasing. Their use has generated environmental pollution and produced large amounts of carbon dioxide. As a result, stakeholders began to seek alternative energy sources with lower exhaustibility and a higher degree of environmental friendliness.

There has been a growing global interest in harnessing the energy of the sun, wind, water, the Earth's interior, and biomass [Hodana et al., 2012, p. 4] as well as in hydrogen; and the interest in nuclear energy has risen again. Table 4 shows the change in the global structure of energy production and consumption in the 21st century.

Table 4. The use of biomass, renewable sources, fossil resources, and nuclear energy in the structure of energy production and consumption in the 21st century

Year	Biomass (% of global share)	Renewable energy sources (% of global share)	Fossil fuels (% of global share)	Nuclear energy (% of global share)
2000	10.2	6.6	77.3	5.9
2005	8.7	6.5	79.4	5.4
2010	7.7	7.7	79.9	4.7
2015	6.9	9.2	79.9	4.0
2020	6.7	11.2	78	4.0

Source: [Bhutada, 2022].

In the 21st century, the share of renewable energy sources in the global energy consumption has increased, doubling over 20 years. The share of biomass has declined. Fossil fuels remained the main energy carrier. The share of nuclear energy has decreased by about 30%.

The World Energy Council estimates that the remaining global coal reserves amount to 665 billion tons, with the annual consumption reaching 7.5 billion tons [Starzycka et al., 2020]. Energy production from coal generates large amounts of carbon dioxide, which are difficult to absorb naturally, and post-production waste. Furthermore, transportation of coal releases dust that is harmful to health and life [Hueting, 1980, p. 51].

3. Energy as an essential element of economic growth and development

Classical economists have already recognised the importance of energy in the economies of states. In classical economics, the basic factors of production such as labour, land, and capital were distinguished; each of these factors is inextricably linked to energy. Natural resources such as coal and oil remain the most popular energy sources in the world. Labor contributes to energy transformation, while energy reserves and the ability to to generate energy.

Reflections on the causes of economic growth and development in the 20th century led to the creation of many theories, including those of Solow, Schumpeter, and Nordhaus. They recognised the power of technological progress and the finiteness and exhaustibility of natural resources, which must be replenished in some way.

Economic growth is the process of expanding the real GDP of an economy over a certain period. It represents the quantitative, sustained growth in output and per capita income, accompanied by the growths in consumption, labour, capital,

and trade. It is measured by the growth rate of real output or real national income. Capital, labour, land, and renewable and non-renewable raw materials are the growth factors [Begg et al., 2014, pp. 414–418].

Economic development is a broader concept as it also includes qualitative changes. The goal of economic development is to improve the livelihood of a country's citizens. It depends on human resources, social attitudes, historical and political conditions, as well as structural changes and technical and technological progress (particularly in: Solow, Schumpeter, and later Romer models). Due to high levels of poverty, economic inequality or unemployment, a country may experience economic growth without achieving development [Sharma, Singh, 2020, p. 8].

Energy plays a fundamental role in economic growth and development. This growth is "a process in which the creators of new trends, economic pathways, energy policy makers and planners, government officials, leaders, entrepreneurs and other stakeholders work to increase energy efficiency and diversify energy sources in a way that promotes job creation and the expansion of regional wealth" [Carley et al., 2011, p. 287].

There is also the so-called "loop" between energy and economic development. As the rate of economic growth has been intensifying, the energy consumption grew, and the rise in the production of increasingly cheaper energy led to an acceleration of the economic growth [Danielewski, 1980, p. 12]. Ensuring continuous economic growth requires the use of more and more energy or increasing its efficiency. Energy integrates production factors, contributes to the creation of added value through labour, and its availability significantly affects the rate of economic change. The key role of energy in economic growth and its flows, and the relationship between the amount of national income and the quality of the environment is shown in the Kuznets curve [Ansari, 2023].

A positive relationship between production growth and energy consumption was observed and described in the second half of the 20th century. It was noted that approximately 1% increase in production led to an increase in energy consumption of 1 to 1.8%. The differences resulted from the specificity of consumer habits and structural differences in the production of specific economies. This indicator can be improved by increasing the efficiency of energy use and engaging in more energy-efficient consumption and production [Hueting, 1980, p. 49]. Negative energy shocks in the economy (such as energy price increases, adoption of energy conservation policies) can adversely affect national income, especially in countries whose energy resources do not meet their needs [Sharma, 2010, p. 3567].

Electricity is referred to as the fifth factor of production, alongside land, labour, capital, and organisation [Sharma, Singh, 2020, p. 9]. It has influenced the development of all areas of the economy and is essential to ensuring a satisfactory and comfortable standard of living. It contributes to improving living conditions and

meeting basic needs – starting with enabling education and learning, providing more time for reading, work, production, and transport, through reducing operating costs and promoting more efficient use of resources, to end with offering more engaging leisure and entertainment opportunities [Anderson, 2000, p. 397–398].

The automation of production processes, the use of office equipment, and access to the Internet would not be possible without electricity. A high level of electrification is an economic necessity. Electricity has been a key factor in improving agricultural productivity through mechanisation [Singh, 2009, pp. 25, 31] and has been essential for many rural industrial activities [Goldemberg, 2000, p. 374].

In his simple empirical analysis conducted in the second decade of the 21st century, D.I. Stern demonstrated a strong positive correlation between GDP and per capita electricity consumption. He confirmed both the impact of economic growth on the level of electricity consumption and the strong positive effect of constant access to electricity on GDP per capita [Stern, 2017, p. 4].

4. Energy and economic growth and development. Norway, China and South Korea case studies

The growth and economic development of some countries were driven by energy and its increasing production. Case studies of selected economies are presented below.

4.1. Norway

Norway's economic development is based on energy. The country is rich in natural resources, especially hydropower and fossil fuels. The unique mountainous landscape and numerous rivers enable a great amount of energy production. Hydropower plants account for almost 90% of Norway's energy mix. Norway reached a record net electricity export in 2020 (20.5 TWh), making Norway one of the largest electricity exporters in Europe. The country is well integrated into the Nordic and European electricity markets [IEA, 2022].

At the beginning of 2023, the total installed production capacity in Norway was 39,703 MW. Regularly, Norwegian power plants produce about 156 TWh. In 2021, Norway set a new production record, reaching a total electricity production of 157.1 TWh. In 2022, due to a low level of water inflow to reservoirs, total electricity production was 146.1 TWh. The energy system constantly balances between production and consumption. A unique feature of the Norwegian hydropower system is its high storage capacity, which accounts for 50% of the overall storage capacity of European

reservoirs. Norway's energy production capacity is flexible, at over 75%. The flexibility of the system is supplemented by wind and solar [Energifaktanorge, n.d.].

Norway's economic development is based on energy, large reserves of crude oil and gas, and its stable energy supply. There has been a significant increase in energy production and GDP per capita in Norway. Table 5 presents the gross national income per capita in comparison with energy production (1971–2021).

Table 5. Energy production and GDP per capita in Norway, 1971–2021

Indicator	1971	1980	1990	2000	2010	2021
Energy production (PJ)	252	2307	5002	9547	8725	8955
GDP per capita (current USD)	3736	15 772	28 243	38 178	88 163	93 073

Source: own study based on [IEA, n.d.; The World Bank, n.d.].

4.2. People's Republic of China

Rich coal resources are the driving force of the Chinese economy and one of the main factors contributing to its rapid economic growth and development. China is the largest investor in renewable sources in the world, but at the same time continues its spending on coal and nuclear energy. China invests in the production and export of electric cars and lithium-ion batteries, as well as in the development of solar energy products. Today, every second passenger car sold in China has an electric or hybrid engine. The electrification process is rapid and helps to strengthen its energy security (almost all electricity is generated from domestic sources) [Kalwasiński, 2024]. Table 6 shows the amount of energy production and GDP per capita, both of which have seen significant growth over the last 30 years.

Table 6. Energy production and GDP per capita in China, 1990–2021

Indicator	1990	2000	2010	2021
Energy production (PJ)	36 880	47 045	93 593	12 4173
GDP per capita (current USD)	318	959	4550	12 617

Source: [IEA, n.d.; The World Bank, n.d.].

4.3. The Republic of Korea

The Republic of Korea is among the top ten largest consumers of energy in the world. This is due to the high level of production of electrical and electronic devices and components [Ghezelbash et al., 2023].

Korea has experienced remarkable economic growth for several decades despite its difficult geography and lack of natural resources. Korea's economy is strongly export-oriented, with exports accounting for 44% of GDP in 2018. Korea is the world's largest producer of semiconductors. To maintain its strong industrial and export base, it is heavily dependent on imports of raw materials, including energy [IEA, 2020]. Table 7 below shows total energy production and consumption in comparison to GDP per capita.

Table 7. Energy production and GDP per capita in South Korea, 1971–2021

Indicator	1971	1980	1990	2000	2010	2021
Energy production (PJ)	267	388	922	1360	1878	2194
Energy consumption (PJ)	570	1310	2733	5301	6738	7763
GDP per capita (current USD)	301	1715	6610	12 257	23 079	32 395

Source: [IEA, n.d.; The World Bank, n.d.].

The country has experienced a significant growth of energy consumption over the last 50 years. Being one of the Asian tigers, Korea reached a high level of GDP per capita in 2021.

The economic growth and development of three different economies presented above are related to energy, its production, and consumption. These countries leverage their individual geographic and political conditions and strengths in international trade.

5. Conclusions

Energy is an essential factor in economic growth and social development. It creates an energy system that underpins all branches of the economy. It is involved in most of the processes that take place. The amount of energy possessed, and its efficiency impacts the momentum of economic change. The use of energy leads to various economic and social benefits and costs. Power engineering (i.e., the process of energy conversion) allows a more efficient use of resources and improves economic and social processes. The main negative externality is environmental pollution. This phenomenon intensified with the advent of the industrial revolution and the massive exploitation of energy resources, which disrupted the Earth's natural physical processes. Due to the varying pace of economic development, natural wealth of different countries, climatic conditions, and political environments, there has been a noticeable polarisation of civilisation development in different parts of the world.

The world has undergone a great energy transformation. Looking back at the historical transformation of energy, three major ones can be identified: the taming

of fire and domestication of draft animals; the use of wheels and windmills; and the construction of the steam engine and use of fossil fuels. The last of these milestones in energy transformation can be further described by three waves of transformation. The first wave was associated with a massive mining of coal. Then, after the invention of the steam engine, these engines became widely used, railroads have been developed, and internal combustion engines appeared. The third wave was marked by the appearance and spread of electricity, the growing importance of electricity in industrial processes, the emergence of jet engines, as well as the use of nuclear energy.

In the history of energy transformations, there have been many instances of shortages and limitations in the access to energy. Cyclical, insufficient energy supplies caused lower production and brought about economic slowdowns [Sharma, Singh, 2020, p. 8]. As a result, innovative energy generation solutions have been developed. By converting different energy sources, more energy could be obtained in a more efficient way [O'Connor, 2010].

In the 21st century, renewable energy sources will most likely play the most important role in the energy sector. They are perceived to be a salvation for the planet and its natural resources that have been overexploited. Hydrogen and ammonia are substances that can play a significant role in the energy sector of economies striving to achieve climate neutrality within several decades.

Some countries (such as Norway, China, or South Korea) took advantage of the specific conditions in which they operated and – among other factors – thanks to energy have achieved high and stable economic growth, fostering economic and social development.

Energy transformation requires an increase in production capacity and substantial investments and financial outlays in the transmission network infrastructure, the construction of energy storage facilities, as well as changes in the behaviours and habits of energy consumers [WEF, 2022]. The types of energy carriers and their source, as well as the size of the demand for energy and its supply have a bearing on economic growth and development. The cost and availability of energy impacts technological development [Pack, 1993, p. 321].

References

Allen R.C., 2013, *Energy transitions in history: The shift to coal* [in:]: *Energy transitions in history: global cases of continuity and change*, eds. R.W. Unger, R. Carson, Center Perspectives, no. 2013/2, https://www.environmentandsociety.org/perspectives/2013/2/energy-transitions-history-global-cases-continuity-and-change [access: 15.12.2024].

Anderson D., 2000, *Energy and economic prosperity*, [in:] *World Energy Assessment, Energy and the challenge of sustainability*, United Nations Development Programme, New York, https://www.undp.org/sites/g/files/zskgke326/files/publications/World%20Energy%20Assessment-2000.pdf [access: 10.12.2024].

Ansari S., 2023, *The Kuznets Curve*, Economics Online, https://www.economicsonline.co.uk/definitions/the-kuznets-curve.html/ [access: 5.12.2024].

Begg D., Vernasca G., Fischer S., Dornbusch R., 2014, *Makroekonomia*, PWE, Warszawa.

Bhutada G., 2022, *Visualizing the history of energy transition*, Visualcapitalist, https://www.visualcapitalist.com/visualizing-the-history-of-energy-transitions/ [access: 2.12.2024].

Carley S., Lawrence S., Brown A., Nourafshan A., Benami E., 2011, *Energy-based economic development*, Renewable and Sustainable Energy Reviews, no. 15, https://www.sciencedirect.com/science/article/pii/S1364032110002583 [access: 28.11.2024].

Chater J., 2005, *A history of nuclear power*, Focus on Nuclear Power Generation, https://courses.grainger.illinois.edu/npre470/sp2018/web/readings/James_Chater_History_nuclear.pdf [access: 12.12.2024].

Ciechanowicz W., 1995, *Energia, środowisko i ekonomia*, Instytut Badań Systemowych PAN, Warszawa.

Danielewski J., 1980, *Paliwa w handlu międzynarodowym*, PWE, Warszawa.

Energifaktanorge, n.d., https://energifaktanorge.no/en/norsk-energiforsyning/kraftproduksjon/ [access: 9.05.2025].

Ghezelbash A., Seyedzadeh M., Khaligh V., Liu J., 2023, *Impacts of green energy expansion and gas import reduction on South Korea's economic growth: a system dynamics approach*, Sustainability, no. 15, https://doi.org/10.3390/su15129281.

Goldemberg J., 2000, *Rural Energy in Developing Countries* [in:] *World Energy Assessment, Energy and the challenge of sustainability*, United Nations Development Programme, New York, https://www.undp.org/sites/g/files/zskgke326/files/publications/World%20Energy%20Assessment-2000.pdf [access: 10.12.2024].

Gradziuk P., 2019, *Rola energii w procesach gospodarowania*, PAN, https://www.researchgate.net/publication/331177588_Rola_energii_w_procesach_gospodarowania [access: 24.11.2024].

GUS, 2023, *Roczniki Statystyki Międzynarodowej*, https://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyki-miedzynarodowej-2023,10,11.html [access: 7.11.2024].

Hodana M., Holtzer G., Kalandyk K., Szymańska A., Szymański B., Żymankowska-Kumon S., 2012, *Odnawialne źródła energii. Poradnik*, Stowarzyszenie Helios.org, Kraków.

Hueting R., 1980, *New scarcity and economic growth. More welfare through less production?* North Holland Publishing Company, Amsterdam.

Igliński B., Buczkowski R., Cichosz M., Iwański P., Rzymyszkiewicz P., 2017, *Technologie hydroenergetyczne*, Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika, Toruń.

IEA, n.d., *Total energy supply (TES) by source, World, 1990–2023*, International Energy Agency, https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource [access: 27.11.2024].

IEA, 2020, *Korea 2020, Energy Policy Review*, International Energy Agency, https://iea.blob.core.windows.net/assets/90602336–71d1–4ea9–8d4f-efeeb24471f6/Korea_2020_Energy_Policy_Review.pdf [access: 9.05.2025].

IEA, 2022, *Norway 2022, Energy Policy Review*, International Energy Agency, https://iea.blob.core.windows.net/assets/de28c6a6–8240–41d9–9082-a5dd65d9f3eb/NORWAY2022.pdf [access: 9.05.2025].

IEI, 2019, *Intermediate Energy Infobook*, The Need Project, Manassas, https://www.need.org/wp-content/uploads/2019/10/Intermediate-Energy-Infobook.pdf [access: 20.12.2024].

Kalwasiński M., 2024, *Chiny na drodze do „zielonego" bezpieczeństwa energetycznego*, Ośrodek Studiów Wschodnich, no. 605, https://www.osw.waw.pl/sites/default/files/komentarze_605_0.pdf [access: 9.05.2025].

Ligus L. (ed.), 2019, *Zarządzanie wartością inwestycji*, Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław.

Malanima P., 2014, *Energy in history* [in:] *The basic environmental history*, eds. M. Agnoletti, S. Neri Serneri, Springer International Publishing, Cham, https://pdfarchived.net/list/the-basic-environmental-history-mauro-agnoletti-4910671 [access: 17.12.2024].

Miljanić O.Š., Pratt J.A., 2022, *Brief history of our relationship with energy* [in:] O.Š. Miljanić, J.A. Pratt, *Introduction to energy and sustainability*, WILEY-VCH GmbH, Weinheim, https://application.wiley-vch.de/books/sample/352734540X_c01.pdf [access: 12.12.2024].

Niedziółka D., 2010, *Rynek energii w Polsce*, Difin SA, Warszawa.

O'Connor P.A., 2010, *Energy transitions*, The Pardee Papers, Boston University, no. 12, https://www.bu.edu/pardee/pardee-paper-012-energy/ [access: 21.12.2024].

Our World in Data, n.d., *Global direct primary energy consumption*, https://ourworldindata.org/grapher/global-primary-energy [access: 4.12.2024].

Pack H., 1993, *Technology gaps between industrial and developing countries: are there dividends for latecomers?* [in:] *Proceedings of the World Bank annual conference on development economics 1992*, Supplement to the World Bank Economic Review and the World Bank Research Observer, eds. L.H. Summers, S. Shah, Floor Discussion of Bell-Pavitt and Pack Papers, World Bank Group, Washington, D.C., https://documents1.worldbank.org/curated/en/353181468739245145/pdf/Proceedings-of-the-World-Bank-annual-conference--on-development-economics-1992.pdf [access: 21.11.2024].

Parsons Charles Algernon, n.d., Encyklopedia PWN, https://encyklopedia.pwn.pl/haslo/Parsons-Charles-Algernon;3954533.html [access: 30.11.2024].

Ritchie H., 2022, *Primary, secondary, final, and useful energy: Why are there different ways of measuring energy?*, Our World in Data, https://ourworldindata.org/energy-definitions [access: 4.12.2024].

Sharma M., Singh K., 2020, *The role of energy economics in economic development: An overview*, Pramana Research Journal, no. 10, https://www.pramanaresearch.org/gallery/prjp%20-%201627.pdf [access: 18.12.2024].

Sharma S.S., 2010, *The relationship between energy and economic growth: Empirical evidence from 66 countries*, Applied Energy, no. 87, https://www.sciencedirect.com/science/article/abs/pii/S0306261910002291 [access: 23.11.2024].

Sikora A.P., Sikora M., 2022, *Amoniak surowcem energetycznym?* Zeszyty Naukowe Instytutu Gospodarki Surowcami Mineralnymi i Energią PAN, no. 110, https://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-0f3660e3–50b1–4d5a-a2f2–753bb187e68a [access: 27.02.2024].

Singh K., 2009, *Rural development principles, policies and management*, SAGE Publications India Pvt Ltd., New Delhi, https://www.cabidigitallibrary.org/doi/full/10.5555/20093064484 [access: 2.12.2024].

Smil V., 2004, *World history and energy*, https://vaclavsmil.com/wp-content/uploads/docs/smil-article-2004world-history-energy.pdf [access: 20.12.2024].

Smil V., 2022, *Energia i cywilizacja. Tak tworzy się historia*, Helion SA, Gliwice.
Starzycka A., Młynarczyk M., Zdanowski A., 2020, *Węgiel kamienny, Hard Coal*, Państwowy Instytut Geologiczny, Warszawa, https://www.pgi.gov.pl/images/muzeum/kopalnia_wiedzy/surowce/foldery/wegiel_kamienny.pdf [access: 9.11.2024].
Statista.com, 2022, *Estimated global population from 10,000BCE to 2100*, https://www.statista.com/statistics/1006502/global-population-ten-thousand-bc-to-2050/ [access: 4.12.2024].
Statista.com, 2024, *Electricity generation worldwide from 1990 to 2024*, https://www.statista.com/statistics/270281/electricity-generation-worldwide/ [access: 4.12.2024].
Stern D.I., 2017, *Energy and economic growth applied research programme thematic note: the linkages between electricity supply and economic growth, applied research programme on energy and economic growth*, https://assets.publishing.service.gov.uk/media/5a267ab8e5274a75088c42b0/Line_23_-_Thematic_note_1.EEG.26.05.2017.v1__1_.pdf [access: 14.12.2024].
Szlęk A., Bijańska J., Wodarski K., 2023, *Amoniak jako nośnik energii*, Nowa Energia, no. 2, https://www.cire.pl/filemanager/Materia%C5%82y%20Problemowe%20(Wies%C5%82aw%20Drozdowski)%20/202848a1a3070cbb27b9faf05d342c4485c17b7280c72995c3b7322f577c206b.pdf [access: 17.12.2024].
Szpilewicz A., 1974, *Surowce dla przyszłości. Paliwa i energia*, Książka i Wiedza, Warszawa.
U.S. Department of Energy Office of Nuclear Energy, n.d., *The history of nuclear energy*, Science and Technology Washington, D.C., https://www.energy.gov/sites/prod/files/The%20History%20of%20Nuclear%20Energy_0.pdf [access: 21.12.2024].
WEF, 2022, *The 200-year history of mankind's energy transitions*, World Economic Forum, https://www.weforum.org/agenda/2022/04/visualizing-the-history-of-energy-transitions/[access: 10.11.2024].
Westinghouse George, n.d., Encyklopedia PWN, https://encyklopedia.pwn.pl/haslo/Westinghouse-George;3995008.html [access: 30.11.2024].
Wielowińska-Pawlak B., 2022, *Nikola Tesla i jego wizjonerska spuścizna*, Nauka na UMCS, https://www.umcs.pl/pl/wszystkie-aktualnosci,23641,nikola-tesla-i-jego-wizjonerska-spuscizna,119447.chtm [access: 30.11.2024].
The World Bank, n.d., https://data.worldbank.org/indicator?tab=all [access: 9.05.2025].
World Energy Balances database, n.d., IEA, https://www.iea.org/data-and-statistics/data-product/world-energy-balances#indicators [access: 9.05.2025].
Worldometer, n.d., *World Population by Year*, https://www.worldometers.info/world-population/world-population-by-year/ [access: 4.12.2024].
WPR, n.d., World Population Review, https://worldpopulationreview.com/ [access: 4.12.2024].
Yeager K., ed., n.d., *Energy and economy*, https://previous.iiasa.ac.at/web/home/research/Flagship-Projects/Global-Energy-Assessment/GEA_Chapter6_economy_hires.pdf [access: 27.11.2024].

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Does my employer care about my garbage? The relationship between pro-environmental actions in the workplace and employees' behaviour at home

Drawing on a survey conducted among employees of companies located in a non-developed country, this article seeks to determine whether there is a relation between actions connected to plastic waste reduction undertaken in the workplace and pro-environmental behaviours in the household. The amount of plastic waste is becoming a global problem, and we believe that effective solutions demand the cooperation of business, society and public authorities. Although, the issue of excessive plastic waste is already well established in the academic literature, the question of the impact of pro-environmental actions undertaken at work on employees' behaviour at home is not sufficiently addressed to be solved. Along with standard statistical measures, we conducted logistic regressions. We found that both the number, along with the type of anti-plastic actions in the workplace, have a positive influence on the employees' willingness to reduce the use of plastic in their households. Furthermore, we found that the most meaningful actions are those aimed at increasing employees' awareness regarding the plastic waste.

Keywords: plastic reduction, pro-environmental behaviour, households, workplace

JEL classification: Q50, D91

Introduction

Excessive plastic waste is a well-established issue in academic literature, international organisations' reports, and traditional and social media [Lebreton, Andrady, 2019]. Despite this, the problem remains insufficiently addressed. According to United Nations data, if current trends continue, by 2050 there will be more plastic waste in the oceans than fish [UN Enviroment Programme, n.d.].

While environmental concerns were initially raised as a challenge for economic policy at the supranational level [Meadows et al., 1972], recent literature suggests that managing environmental change at the global level requires cooperation between the triad of the government, businesses, and households as each of those stakeholders has different motives. For example, the public sector may intervene to address the environment as a market failure, the business sector may consider environmental issues to fall under the purview of corporate social responsibility (CSR) or profit maximisation [Slack et al., 2015], while individual households may view pro-environmental behaviours from the perspective of altruism or cost-cutting, among other factors [Steg, Vlek, 2009].

While the literature concerning the majority of interdependencies between the above-mentioned agents is generally well-established, little attention has been paid to the relationship between corporate pro-environmental actions and employees' behaviour at home. It particular, it remains unclear whether engaging in pro-environmental actions in the workplace may spill over to influence employees' behaviour at home and what factors may facilitate such spillover effects.

Understanding the variables that influence pro-environmental behaviour is challenging due to inconsistencies in individuals' behaviour. It is generally agreed that engagement in one pro-environmental behaviour domain does not necessarily spill over to another [Maki et al., 2019]. For instance, people who recycle waste do not necessarily cycle to work or drink from reusable cups. Moreover, only few studies have investigated whether there is a relationship between conceptually similar actions undertaken in different areas, such as plastic waste reduction in the workplace and in the household [Whitmarsh, O'Neill, 2010].

Studying the relationship between pro-environmental actions undertaken in the workplace and employees' behaviour at home is important for several reasons. Firstly, if engaging in pro-environmental actions in the workplace encourages similar behaviours at home, this could have significant implications for the attempts to promote sustainable behaviour more broadly and, in that sense, could amplify the impact of these initiatives. Secondly, investigating the factors that enable spillover effects could help to design workplace actions more effectively in promoting sustainable behaviours.

To address these issues, this study aims to investigate the relationship between pro-environmental actions in the workplace and employees' behaviour at home. Specifically, we investigate the impact of green actions undertaken by the employer on off-work behaviour in terms of reducing plastic waste. Overall, this study seeks to contribute to a better understanding of the potential spillover effects of workplace pro-environmental actions and to inform about the development of more effective interventions for promoting sustainable behaviour. In that sense, our study contributes to the literature on the subject in several ways. Firstly, we

investigate the unique impact of pro-environmental actions undertaken at work on employees' household behaviour. Secondly, we analyse the significance of different initiatives aimed at plastic use reduction at the workplace within the spillover effect. Last but not least, to the best knowledge of the authors, it is the first paper addressing this issue in Poland.

The remaining part of the paper is structured as follows: the next section contains a review of the literature and presents our research hypothesis. The third section explains the dataset and the methodology used. The fourth section describes the results while the final section contains our conclusions as well as theoretical and managerial implications.

1. Theoretical background and hypotheses development

1.1. Individual Pro-Environmental Behaviour

Pro-environmental behaviour (PEB) is defined as a behaviour that consciously aims to minimise the adverse impact of one's activities on the natural and built environment [Kollmuss, Agyeman, 2002]. According to Stern et al. [1999] and Tian and Liu [2022], PEB encompasses all efforts to decrease or limit an individual's adverse environmental footprint. Stern et al. [1999] categorises PEB into three types: green purchasing, environmental citizenship behaviour, and activist behaviour. Green purchasing refers to consumers choosing products and services that have a lower adverse impact on the environment [Chen, Chang, 2012; Joshi, Rahman, 2015]. Citizenship behaviour involves any activity that has a positive impact on the environment, not necessarily related to purchasing [Dono et al., 2010; Mackay et al., 2021]. Lastly, environmental activist behaviour involves participating in public actions and supporting initiatives that aim to protect the environment.

The common definition of PEB [Kollmuss, Agyeman, 2002] ignores the fact that people perform their actions in different contexts or settings. In practice, this means that behaviours typical of one domain of life or certain spaces may not be possible or effective in another. This is both a problem and an opportunity. Many researchers on behaviour change have focused so far on the home as one of the key areas of everyday life, but there has recently been a growing interest in exploring the workplace as an area where sustainable behaviour can be learned and encouraged. The main reason for this is the understanding of the role of the organisation as a producer of significant greenhouse gas emissions and its potential for steering behaviours in a new, more sustainable direction.

From a theoretical perspective, the motivation behind individual pro-environmental behaviour is often explained by two frameworks: the theory of

planned behaviour (TPB) proposed by Ajzen [1985] and Stern's [2004] value–belief–norm model (VBN). The TPB posits that an individual's behaviour results from their intentions, which are composed of three factors: attitudes, subjective norms, and perceived behavioural control. In the environmental context, attitudes can be understood as a general attitude towards the environment and pro-environmental actions. Research indicates that attitudes play a significant role in pro-environmental behaviour, but they only explain certain behaviours and are relatively easy to change. More stable individual factors, such as values and identities, can influence a wider range of behaviours in different contexts and situations. Subjective norms refer to social expectations and pressures towards pro-environmental behaviour. Finally, perceived behavioural control refers to an individual's feeling of their ability to perform pro-environmental actions [Ajzen, 1985; Ajzen, 2002].

On the other hand, the VBN model is rooted in Schwartz's [1977] moral norm-activation theory of altruistic behaviour and in Dunlap and Van Liere's [1978] new environmental paradigm. Stern's [2004] model consists of a 5-stage causal chain: values, individual environmental worldview (measured and often referred to as the new environmental paradigm), awareness of consequences, ascription of responsibility to self-beliefs, and personal norms. In the environmental context values translate into a set of principles that should guide the formulation of environmental beliefs and are often general and formulated in early life stages. Environmental worldview relates to an individual belief about human-environment relationship, such as human's ability to restore balance with nature and to limit the economic growth. Awareness of consequences is related to individual consciousness about the negative outcomes of acting against the environment (or not acting pro-environmentally). Ascriptions of responsibility to self-beliefs refer to the feeling of being responsible for the negative impact on the environment and the ability to mitigate it, which translates into personal norms that oblige an individual to perform pro-environmental actions. In general, the VBN theory also finds support in numerous empirical studies [De Groot, Steg, 2008; Chen, 2015; Wynveen et al., 2015].

According to a study conducted by Yuriev et al. [2018], the TPB is the dominant framework in empirical studies of workplace pro-environmental behaviour. For instance, De Leeuw et al. [2015] found that TPB is highly effective in explaining pro-environmental behaviour among high-school students, particularly in terms of the perceived behavioural control. The study also suggests that the pro-environmental behaviour of students can be influenced by the behaviour of their parents and family as well as celebrities. Graves et al. [2013] demonstrated that TPB can account for up to 61% of the variation in employees' willingness to engage in pro-environmental behaviours in the workplace. TPB is also widely referred to in literature on household behaviour. For example, Pakpour et al. [2014] found that TPB can explain 47% of the variability in households' pro-environmental behaviour.

1.2. Pro-environmental behaviour at workplace

While TPB and VBN provide useful frameworks for understanding an individual's pro-environmental behaviour, it is important to apply these theories in context and examine the specific social, economic, and environmental factors that can influence behaviour, such as education and knowledge, social norms and peer influence […] economic factors […], convenience and access environmental cues and the environment in which they function, including their workplace [Steg, Vlek, 2009; Abrahamse, Steg, 2013]. The latter is of a particular interest in the context of this study.

Organizational Citizenship Behaviour (OCB) refers to voluntary behaviours of employees that are not part of their contractual obligations [Organ, 1988]. This concept is not exclusively related to the environment and is used in various contexts. In contrast, organisational citizenship behaviour for the environment (OCBE) focuses specifically on an individual's pro-environmental actions in the workplace [Boiral, Paille, 2012]. While OCBE is derived from OCB, it has three distinct components: eco-helping (such as sharing knowledge with co-workers), eco-civic engagement (supporting the greening of an organisation), and eco-initiatives (introducing personal eco-initiatives). It is important to note that OCB and OCBE should be clearly distinguished [Paille, Boiral, 2013].

There have been several empirical studies that investigate the impact of pro-environmental actions undertaken in the workplace on households' awareness and behaviour, independent of the standard theoretical frameworks presented above. For instance, Lo et al. [2012] found that energy-saving behaviour at home differs from individuals' behaviour at the workplace. Likewise, Lee et al. [1995] suggest that the propensity to recycle is higher at home than at work. Al-Shemmeri and Naylor [2017] demonstrate that energy-saving behaviours at home and in the workplace are highly related: employees who act pro-environmentally at home are more likely to behave similarly at work. The differences between the factors that influence pro-environmental behaviour in the workplace and households are highlighted by Blok et al. [2015]. The authors suggest that external factors, such as leadership support, play a significant role in workplace behaviour and that these factors are absent at home.

The perception of pro-environmental actions and their costs can differ between employers and employees, which can affect the environmental performance of a company that relies on employee volunteering [Greene et al., 2014]. At the same time, the environmental performance of a company is primarily dependent on employees' voluntary engagement [Boiral, 2009]. The attitude towards pro-environmental behaviours in the workplace comprises personal and organisational factors, and incentives promoting such behaviours may depend on the industry or type of organisation [Manika et al., 2015]. While environmental information

dissemination alone may be insufficient [Ramus, 2002], well-established policies and managers' commitment can stimulate pro-environmental actions. Leaders' pro-environmental norms and workplace behaviour can affect employees' environmental passion, which in turn enables organisation-wide greening [Robertson, Barling, 2013]. However, a study by Saifulina and Carballo-Panela [2017] has shown that employees' attitude and organisational support are the most important determinants of workplace environmentally friendly behaviour (WEFB). Surprisingly, the influence of supervisors and colleagues on employees' behaviour was not confirmed in some studies. Finally, green training has been shown to successfully stimulate employees' pro-environmental behaviour in the workplace [Zientara, Zamojska, 2016; Pham et al., 2018].

1.3. Spillover effects of workplace pro-environmental initiatives on employees' household behaviour

Taking the aforementioned factors into consideration, the question arises as to whether and how the employers' engagement in pro-environmental activities produces a positive spillover effect, resulting in pro-environmental behaviour in the household. On the one hand, some scholars argue that PEB in the workplace may result in a negative spillover, as engagement in OCBE may be a result of the expectations, norms, and pressures set by the organisation [Littleford et al., 2014; Seroka-Stolka, Fijorek, 2020]. On the other hand, we believe that by creating a social norm, employers may encourage workers to adopt similar behaviour in their personal lives. According to the principles of TPB, individuals are more likely to engage in pro-environmental behaviour when they perceive their actions as socially desirable. This is supported by the fundamentals of the social learning theory, which suggests that people learn from observing the behaviour of others and the consequences of those actions.

Individuals learn through observation and imitation of behaviours of the people who are important to them, specifically their colleagues or managers at work. Studies found that employees who engaged in workplace PEB were more likely to engage in PEB at home [Kormos, Gifford, 2014]. Furthermore, initiatives aimed at PEB in the workplace, such as reducing plastic packaging, can create a sense of shared responsibility and commitment to sustainability among colleagues, which can further reinforce pro-environmental attitudes and behaviours in households. Therefore, we argue that employers' engagement in pro-environmental activities can produce a positive spillover effect, triggering pro-environmental behaviour in the household. However, to achieve this effect, it is essential to create a supportive and empowering workplace culture that encourages pro-environmental behaviours and initiatives. Such initiatives should involve the participation of all employees and should be based on effective communication, education, and leadership support.

Our particular focus is on awareness campaigns in the workplace, as they are perceived as particularly effective in promoting sustainable behaviours among employees, such as reducing their environmental impact by using fewer plastic products at home. These campaigns provide employees with the necessary information and resources to become more conscious of their actions' environmental consequences. By raising awareness, employees are more likely to adopt sustainable practices. Additionally, workplace campaigns can help promote a culture of sustainability that extends beyond the workplace into employees' personal lives. Research shows that awareness campaigns can promote pro-environmental behaviour in households [Kollmuss, Agyeman, 2002], contributing to a more sustainable society overall. Therefore, when a company initiates an awareness campaign related to pro-environmental initiatives, it creates a normative influence that can lead to the formation of a social norm promoting environmentally responsible behaviour outside the company.

Moreover, the self-efficacy theory proposes that people are more likely to engage in a behaviour if they feel capable of doing it successfully. To increase employees' perceived self-efficacy and confidence in adopting pro-environmental behaviours, companies can offer external incentives. For instance, providing employees with reusable items that they can use in their personal lives instead of disposable plastic items can encourage them to reduce plastic waste outside of work. Additionally, the diffusion of innovation theory suggests that individuals who are exposed to new ideas and practices are more likely to adopt them over time. By implementing initiatives that reduce plastic use in general or offering innovative reusable items, employers can foster PEB in employees' households.

Based on the above line of argumentation, we contend that:

H1: There is a positive relationship between workplace awareness campaigns and pro-environmental behaviour in households.

H2: There is a positive relationship between reducing the use of plastic packaging for workplace products and pro-environmental behaviour in households.

H3: There is a positive relationship between obligatory plastic waste recycling and pro-environmental behaviour in households.

H4: There is a positive relationship between providing employees with reusable, non-plastic items and pro-environmental behaviour in households.

H5: There is a positive relationship between conducting competition for employees aimed at plastic use reduction and pro-environmental behaviour in households.

2. Context of the study

For our analysis, we have selected Poland as a case study of a non-developed country. This choice is particularly noteworthy for several reasons. Firstly, as Yuriev et al. [2018] noted, the majority of recent studies on pro-environmental behaviour among employees have focused on developed countries, primarily the UK and the US. According to literature on the Environmental Kuznets Curve (EKC) [Grossman, Krueger, 1991; Stern, 2004; Zielińska-Głębocka et al., 2020], the inclination to protect the environment can vary significantly between developed and less-developed countries. This implies that there may be differences in individual pro-environmental behaviour in countries at different stages of development [Vicente-Molina, et al., 2013]. Studies also suggest that ecological awareness in Poland is relatively low, but increasing [Wądołowska, 2011]. Interestingly, Mazurek-Łopacińska and Sobocińska [2014] argue that Poles' pro-environmental behaviour may be partly explained by their saving habits rather than ecological concerns. Furthermore, the authors observe that ecological awareness does not necessarily translate into pro-environmental behaviour. This conclusion is supported by a minimal change in the Environmental Performance Index over the last 10 years (Poland was ranked 37th in 2020, with an index of 60.9 and a 1.1-point change over a decade). On the other hand, Poland is subject to the European Union's stringent environmental policies, such as the European Green Deal, which aims to achieve environmental neutrality by 2050. From this perspective, ecological awareness and action should involve the triad of administration, businesses, and households, which presents a particular challenge for Poland.

Finally, the empirical literature focusing on non-developed countries, particularly Poland, remains relatively scarce. Zientara and Zamojska [2016] examined the relationship between green organisational climate (GOC) and OCBE in the Polish hotel industry. Their findings revealed a generally low level of GOC, which nevertheless exerted a direct influence on OCBE. They also identified a positive impact of employees' values and commitment on environmentally oriented behaviours. In a subsequent study, Zientara et al. [2019] surveyed coal miners in Poland to determine whether the industry was implementing organisational greening principles and whether employees engaged in pro-environmental practices. The authors found that a green workplace climate positively affects individuals' behaviour, both at work and at home. Moreover, Szeliga-Duchnowska and Szewczyk [2020] investigated environmental workplace behaviour in small and medium-sized enterprises (SMEs) in Poland. Their study identified several counter-ecological behaviours, mainly related to waste management, and – crucially – showed that in more than 70% of cases, employees were unaware of their employers' pro-ecological initiatives. These findings highlight that examining the

behaviour of employers and employees in Poland may offer valuable insights into the challenges and opportunities associated with fostering pro-environmental behaviour in non-developed countries and may indicate the potential for a broader cultural shift towards sustainability.

In parallel, central and local governments in Poland have been implementing various policies and regulations aimed at reducing plastic waste, such as mandatory recycling and charges for plastic shopping bags. Although these measures have increased the number of individuals engaging in plastic-reduction activities, most of these actions remain primarily cost-driven and, therefore, insufficient. Consequently, an effective approach to reducing plastic waste requires a higher level of voluntary commitment. In line with this argument, we contend that pro-environmental behaviour within households should involve self-initiated and voluntary actions rather than those motivated solely by economic incentives.

3. Research design

3.1. Data collection and participants

To test our hypotheses, we employed an online self-report questionnaire. The survey was administered to employees working in middle-sized and large companies operating in Poland. To select the companies for our study, we started by defining our criteria as covering companies operating in Poland with a workforce of more than 49 employees. We then accessed the ORBIS database – a global database of public and private companies – and conducted a search using these defined criteria. Using a random number generator, we selected 500 companies from the list. Next, we contacted them via email and asked for their participation in the study. In particular, we requested them to send a link to a questionnaire and a description of the study to their employees. In total, we received 125 responses, out of which 9 we considered incomplete and therefore excluded from further analysis. As a result, 116 responses were used in our analysis.

The study participants comprised 78% females, with an average age of 35 years. A significant majority (96%) had attained a university education, and 84% of them resided in multi-family buildings such as flats or apartments. On average, each household had 2.48 individuals. More than 70% of the respondents worked for companies with a staff size exceeding 249, while 43% were employed by international organisations (Table 1).

Table 1. Sample characteristic (N = 125; 9 responses excluded from further analysis)

Variable	Characteristic	(%)
Gender	men	22
	women	78
Age	18–24	5.2
	25–34	50
	35–44	27.6
	45–54	13.8
	55+	3.4
Education	high school	5
	university graduate	95
Residence	single-family house	16
	flat	84
Number of people in the household	1	17.2
	2	40.5
	3	20.7
	4 or more	21.6

Source: Own elaboration.

3.2. Instrument development and data analysis

The survey questionnaire comprised four parts. The first section aimed to measure employees' pro-environmental engagement with regard to reducing plastic usage in their households. Specifically, participants were asked to select from a list of twenty activities those that they undertake in their households. We considered engagement to be high if they indicated a minimum of five activities (first quartile).

The second part focused on the employer's efforts towards reducing plastic usage in the workplace. In particular, we enquired about specific activities such as conducting awareness campaigns, distributing reusable non-plastic items to employees, reducing the use of products in plastic packaging, and obligatory plastic waste recycling (via yes/no questions). We also controlled for age, gender, place of residence, and number of people living in the household (Table 2).

A logistic regression approach was employed to test the hypotheses. This statistical method enables the examination of how changes in the selected variables relate to the likelihood of engaging in pro-environmental behaviour. In this study, the level of engagement in plastic use reduction is represented by a binary variable with two categories: low engagement ("0") and high engagement ("1"). Importantly, respondents who selected five or fewer activities aimed at reducing plastic use

Table 2. Description of variables

Variable	Description
Engagement	individual engagement in households aimed at avoidance of plastic and its use reduction in the household (dummy variable)
Age	the age of respondents
Residence	the type of residence of respondents (single-family house or flat/apartment)
Household	the number of people living in the household
Campaigns	workplace campaigns to raise the awareness of the need to reduce plastic use (dummy variable)
Reduction	reducing the use of products in plastic packages in the workplace (dummy variable)
Reusables	distributing reusable items to employees, such as bottles or bags, in the workplace (dummy variable)
Competitions	competitions organised by employer aimed at plastic use reduction (dummy variable)
Recycling	obligatory plastic waste recycling in the workplace (dummy variable)

Source: Own elaboration.

at their households were classified as having low engagement, while those who selected more than five activities were classified as highly engaged. Consistent with prior studies [Cameron, Trivedi, 2010], we evaluated our results using the pseudo-R^2 measure, predictive accuracy, and standard post-estimation analysis.

4. Results

4.1. Statistical analysis

Initially, we conducted a simple statistical analysis of the answers provided in the questionnaire. The level of concern about plastic waste in Poland is relatively high, with 98% of respondents segregating plastic waste, and 97% undertaking further activities to reduce the use of plastic and the quantity of plastic waste produced by their households. On average, respondents take 8.82 actions aimed at reducing plastic use, with a mean value of 9. Specifically, 94% of respondents carry reusable shopping bags, 80% do not use plastic plates and cutlery, 77% do not use disposable dishes or cups, and 74% regularly use reusable products. More than half of our respondents reported that they have stopped using straws, drink tap water to avoid using plastic bottles, select products that do not have any plastic packaging, and use reusable wrappers to pack food. On the other hand, less than 20% of respondents purchase bar cosmetics, refill empty cosmetic containers, avoid using plastic sponges, or prepare their own cleaning products (Table 3).

Table 3. Selected actions aimed at plastic usage reduction in households

Question	Responses (%)
I carry reusable shopping bags when I go shopping	94
I have stopped using plastic plates and cutlery	80
I do not use disposable dishes, cups or cutlery	77
I use reusable products	74
I have stopped using disposable straws	68
I drink tap water to avoid using plastic bottles	67
I choose products that do not have any unnecessary plastic packaging	55
I use reusable breakfast wrappers and lunch boxes instead of plastic wraps and bags to pack food	51
I limit my clothing purchases	48
I avoid buying food in plastic packaging	47
I carry my own coffee mug with me	47
I buy clothes of good quality made from natural materials	46
I have stopped using plastic cotton buds	44
I buy products by weight and pack them into containers that I bring with me	39
I carry my own cutlery to avoid using plastic cutlery	32
I refill empty cosmetic containers	19
I buy bar cosmetics	16
I have stopped using plastic sponges	13
I prepare household cleaning products myself	13
I use a bamboo toothbrush (or a toothbrush made from another environmentally friendly material)	13

Source: Own elaboration.

Seventy-five percent of our respondents declared that their employers carry out promotional campaigns to raise the awareness of the need to reduce plastic use. Seventy-two percent added that their employer had introduced obligatory recycling and another 61% reported that plastic water bottles had been replaced by tap filter or glass bottles in their workplace (Table 4).

Table 4. Selected actions aimed at plastic use reduction in the workplace

Question	Responses (%)
Pro-environmental campaigns	75
Obligatory recycling	72
Replacing plastic water bottles with tap filters or glass bottles	61
Replacing plastic dishes with reusable ones, ceramic, or glass	49
Distributing reusable shopping bags, bottles, etc.	43

Source: Own elaboration.

4.2. Hypotheses testing

In order to test the hypotheses, we conducted the logistic regression, with the independent variable indicating an individual's engagement in plastic reduction. The model included several independent variables, such as age, gender, and employers' action aimed at reducing plastic use (see Table 2).

The logistic regression model was statistically significant ($\chi^2(8) = 16.41$, $p = .0037$), indicating that the model as a whole was an acceptable fit for the data. The model explained 10.36% of the variance in purchase behaviour (pseudo $R^2 = .1036$). Table 5 presents the coefficients, standard errors, and p-values for each independent variable in the model. Surprisingly, among employers' actions aimed at reducing plastic use in the workplace, only campaigns designed to increase employees' awareness turned out to be significantly related to individuals' engagement in their workplace ($\beta = 1.7907$; $p = .003$), thus H1 was supported. Employers' effort to reduce the use of plastic goods in the workplace ($\beta = –.4324$, $p = .35$), obligatory recycling ($\beta = .2688$, $p = .59$), as well as providing employees with reusable non-plastic items ($\beta = –.4997$, $p = .26$) and conducting competitions with incentives to reduce plastic items ($\beta = –.7061$, $p = .174$) were not significantly related to employee engagement in plastic use reduction at home. Thus, H2–H5 were not supported. The model was correctly classified in 66%.

Table 5. Logit regression results – variables coefficients, standard errors and p-values

Hypothesis	Coeff.	SE	p-value	Decision
H1	1.7907	0.6053	0.003	supported
H2	0.4324	0.4607	0.348	unsupported
H3	0.2688	0.5048	0.594	unsupported
H4	–0.4997	0.4469	0.264	unsupported
H5	–0.7061	0.5199	0.174	unsupported

Source: Own elaboration.

5. Discussion and implications

As already highlighted above, the relationship between pro-environmental actions in the workplace and pro-environmental behaviour at home was generally neglected in the academic literature. In line with Lee et al. [1995] it should be underlined that the determinants of pro-environmental behaviour at home and at the workplace differ. For example, economic factors (such as utilities costs) can play significant role at home [Siero et al., 1989], while in the workplace, the behaviour

can be affected by organisational support. Despite these differences, we find evidence that both the concepts are clearly linked, which is in line with the results obtained by Al-Shemmeri and Naylor [2017].

In particular, our results revealed that campaigns increasing employees' awareness of plastic use reduction in the workplace were significantly related to individuals' engagement in plastic use reduction at home, thus supporting the first hypothesis (H1). This finding is consistent with the previous research that has highlighted the importance of education and awareness-raising initiatives in promoting sustainable behaviour change [Kollmuss, Agyeman, 2002]. Our results indicate that supporting employees' pro-environmental behaviours can imply a "positive externality" for the environment in the form of change of at-home behaviours, as a complement to a parallel behaviour in the workplace. This in turn supports the findings of Linder et al. [2018] or Chow et al. [2017] who suggest that actions raising environmental awareness can successfully influence employees' behaviour. Most household activities are limited to actions imposed by legal regulations and introduced fees. However, we believe that voluntary actions stemming from growing awareness and understanding by individuals are the key to an effective reduction of plastic waste production. Hence, it is important to provide the proper means and training, also in the individuals' environments, in particular in the workplace. We think that actions undertaken by employers can significantly influence pro-environmental behaviours in households.

Our findings also suggest that workplace education may spill over into the home environment. This finding supports the idea of the social learning theory. According to social learning theory, individuals learn by observing others and modelling their behaviour [Bandura, 1977]. This suggests that the workplace can serve as a site for social learning, where employees can observe and learn from their colleagues' sustainable behaviours. Moreover, social learning theory suggests that environmental cues can also influence individuals' behaviour. In this study, campaigns aimed at increasing employees' awareness of plastic use reduction may have acted as environmental cues, reminding individuals to engage in sustainable behaviour not only at work but also in their personal lives. By creating a culture of sustainability within the workplace, organisations can inspire employees to adopt sustainable behaviours both at work and in their personal lives.

In contrast, the lack of significant relationships between other employer-led initiatives, such as reducing plastic use in the workplace, providing reusable non-plastic items, conducting competitions with incentives, obligatory recycling, and individuals' engagement in plastic reduction at home (not supporting H2–H5) suggests that these initiatives may not be effective in promoting sustainable behaviour change, which is contrary to previous research [Pham et al., 2018; Pham et al., 2019]. This can – at least partly – be explained by the TPB. According to TPB,

individuals' intentions to engage in a behaviour are influenced by their attitudes, subjective norms, and perceived behavioural control [Ajzen, 1991]. The findings suggest that employer-led initiatives other than awareness campaigns may not have been effective in changing employees' attitudes, subjective norms, or PBC related to plastic use reduction at home. Additionally, it seems that employees do not become more self-efficacious or fail to develop the habit of acting in a pro-environmental way. Perhaps it is related to the fact that, at least in selected cases, employers' actions have been concentrated on greening and building a good image, rather than on the empowerment of their employees to become agents of sustainable change. This highlights the need for a more comprehensive approach to sustainability in the workplace, which includes empowering employees to become sustainability advocates both at work and in their personal lives.

Our findings also have important implications for policymakers and employers who may wish to promote sustainable behaviours among their employees. They suggest that education and awareness-raising initiatives may be effective not only in the workplace but also in promoting sustainable behaviours at home. On the other hand, although some actions – such as replacing plastic items with more sustainable alternatives or implementing obligatory recycling – may help to reduce plastic use within the company, our findings suggest that these actions may not generate a spill-over effect into employees' personal lives. This highlights the need for a more comprehensive approach to promoting sustainable behaviour change within organisations. CSR and ESG managers should prioritise educational initiatives aimed at raising employees' awareness of the environmental impacts of plastic use and at empowering them to become agents of change. Furthermore, our study emphasises the importance of not relying solely on providing employees with reusable items as a means of reducing plastic use. While providing reusable items may be a well-intentioned action, our findings suggest that it may not be sufficient to generate sustainable behaviour change. Instead, CSR and ESG managers should focus on promoting behaviour change through education and awareness-raising initiatives.

6. Conclusions

In this article, we have aimed to analyse the impact of different groups of actions undertaken by employers on individuals' pro-environmental behaviour. Based on a sample of 116 responses from corporate employees in Poland, our study suggests that activities targeted at increasing awareness and knowledge about plastic waste production have the most significant impact on individuals' pro-environmental behaviours. However, we have also found that the number of

pro-ecological actions undertaken in the company significantly impacts individuals' pro-environmental behaviours, thus suggesting that the more actions are taken, the better the pro-environmental habits are developed. Nonetheless, awareness campaigns remain the most significant factor in driving change.

Despite the findings of our study, we recognise several limitations that should be mentioned. First, we acknowledge the potential for selection bias – given that the questionnaire was distributed voluntarily, it could lead to the participation of more environmentally aware employees. However, as noted by Brodzicki and Ciołek [2016], a lack of balance between sub-samples in logistic regression is not particularly problematic.

Furthermore, as the questionnaire focused solely on plastic waste reduction behaviours, the obtained results may not be universal to all pro-environmental behaviours. Therefore, further research should investigate the relationship between the workplace and home and consider a broader range of pro-environmental behaviours.

Lastly, the results of our study should be confirmed on a larger research sample, preferably in a panel data setting. By doing so, we could better understand the relationship between employers' actions, individual pro-environmental behaviours, and the potential spillover effect.

References

Abrahamse W., Steg L., 2013, *Social influence approaches to encourage resource conservation: A meta-analysis*, Global Environmental Change, no. 23(6).

Ajzen I., 1985, *From intentions to actions: A theory of planned behavior* [in:] *Action control: From cognition to behavior*, eds. J. Kuhl, J. Beckmann, Springer Berlin Heidelberg, Berlin–Heidelberg.

Ajzen I., 1991, *The theory of planned behavior*, Organizational Behavior and Human Decision Processes, no. 50(2).

Ajzen I., 2002, *Perceived behavioral control, self efficacy, locus of control, and the theory of planned behavior 1*, Journal of Applied Social Psychology, no. 32(4).

Al-Shemmeri T., Naylor L., 2017, *Energy saving in UK FE colleges: The relative importance of the socio-economic groups and environmental attitudes of employees*, Renewable and Sustainable Energy Reviews, no. 68.

Bandura A., 1977, *Self-efficacy: toward a unifying theory of behavioral change*, Psychological Review, no. 84(2).

Blok V., Wesselink R., Studynka O., Kemp R., 2015, *Encouraging sustainability in the workplace: a survey on the pro-environmental behaviour of university employees*, Journal of Cleaner Production, no. 106.

Boiral O., 2009, *Greening the corporation through organizational citizenship behaviours*, Journal of Business Ethics, no. 87.

Boiral O., Paillé P., 2012, *Organizational citizenship behaviour for the environment: Measurement and validation*, Journal of Business Ethics, no. 109.

Brodzicki T., Ciołek D., 2016, *Determinanty działalności eksportowej polskich firm produkcyjnych*. Gospodarka Narodowa, no. 2.

Cameron A.C., Trivedi P.K., 2010, *Microeconometrics using stata*. Revised edition, Stata Press, College Station, TX.

Cecere G., Mancinelli S., Mazzanti M., 2014, *Waste prevention and social preferences: the role of intrinsic and extrinsic motivations*, Ecological Economics, no. 107.

Chen M.F., 2015, *An examination of the value belief norm theory model in predicting pro environmental behaviour in Taiwan*, Asian Journal of Social Psychology, no. 18(2).

Chen Y.S., Chang C.H., 2012, *Enhance green purchase intentions: The roles of green perceived value, green perceived risk, and green trust*, Management Decision, no. 50(3).

Chow C.F., So W.M.W., Cheung T.Y., Yeung S.K.D., 2017, *Plastic waste problem and education for plastic waste management* [in:] *Emerging practices in scholarship of learning and teaching in a digital era*, eds. S.C. Kong, T.L. Wong, M. Yang, C.F. Chow, K.H. Tse, Springer, Singapore.

Ciocirlan C.E., 2016, *Environmental workplace behaviours: definition matters*, Organization & Environment, no. 30.

Curtis J., Lyons S., O'Callaghan-Platt A., 2011, *Managing household waste in Ireland: behavioural parameters and policy options*, Journal of Environmental Planning and Management, no. 54.

De Groot J.I., Steg L., 2008, *Value orientations to explain beliefs related to environmental significant behavior: How to measure egoistic, altruistic, and biospheric value orientations*, Environment and Behavior, no. 40(3).

De Leeuw A., Valois P., Ajzen I., Schmidt P., 2015, *Using the theory of planned behaviour to identify key beliefs underlying pro-environmental behaviour in high-school students: Implications for educational interventions*, Journal of Environmental Psychology, no. 42.

Dono J., Webb J., Richardson B., 2010, *The relationship between environmental activism, pro--environmental behaviour and social identity*, Journal of Environmental Psychology, no. 30(2).

Dunlap R.E., Van Liere K.D., 1978, *The "new environmental paradigm"*, The Journal of Environmental Education, no. 9(4).

Fernández E., Junquera B., Ordiz M., 2003, *Organizational culture and human resources in the environmental issue: a review of the literature*, International Journal of Human Resource Management, no. 14.

Gilley K., Worrell D., El-Jelly A., 2002, *Corporate environmental initiatives and anticipated firm performance: the differential effects of process-driven versus product-driven greening initiatives*, Journal of Management, no. 26.

Gilli M., Nicolli F., Farinelli P., 2018, *Behavioural attitudes towards waste prevention and recycling*, Ecological Economics, no. 154.

Graves L.M., Sarkis J., Zhu Q., 2013, *How transformational leadership and employee motivation combine to predict employee proenvironmental behaviours in China*, Journal of Environmental Psychology, no. 35.

Greene C., Crumbleholme L., Myerson J., 2014, *Sustainable cultures: Engaging employees in creating more sustainable workplaces and workstyles*, Facilities, no. 32(7/8).

Grossman G.M., Krueger A.B., 1991, *Environmental impacts of a North American Free Trade Agreement*, National Bureau of Economic Research Working Paper 3914, NBER, Cambridge, MA.

Hart S., Ahuja G., 1996, *Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance*, Business Strategy and the Environment, no. 5(1), 30–37.

Hoffman A.J., 1993, *The importance of fit between individual values and organisational culture in the greening of industry*, Business Strategy and the Environment, no. 2.

Joshi Y., Rahman Z., 2015, *Factors affecting green purchase behaviour and future research directions*, International Strategic Management Review, no. 3(1–2).

King A., Lenox M., 2002, *Exploring the locus of profitable pollution reduction*, Management Science, no. 48.

Kirakozian A., 2016, *One without the other? Behavioural and incentive policies for household waste management*, Journal of Economic Surveys, no. 30.

Kollmuss A., Agyeman J., 2002, *Mind the gap: why do people behave environmentally and what are the barriers to pro-environmental behaviour?* Environmental Education Research, no. 8.

Kormos C., Gifford R., 2014, *The validity of self-report measures of proenvironmental behavior: A meta-analytic review*, Journal of Environmental Psychology, no. 40.

Lebreton L.C.M., Andrady A.L., 2019, *Future scenarios of global plastic waste generation and disposal*, Science Advances, no. 5.

Lee Y.-J., De Young R., Marans R.W., 1995, *Factors influencing individual recycling behaviour in office settings: a study of office workers in Taiwan*, Environment and Behaviour, no. 27.

Linder N., Lindahl T., Borgström S., 2018, *Using behavioural insights to promote food waste recycling in urban households – Evidence from a longitudinal field experiment*, Frontiers in Psychology, no. 9.

Littleford C., Ryley T.J., Firth S.K., 2014, *Context, control and the spillover of energy use behaviours between office and home settings*, Journal of Environmental Psychology, no. 40.

Lo S.H., Peters G.-J.Y., Kok G., 2012, *Energy-related behaviours in office buildings: a qualitative study on individual and organisational determinants*, Applied Psychology: An International Review, no. 61.

Mackay C.M., Schmitt M.T., Lutz A.E., Mendel J., 2021, *Recent developments in the social identity approach to the psychology of climate change*, Current Opinion in Psychology, no. 42.

Maki A., Carrico A.R., Raimi K.T., Truelove H.B., Araujo B., Yeung K.L., 2019, *Meta-analysis of pro-environmental behaviour spillover*, Nature Sustainability, 2.

Manika D., Wells V.K., Gregory-Smith D., Gentry M., 2015, *The impact of individual attitudinal and organisational variables on workplace environmentally friendly behaviours*, Journal of Business Ethics, no. 126.

Mazurek-Łopacińska K., Sobocińska M., 2014, *Determinanty rozwoju zrównoważonej konsumpcji w Polsce – wybrane zagadnienia*, Zeszyty Naukowe Uniwersytetu Szczecińskiego, no. 824.

Meadows D.H., Meadows D.L., Randers J., Behrens W., 1972, *The Limits to Growth*, Universe Books, New York.

Molina-Azorín J.F., Claver-Cortés E., Pereira-Moliner J., Tarí J.J., 2009, *Environmental practices and firm performance: an empirical analysis in the Spanish hotel industry*, Journal of Cleaner Production, no. 17.

Njeru J., 2006, *The urban political ecology of plastic bag waste problem in Nairobi, Kenya*, Geoforum, no. 37.

Organ D.W., 1988, *Organizational Citizenship Behaviour: The Good Soldier Syndrome*, Lexington Books, Lexington, Mass.

Paillé P., Boiral O., 2013, *Pro-environmental behaviour at work: Construct validity and determinants*, Journal of Environmental Psychology, no. 36.

Paillé P., Chen Y., Boiral O., Jin J., 2014, *The impact of human resource management on environmental performance: An employee-level study*, Journal of Business Ethics, no. 121.

Pakpour A.H., Zeidi I.M., Emamjomeh M.M., Asefzadeh S., Pearson H., 2014, *Household waste behaviours among a community sample in Iran: An application of the theory of planned behaviour*, Waste Management, no. 34.

Pham N.T., Phan Q.P.T., Tučková Z., Vo N., Nguyen L.H., 2018, *Enhancing the organizational citizenship behaviour for the environment: the roles of green training and organizational culture*, Management & Marketing. Challenges for the Knowledge Society, no. 13.

Pham N.T., Tučková Z., Jabbour C.J.C., 2019, *Greening the hospitality industry: How do green human resource management practices influence organizational citizenship behaviour in hotels? A mixed-methods study*, Tourism Management, no. 72.

Ramus C.A., 2002, *Encouraging innovative environmental actions: what companies and managers must do*, Journal of World Business, no. 37.

Robertson J.L., Barling J., 2013, *Greening organizations through leaders' influence on employees' pro-environmental behaviours*, Journal of Organizational Behaviour, no. 34.

Saifulina N., Carballo-Penela A., 2017, *Promoting sustainable development at an organizational level: an analysis of the drivers of workplace environmentally friendly behaviour of employees*, Sustainable Development, no. 25.

Schwartz S.H., 1977, *Normative influences on altruism* [in:] *Advances in experimental social psychology*, ed. L. Berkowitz, Academic Press, New York.

Seroka Stolka O., Fijorek K., 2020, *Enhancing corporate sustainable development: Proactive environmental strategy, stakeholder pressure and the moderating effect of firm size*, Business Strategy and the Environment, 29(6).

Sierro S., Boon M., Kok G., Siero F., 1989, *Modification of driving behaviour in a large transport organization: a field experiment*, Journal of Applied Psychology, no. 74.

Slack R.E., Corlett S., Morris R., 2015, *Exploring employee engagement with (corporate) social responsibility: A social exchange perspective on organisational participation*, Journal of Business Ethics, no. 127.

Steg L., Vlek C., 2009, *Encouraging pro-environmental behaviour: An integrative review and research agenda*, Journal of Environmental Psychology, no. 29.

Stern D.I., 2004, *The rise and fall of the environmental Kuznets curve*, World Development, no. 32.

Stern P.C., Dietz T., Abel T., Guagnano G.A., Kalof L., 1999, *A value-belief-norm theory of support for social movements: The case of environmentalism*, Human Ecology Review, no. 2.

Szeliga-Duchnowska A., Szewczyk M., 2020, *Environmental Workplace Behaviours – It Takes Two to Tango*, European Research Studies, no. 23.

Tian H., Liu X., 2022, *Pro-environmental behavior research: Theoretical progress and future directions*, International Journal of Environmental Research and Public Health, no. 19(11).

UN Enviroment Programme, n.d., *Plastic pollution*, https://www.unenvironment.org/interactive/beat-plastic-pollution/ [access: 3.08.2023].

Vicente-Molina M.A., Fernández-Sáinz A., Izagirre-Olaizol J., 2013, *Environmental knowledge and other variables affecting pro-environmental behaviour: comparison of university students from emerging and advanced countries*, Journal of Cleaner Production, no. 61.

Viscusi W.K., Huber J., Bell J., Cecot C., 2009, *Discontinuous behavioural responses to recycling laws and plastic water bottle deposits*, NBER Working Paper, no. 15585.

Wądołowska K., 2011, *Zachowania proekologiczne Polaków*, Centrum Badania Opinii Społecznej, Warszawa, http://www.cbos.pl/SPISKOM.POL/2011/K_023_11.PDF [access: 3.08.2023].

Wagner M., 2005, *How to reconcile environmental and economic performance to improve corporate sustainability: corporate environmental strategies in the European paper industry*, Journal of Environmental Management, no. 76.

Wagner M., Van Phu N., Azomahou T., Wehrmeyer W., 2002, *The relationship between the environmental and economic performance of firms: an empirical analysis of the European paper industry*, Corporate Social-Responsibility and Environmental Management, no. 9.

Whitmarsh L., O'Neill S., 2010, *Green identity, green living? The role of pro-environmental self--identity in determining consistency across diverse pro-environmental behaviours*, Journal of Environmental Psychology, no. 30.

Wynveen C.J., Wynveen B.J., Sutton S.G., 2015, *Applying the value-belief-norm theory to marine contexts: Implications for encouraging pro-environmental behavior*, Coastal Management, no. 43.

Yuriev A., Boiral O., Francoeur V., Paillé P., 2018, *Overcoming the barriers to pro-environmental behaviors in the workplace: A systematic review*, Journal of Cleaner Production, no. 182.

Zielińska-Głębocka A., Kwiatkowski J.M., Tomaszewski T., 2020, *Zróżnicowanie i stany nierównowagi w gospodarce globalnej*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk.

Zientara P., Zamojska A., 2016, *Green organizational climates and employee proenvironmental behaviour in the hotel industry*, Journal of Sustainable Tourism, no. 26, http://dx.doi.org/10.1080/09669582.2016.1206554.

Zientara P., Zamojska A., Maciejewski G., Nikodemska-Wołowik A.M., 2019, *Environmentalism and Polish coal mining: A multilevel study*, Sustainability, no. 11(11).

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The voiceless generation: The fight for progressive values within European trade unions

The study explores how Millennial union officials assess their unions' engagement with young people. The focus is on unions' image, agenda, governance, and use of social media. It builds on a qualitative research framework. Semi-structured qualitative interviews were used as the principal method of inquiry. The results indicate that while there is a growing realisation of the need to broaden union agendas in order to better appeal to young people, only a few unions have actually started to pay attention to progressive causes. Opinions were also divided on whether younger unionists were given a greater say in decision-making. Likewise, while some interviewees positively assessed their unions' embrace of social media, others were more critical. The paper contributes to the literature on the relationship between unions and young workers, while at the same time also providing insights into the debate on union revitalisation.

Keywords: trade unions, youth, progressive values, Europe

JEL classification: A13, J15, J51, L31

Introduction

It is beyond significant debate that, since the 1980s, humanity has been witnessing the decline of trade unions [Beaumont, 1987]. This, in turn, has not only ignited discussions about their revitalisation [Gumbrell-McCormick, Hyman, 2013; Ibsen, Tapia, 2017; Holgate et al., 2018; Kelly, 2018; Simms et al., 2019] but has also drawn particular attention to youth unionisation [Waddington, Kerr, 2002]. This is especially relevant given that trade unions have long maintained a strained relationship with younger workers [Hodder, 2015]. As a result, both scholars and union practitioners have undertaken numerous initiatives to engage younger generations in union activities [Lorenzini, 2016; Hodder, Houghton, 2020; Smith, Duxbury, 2020].

The literature points to three primary reasons for the low unionisation rates among Generation Z and Millennials: the characteristics of the labour market, issues

related to young people's attitudes, and the inadequacy of union responses to these challenges [Waddington, Kerr, 2002]. Additionally, many service-sector firms tend to offer part-time employment and temporary or contract-based jobs, which are not conducive to unionisation [Heery et al., 2004; Tailby, Pollert, 2011; Polkowska, 2021].

Against this backdrop, the present study – based on semi-structured interviews with 16 young trade union activists from across Europe – aims to assess how they perceive their unions' engagement with young people. It contributes to the extensive body of literature on the relationship between trade unions and youth [Freeman, Diamond, 2003; Tailby, Pollert, 2011; Castiglioni, 2012; Vandaele, 2012, 2015, 2018; Lorenzini, 2016; Cha et al., 2019; Hodder, Houghton, 2020]. Given the connection between youth unionisation and ongoing efforts to reverse the decline of trade unions, this research also carries implications for the broader debate on revitalisation [Gumbrell-McCormick, Hyman, 2013; Ibsen, Tapia, 2017; Holgate et al., 2018; Kelly, 2018; Simms et al., 2019]. Considering young people's lifestyle habits and the potential of digital technologies, it places particular emphasis on unions' engagement through social media [Hodder, Houghton, 2015, 2020; Carneiro, Costa, 2020; Wood, 2020; Houghton, Hodder, 2021]. The inclusion of data from multiple European countries adds depth to this study, potentially offering crucial insights into issues that are critical for the future of the labour movement.

1. Literature overview

In response to disadvantageous changes, trade unions have sought to restore their position autonomously, notably through the implementation of revitalisation strategies [Ibsen, Tapia, 2017; Kelly, 2018]. In this context, the generational gap in unionisation between younger and older workers has once again emerged as a key focus. Indeed, although young workers have borne a significant share of the structural transformations leading to precarious employment and poor working conditions, they are less likely than their older colleagues to be union members [Hodder, 2015]. Notably, young people tend to be employed in sectors where part-time work and freelance contracts are quite common. Organizing such workers is not only particularly challenging [Polkowska, 2021; Tailby, Pollert, 2011], but also the traditional "workplace-based unionisation" model may be ill-suited for many of them [Heery et al., 2004, p. 20].

In practice, this means that when faced with adverse conditions in a non-unionised workplace, young workers are confronted with the choice of either leaving or voicing their concerns independently [Hirschman, 1970], and they often ultimately opt to leave. As a result, they develop weak attachments to their workplaces, which hinders the formation of personal bonds and, most importantly,

a sense of community with colleagues – a factor that naturally predisposes individuals to union membership [Castiglioni, 2012]. Given that Generation Z and Millennials primarily interact with non-unionised workers, they are unlikely to encounter trade unions early in their careers, making it possible that they may never become union members at all [Carter, 2006].

In this context, it has been suggested that young people exhibit low unionisation rates because they lack knowledge about what unions are – "I don't know what a TU [trade union] is" [Lorenzini, 2016, p. 22], or because they hold stereotypes portraying unions as outdated organisations for older manual labourers uninterested in youth issues [Zientara et al., 2021].

All of this underscores the importance of education (awareness-raising) and promotion. To this end, European trade unions have, in recent years, implemented several initiatives specifically targeting young people [Lorenzini, 2016; Smith, Duxbury, 2020]. These initiatives include: (1) organizing meetings and debates in schools and universities; (2) participating in events (such as concerts and festivals) where young union members can engage with their peers and discuss union membership; (3) conducting workplace visits in sectors with a high concentration of young employees, all while promoting the idea that unions seek to protect the rights and interests of all workers; and (4) developing mobile applications and posting video content on social media platforms to introduce the fundamentals of union representation and to communicate updates, events, and campaigns.

It is argued that because Generation Z and Millennials are emotionally attached to values such as equality, participation, and resistance – qualities inherently supported by social media – the question arises as to how unions intend to attract young workers if they continue to be perceived as organisations dominated by older, male leaders committed to a centralised, top-down management style. In other words, it is difficult to envision unions increasing their appeal to young people without granting them a greater voice in decision-making and facilitating their advancement within union hierarchies. Indeed, evidence suggests that young union members are not only underrepresented at higher levels of most unions but also have little influence over youth-related policies [Lorenzini, 2016]. This aspect is crucial, as it pertains to values that are particularly important to Generation Z. Some scholars argue that beyond typical socio-economic concerns (e.g., unstable livelihoods), progressive post-material issues – such as non-discrimination, equal opportunities and environmental responsibility – serve as strong motivators for young people to engage in collective action [Gursoy et al. 2013].

It is now widely recognised that the Internet and social media "offer trade unions opportunities to expand their membership base and improve levels of activism and mobilisation" [Houghton, Hodder, 2021, p. 220]. This reflects the broader perspective that, in contemporary society, the battle for individuals' hearts

and minds – whether as consumers, voters, employees, or organisational members – increasingly takes place online. Undoubtedly, this trend was accelerated by the COVID-19 pandemic, during which personal relationship-building was virtually impossible and was replaced by online interactions.

Broadly speaking, digital technology (i.e., websites, social media platforms, and mobile applications) can aid in the revitalisation of unions in multiple ways. First, the internet and social media provide "an opportunity to significantly scale up organizing campaigns" [Simms et al., 2019, p. 338]. Second, they can enhance mobilisation and encourage worker engagement. For example, Wood [2020] demonstrates how McDonald's employees mobilised after watching relevant content (e.g., videos) posted on Facebook and YouTube. Third, these digital tools can improve communication with the general public, as well as with current and potential union members [Carneiro, Costa, 2020; Smith, Duxbury, 2020; Houghton, Hodder, 2021; Uba, Jansson, 2021]. Fourth, the internet and social media can serve as valuable recruitment tools for attracting new members [Houghton, Hodder, 2021]. Simultaneously, they can foster a sense of collective identity and cohesion among a heterogeneous workforce by exposing and publicizing instances of injustice and exploitation, as well as providing legal and emotional support to temporary workers and self-employed contractors – an issue highly relevant to my line of argumentation. Finally, and equally importantly, these tools can help trade unions exert influence on internal policy and public debate [Uba, Jansson, 2021].

One of the challenges, however, is that relatively few Internet users visit union websites, which also "tend to present union identity in a singular image" [Hodder, Houghton, 2020, p. 42]. Notably, some research indicates that unions lean toward an outdated, "one-way" communication model [Carneiro, Costa, 2020]. In practice, this means that it can be difficult to interact and exchange opinions and experiences on some unions' social media pages (such as Facebook), even when interactive tools are available, resulting in a unidirectional flow of communication. In this sense, Lorenzini asserts that "it is important that […] communication is not one-sided and that users' questions, comments, or requests are responded to" [Lorenzini, 2016, p. 21]. Consequently, it appears that interaction and dialogue between unions and the public (i.e., current and potential members) leave much to be desired, with negative implications for internal communication, marketing and recruitment [see Hodder, Houghton, 2015, 2020; Carneiro, Costa, 2020]. However, some studies suggest that "trade unions seem to use social media in an engaging way" [Houghton, Hodder, 2021, p. 236].

All of these factors have far-reaching implications, as interaction – embodying a "two-way" communication model – helps individuals familiarise themselves with and better understand union identity [Houghton, Hodder, 2021]. It is plausible that engaging with union representatives on Facebook or Twitter enhances this

understanding. Naturally, one could argue that to fully grasp union identity, which is by no means static [Hyman, 1994], it is not sufficient to rely solely on social media.

Against this backdrop, the present study aims to determine how Millennial trade union representatives from across Europe evaluate their unions' engagement with young people. In doing so, it seeks to address the following research questions:

- RQ1: How do Millennial representatives perceive the way trade unions are viewed by young people?
- RQ2: How do they assess their unions' efforts to expand their agendas and make their governance systems more inclusive and participatory?
- RQ3: How do they evaluate the use of social media by trade unions for communication, promotion, and recruitment?

2. Methodology

This study is grounded in a qualitative research framework. As the primary research method, I employed semi-structured qualitative interviews [Rubin, Rubin, 1995]. This technique is recommended when a research project, as in this case, has a "fairly clear focus" [Bryman, Bell, 2007, p. 479]. The interviews included open-ended questions concerning young leaders' perspectives on their unions' engagement with youth (agendas/programs, the status of young union members, the use of social media, communication, advertising and recruitment) (Table 1).

The interviews were conducted via video link and lasted approximately 45 minutes. The interview data were digitally recorded, transcribed verbatim, and reviewed. A consistent transcription format was applied to enhance the comparability of responses, thereby facilitating both a comprehensive understanding and an in-depth analysis of the data [King, Horrocks, 2010].

Subsequently, I conducted a thematic analysis of the interview transcripts, a research technique used to identify categories for analysis through a predefined coding scheme [Braun, Clarke, 2006]. This process was carried out using qualitative coding in Nvivo 12, which entails "[…] identifying segments of data as relating to or exemplifying a broader idea, instance, theme, or category" [Lewins, Silver, 2007, p. 81]. Following Hay's [2005] recommendations, the process consisted of two stages: (1) basic coding, aimed at recognizing general themes, and (2) in-depth, interpretative coding, used to identify and analyse more specific themes and emerging patterns. These were then reviewed, linked to the research questions and existing literature, and categorised into key themes [Miles, Huberman, 1994].

Table 1. Interviewee characteristics

No.	Sex	Age	Country	Position
1	F	32	Spain	Representative of the Trade Union Youth Committee
2	F	33	Bulgaria	Junior Officer
3	F	33	Slovenia	Representative of the Trade Union Youth Committee
4	M	38	Malta	Union President
5	F	31	France	Junior Officer
6	M	32	Slovakia	Union President
7	F	31	Sweden	Representative of the Trade Union Youth Committee
8	M	38	Italy	Junior Officer
9	M	34	Poland	Representative of the Trade Union Youth Committee
10	F	35	Romania	Representative of the Trade Union Youth Committee
11	F	32	Lithuania	Representative of the Trade Union Youth Committee
12	F	30	Sweden	Junior Officer
13	F	36	Poland	Representative of the Trade Union Youth Committee
14	M	35	Malta	Junior Officer
15	M	34	Finland	Representative of the Trade Union Youth Committee
16	F	31	Ukraine	Junior Officer

Source: Own contribution.

Most importantly, interviewees were recruited through personal contacts. This was made possible by an acquaintance with a high-ranking youth representative whose union is affiliated with the European Trade Union Confederation, allowing me to establish connections with Millennial union leaders.

3. Results

Most interviewees reported an observation that, after experiencing dramatic losses in influence and membership in recent years, trade unions have declined in popularity and, more concerningly, face a significant image problem. In some regions, union members are perceived as "enemies" (Interviewee #1), or simply as "strikers" (Interviewee #2) and troublemakers. In certain countries (e.g., Spain), the general public views unions as corrupt and lacking transparency. However,

some dissenting voices argued that trade unions have a "positive" (Interviewees #4 and #8) or "modern" (Interviewee #6) image.

When asked specifically about the perception and attitude of young people toward trade unions, most interviewees acknowledged that Generation Z and Millennials tend to view unions in a negative light. As could have been expected a priori, many stereotypes portraying trade unions as "old-fashioned" organisations for older, blue-collar workers "with moustaches" (Interviewee #5) were echoed. These findings resonate with previous observations in the literature on youth unionisation [Hodder, 2015].

All interviewees emphasised the importance of education and raising awareness among young people (both in schools and universities), highlighting that the core issue is a lack of understanding of what trade unions actually are [Zientara et al., 2021]. In this sense, only a minority believed that Generation Z and Millennials were entirely unaware of the existence of unions per se – "I don't know what a trade union is" (e.g., Interviewee #10). From a certain perspective, this finding aligns with the notion that young workers are "blank slates" who can be shaped into union members if the principles of the labour movement are clearly and persuasively explained to them [Freeman, Diamond, 2003]. Some representatives also pointed to the diversity of union identities (i.e., numerous organisations pursuing different goals), which could cause confusion and discourage young people from joining (Interviewee #5).

Nevertheless, all interviewees unanimously agreed that it is absolutely essential for unions to support the rights and interests of young workers. As Interviewee #8 put it: "We strive to protect and secure the rights of precarious and atypical workers." This is particularly noteworthy given that unions have long tended to "favour the relatively privileged at the expense of the most precarious" [Hyman, 1999, p. 104]. It is also worth mentioning that a Slovenian trade union was specifically established "for young people and young workers in precarious employment" (Interviewee #3), making it stand out among its European counterparts [see Lorenzini, 2016, p. 29].

When asked about efforts to expand and modernise their agendas to better appeal to Generation Z and Millennials, many interviewees noted that their unions remained primarily focused on traditional issues (such as wages and working conditions). However, there was a growing awareness of gender equality, environmental protection, and possibly minority rights. Some representatives, however, indicated that this was not the case in their organisations. As Interviewee #4 stated, "In our trade union, we do not generally engage with other issues, such as ecology or, for example, women's rights." The most categorical response came from the Finnish representative (Interviewee #15): "The union's agenda is non-negotiable." Another interviewee rejected any modifications to the agenda

of traditional trade unions altogether (Interviewee #14). That said, it was evident that awareness was emerging among most union leaders that making workplaces more inclusive for women, LGBTQ+ individuals and environmentally conscious workers could be instrumental in attracting young employees.

When specifically asked about their unions' interactions with social media audiences [Carneiro, Costa, 2020; Houghton, Hodder, 2021], opinions were again divided. While some argued that their unions used social media in an engaging and interactive manner (Interviewees #11 and #13), others were more critical of the quality and extent of interactions (Interviewees #12 and #16). All in all, it would be difficult to use this mixed evidence as an argument for or against the claim that trade unions are not fully utilizing social media's potential [Carneiro, Costa, 2020]. However, one thing is certain: there is now no doubt that unions must leverage social media to attract younger workers. As Interviewee #4 stated, "I think young trade unionists should emphasise that social media is the way forward. And this is the new battleground."

Several interviewees also highlighted that, in formulating their messages and expressing their identity, unions should use value-laden terms, particularly "equality" and "responsibility". These were perceived as carrying positive connotations and as particularly appealing to Generation Z and Millennials. In contrast, less emphasis was placed on using words such as "partnership" and "collaboration". However, it is worth noting that the concept of partnership was not entirely dismissed, as evidenced by the following quote: "In fact, the most important thing would be to make young people understand that joining a union means they should cooperate with employers, work together and form a team to improve the quality of work and deliver better results for employers" (Interviewee #9).

Finally, most interviewees also agreed that young trade unionists should be entrusted with the responsibility of leading marketing and recruitment campaigns, based on the principle that the best strategy is one where "young people talk to young people" (Interviewee #5).

4. Discussion

A key tension emerging from the study is the divide between unions that recognise the importance of expanding their agendas to include issues such as gender equality, environmental sustainability, and minority rights, and those that remain focused solely on traditional labour concerns such as wages and working conditions. While some union representatives saw the inclusion of broader social justice issues as a necessary step toward attracting younger members, others were resistant, emphasizing that their core priorities should remain unchanged. This reflects

previous discussions on the feasibility of programmatic adaptation in unions representing more traditional labour sectors [Hyman, 1999; Lorenzini, 2016].

Moreover, the findings highlight the double-edged nature of social media as a tool for union engagement. While some respondents noted its effectiveness in communication and recruitment, others remained sceptical about its actual impact. This supports previous research suggesting that although social media is essential for modern union strategies, it must be complemented by direct engagement and traditional organizing efforts [Carneiro, Costa, 2020; Houghton, Hodder, 2021]. The notion that "young people listen to other young people" was widely acknowledged by respondents, reinforcing the idea that peer-to-peer mobilisation is one of the most effective strategies for union renewal [Freeman, Diamond, 2003]. Moving forward, unions must prioritise youth-led initiatives, ensuring that younger members play a central role in shaping and communicating the union's mission.

5. Conclusions

These findings have significant implications for the debate on trade union revitalisation. Above all, they reinforce the view that increasing unions' appeal to Generation Z and Millennials should be one of the labour movement's primary priorities. Specifically, trade unions must do more to enhance their public image while simultaneously debunking myths and stereotypes associated with trade unionists. Whether the "modernisation" of union agendas and the incorporation of non-discriminatory labour rights would be feasible for certain blue-collar unions remains a contentious issue. However, there are reasons to believe that such an approach could help unions establish stronger connections with younger workers. Most importantly, it is becoming increasingly undeniable that, to achieve this goal, trade unions must ensure that gender equality – and particularly sustainable development – occupy a central place in their programs.

Given these considerations, unions should redouble their efforts in education and outreach, striving to maximise the potential of social media without necessarily abandoning traditional recruitment and organizing methods. This would involve adopting language that resonates with Generation Z and Millennials, as well as framing their messages differently by placing greater emphasis on values and the specific concerns and aspirations of young people. At the same time, intensifying efforts to involve young trade unionists in campaigns and recruitment initiatives appears essential, as they are best positioned to persuade their peers to join unions.

References

Beaumont P.B., 1987, *The decline of trade union organization*, Croom Helm, London.

Braun V., Clarke V., 2006, *Using thematic analysis in psychology*, Qualitative Research in Psychology, no. 3(2).

Bryman A., Bell E., 2007, *Business research methods*, Oxford University Press, Oxford.

Carneiro B., Costa H.A., 2020, *Digital unionism as a renewal strategy? Social media use by trade union confederations*, Journal of Industrial Relations, no. 64, https://doi.org/10.1177/0022185620979337.

Carter, B., 2006, *Trade union organizing and renewal: A response to de Turberville*, Work, Employment and Society, no. 20.

Castiglioni G., 2012, *Young people and trade unions: New challenges for a generational change*, Mediterranean Journal of Social Sciences, no. 3.

Cha M., Dupay C., Holgate J., Simms M., Tapia M., 2019, *Unions are only as old as they feel: lessons on young worker engagement from the UK, France, Germany and the US*, ETUI, Brussels.

Freeman R., Diamond W., 2003, *Young workers and trade unions* [in:] *Representing workers: Union recognition and membership in Britain*, eds. H. Gospel, S. Wood, Routledge, London–New York.

Gumbrell-McCormick R., Hyman R., 2013, *Trade unions in Western Europe: Hard times, hard choices.* Oxford University Press, Oxford.

Gursoy D., Chi C.G., Karadag E., 2013, *Generational differences in work values and attitudes among frontline and service contact employees*, International Journal of Hospitality Management, no. 32, https://doi.org/10.1016/j.ijhm.2012.04.002.

Hay I., 2005, *Qualitative research methods in human geography.* Oxford University Press, Oxford.

Heery E., Conley H., Delbridge R., Stewart P., 2004, *Beyond the enterprise: Trade union representation of freelancers in the UK*, Human Resource Management Journal, no. 14, https://doi.org/10.1111/j.1748–8583.2004.tb00117.x.

Hirschman A.O., 1970, *Exit, voice, and loyalty: Responses to decline in firms, organizations, and states.* Harvard University Press, Cambridge, MA.

Hodder A., 2015, *"Old dusty men"? Young people and trade unions in the UK* [in:] *Young workers and trade unions: A global view*, eds. A. Hodder, L. Kretsos, Palgrave Macmillan, Basingstoke.

Hodder A., Houghton D.J., 2015, *Union use of social media: A study of the University and College Union on Twitter*, New Technology, Work and Employment, no. 30, https://doi.org/10.1111/ntwe.12055.

Hodder A., Houghton D.J., 2020, *Unions, social media and young workers – Evidence from the UK*, New Technology, Work and Employment, no. 35, https://doi.org/10.1111/ntwe.12154.

Holgate J., Simms M., Tapia M., 2018, *The limitations of the theory and practice of mobilization in trade union organizing*, Economic and Industrial Democracy, no. 39, https://doi.org/10.1177/0143831X18777608.

Houghton D.J., Hodder A., 2021, *Understanding trade union usage of social media: A case study of the Public and Commercial Services union on Facebook and Twitter*, New Technology, Work and Employment, no. 36, https://doi.org/10.1111/ntwe.12209.

Hyman R., 1994, *Changing trade union identities and strategies* [in:] *New frontiers in European industrial relations*, eds. R. Hyman, A. Ferner, Blackwell, Oxford.

Hyman R., 1999, *Imagined solidarities: Can trade unions resist globalization?* [in:] *Globalization and labour relations*, ed. P. Leisink, Edward Elgar, Cheltenham–Northampton.

Ibsen C., Tapia M., 2017, *Trade union revitalization: where are we now? Where to next?*, Journal of Industrial Relations, no. 59, https://doi.org/10.1177/0022185616677558.

Kelly J., 2018, *Rethinking industrial relations revisited*, Economic and Industrial Democracy, no. 39, https://doi.org/10.1177/0143831X18777612.

King N., Horrocks C., 2010, *Interviews in qualitative research*, Sage, London.

Lewins, A., Silver, C., 2007, *Using software in qualitative research*, Sage, Los Angeles–London.

Lorenzini C., 2016, *Just Go for It! A Compendium of best practices from all over Europe on involving young people in trade unions*, European Federation of Building and Woodworkers, Brussels.

Miles N.B., Huberman A.M., 1994, *Qualitative data analysis: a sourcebook of new methods*, Sage, Thousand Oaks, CA.

Polkowska D., 2021, *Unionisation and mobilisation within platform work: towards precarisation – a case of Uber drivers in Poland*, Industrial Relations Journal, no. 52, https://doi.org/10.1111/irj.12315.

Rubin H., Rubin I., 1995, *Qualitative interviewing: the art of hearing data.* Sage, Thousand Oaks, CA.

Simms M., Holgate J., Roper C., 2019, *The Trades Union Congress 150 years on: a review of the organising challenges and responses to the changing nature of work*, Employee Relations, no. 41, https://doi.org/10.1108/ER-09–2018–0242.

Smith C., Duxbury L., 2020, *It is not just what you say, but how you say it: A case study exploring union member communications*, Industrial Relations Journal, no. 51, https://doi.org/10.1111/irj.12278.

Tailby S., Pollert A., 2011, *Non-unionized young workers and organizing the unorganized*, Economic and Industrial Democracy, no. 32, https://doi.org/10.1177/0143831X10388532.

Uba K., Jansson J., 2021, *Political campaigns on YouTube: Trade unions' mobilization in Europe*, New Technology, Work and Employment, no. 36, https://doi.org/10.1111/ntwe.12181.

Vandaele K., 2012, *Youth representatives' opinions on recruiting and representing young workers: A twofold unsatisfied demand?*, European Journal of Industrial Relations, no. 18, https://doi.org/10.1177/0959680112452692.

Vandaele K., 2015, *Youth structures in six European trade union federations: a short overview*, Transfer, no. 21, https://doi.org/10.1177/1024258915603920.

Vandaele K., 2018, *How can trade unions connect with young workers?* [in:] *Youth labor in transition: Inequalities, mobility, policies in Europe*, eds. J. O'Reilly, J. Leschke, R. Ortlieb, M. Seeleib-Kaiser, Oxford University Press, Oxford.

Waddington J., Kerr A., 2002, *Unions fit for young workers?*, Industrial Relations Journal, no. 33, https://doi.org/10.1111/1468–2338.00237.

Wood A., 2020, *Beyond mobilization at McDonald's: Towards networked organizing*, Capital and Class, no. 44, https://doi.org/10.1177/0309816820906354.

Zientara P., Adamska-Mieruszewska J., Bąk M., 2021, *'Hotel employees' views on fairness, well--being and collective representation in times of the coronavirus crisis: Evidence from Poland*, Industrial Relations Journal, no. 52, https://doi.org/10.1111/irj.12345.

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The financial impact of the coronavirus pandemic on selected companies from the e-commerce sector: A case study of Amazon, Alibaba, and Asos

Since 2020, the coronavirus pandemic has significantly impacted the functioning of various sectors and companies worldwide. The pandemic has accelerated the adoption of digital technologies, reshaped global consumer behaviour and triggered an unprecedented growth in online shopping. The aim of the article is to assess the influence of the coronavirus pandemic on the e-commerce sector by examining the financial standing, position, and performance of three e-commerce platforms from different regions such as Amazon, Alibaba, and Asos, both before and during the pandemic. The hypothesis of the article is that the coronavirus pandemic has significantly impacted the financial situation and operations of e-commerce platforms across various regions. The analysis focuses on the years 2017–2020 to provide a comparative perspective on financial conditions before and during the initial phases of the pandemic, highlighting the most disruptive period in 2020 while intentionally excluding the later stages of the coronavirus pandemic and the recovery period. While the final phase of the selected period reflects immediate disruptions, it also includes early regulatory and market adjustments, making this timeframe a combination of sudden impacts and initial responses. This approach captures the contrast between pre-pandemic stability and early-pandemic disruptions, avoiding complexities from prolonged pandemic phases and recovery. The article adopts a quantitative method using ratio analysis to analyse liquidity, debt, efficiency, and profitability by examining financial statements such as balance sheets and profit and loss statements. The findings demonstrate that the pandemic has indeed impacted the e-commerce sector. However, the extent of this impact varied across platforms and regions. The article provides a deeper understanding of the sector's financial performance during a pandemic crisis and identifies key indicators driving this growth. The results provide valuable implications for businesses and policymakers, emphasizing sector's evolving role in global economy.

Keywords: financial analysis, ratio analysis, e-commerce, coronavirus pandemic

JEL classification: G00, G32, L81

Introduction

The pandemic has changed the functioning of many sectors and companies in almost all countries since the beginning of 2020. One of the sectors that has been

significantly impacted by the crisis is e-commerce. As the pandemic spread, demand shifted from traditional brick-and-mortar stores to digital commerce. Consumers were forced to change their daily habits, behaviours, and practices. This form of shopping became one of the leading alternatives for both businesses and private customers [UNCTAD, 2021].

This article assesses the financial performance of three major e-commerce platforms: Amazon, Alibaba, and Asos, both before and during the pandemic. The research focuses on key financial indicators such as liquidity, debt, efficiency, and profitability, covering the years 2017–2020. These metrics reveal patterns in the financial conditions of these platforms before and during the crisis, shedding light on how the coronavirus pandemic influenced their financial standing, performance, and operations. Analysing the year 2020 enables the study to capture the immediate impacts of the pandemic on financial performance, while also reflecting early regulatory and market adjustments that shaped initial responses to the crisis. By concentrating on this pivotal year, the research highlights the sharp contrast between pre-pandemic stability and the disruptions triggered by the early stages of the pandemic. This approach avoids the complexities of prolonged recovery phases and varying rates of adjustment, ensuring that the findings accurately reflect the sector's financial condition during the most critical period of disruption. The research problem is noteworthy because the coronavirus pandemic caused one of the most substantial global economic disruptions in recent history. This issue is particularly vital given the unprecedented shift in consumer behaviour towards digital commerce and the reliance on e-commerce as a key driver of global economic activity during the pandemic [OECD, 2020]. Understanding how major e-commerce platforms responded to the financial and operational challenges of the pandemic is essential for identifying strategies that would enhance resilience in similar future crises.

Prior to this research, existing literature highlighted the growing importance of e-commerce as a critical driver of global trade and its capacity to thrive in digital environments. Studies emphasised the sector's adaptability to rapidly changing market dynamics, supported by technological advancements and increasing consumer reliance on online platforms. However, limited empirical evidence existed on how individual e-commerce platforms managed their financial performance and operations during significant economic disruptions, such as the coronavirus pandemic. This research expands knowledge on the financial resilience of e-commerce platforms by providing empirical evidence of how major e-commerce platforms performed during extraordinary economic challenges, such as the coronavirus pandemic. The findings focus on key financial indicators, offering a detailed understanding of the financial impact of the pandemic on the e-commerce sector.

The aim of the article is to assess the financial impact of the coronavirus pandemic on the e-commerce sector by analysing the financial situation, position, and performance of three platforms from different regions before and during the pandemic. The hypothesis posits that the coronavirus pandemic has significantly influenced the financial situation and functioning of e-commerce platforms across various regions.

1. Literature overview

The e-commerce industry has undergone a transformative evolution, with its trajectory profoundly impacted by the coronavirus pandemic. Scholarly discussions have explored various factors influencing online consumer behaviour, but a synthesis of these findings highlights key insights relevant for understanding the financial impact of the pandemic on e-commerce platforms like Amazon, Alibaba, and Asos. Pandey and Parmar [2019] identified several critical determinants of online shopping behaviour, including demographic factors, technological proficiency, and the influence of website design, ease of navigation, and social media on user engagement. They also found that situational factors, product characteristics, and promotional strategies such as discounts, flexible payment options, and personalised offers were crucial in driving purchasing decisions. Delivery reliability and after-sales services were emphasised as key elements in building consumer trust and loyalty. These findings, while significant before the pandemic, are crucial for understanding the shifts in consumer expectations during the crisis, where platforms had to quickly adapt to new challenges. These insights are particularly significant in the context of the pandemic's impact on the e-commerce sector, where platforms had to rapidly adjust to the surge in demand for online services and shifts in consumer purchasing behaviour. The coronavirus pandemic accelerated these trends, highlighting the necessity for platforms to remain agile, responsive, and consumer-centric to maintain growth and competitiveness during times of crisis.

Further studies have examined the effects of the coronavirus pandemic on the global e-commerce market, with Elrhim and Elsayed [2020] offering an analysis of this impact on five of the largest e-commerce companies: Amazon (USA), Alibaba (China), Rakuten (Japan), Zalando (Germany), and Asos (UK). The study evaluated the relationship between the spread of COVID-19, measured by daily cumulative infections, new cases, cumulative deaths, and new deaths, and the stock performance of these companies. Using daily stock returns as the dependent variable, the analysis covered the period from March 15 to May 25, 2020, providing insights into the financial market responses to the pandemic. The study demonstrated that these companies experienced positive daily stock returns during the analysed period,

emphasising their resilience in adapting to pandemic-induced market conditions. The impact varied by company and region, reflecting the local severity of the pandemic. For Amazon (USA) and Asos (UK), cumulative infections had the strongest effect on stock performance, consistent with the high levels of COVID-19 cases in these countries during the research period. In contrast, new cases had a greater impact on Alibaba (China) and Rakuten (Japan), while cumulative deaths were the most significant factor for Zalando (Germany). This study highlights the heterogeneity in the response of e-commerce stock returns to the pandemic, shaped by regional differences in the severity of the outbreak. The findings underscore how public health crises can significantly influence financial markets, particularly the growing e-commerce sector. By analysing the interplay between pandemic metrics and market performance, this research contributes to a deeper understanding of the resilience and variability of e-commerce platforms during global disruptions. While this study offers valuable insights into the resilience of these companies during the pandemic, it also highlights the need for a deeper exploration of how different firms adapted their business strategies and financial operations to survive and thrive under rapidly changing conditions.

Other research has analysed the impact of the coronavirus pandemic on consumer behaviour, with Jílková and Králová [2021] examining its effects on digital consumer trends and online shopping. Their study explored behavioural changes across generational cohorts using surveys conducted in two waves, one before the pandemic and one during it. These cohorts included Generation Alpha, Generation Z, Millennials, Generation X, Baby Boomers, and the Silent Generation. The findings revealed that fear of the pandemic, a desire for safety, and government restrictions drove consumers to engage in online shopping during the crisis. The research noted a sharp rise in online transactions, changes in search patterns, payment preferences, and delivery methods. Notably, Baby Boomers and the Silent Generation, previously less inclined to shop online, turned to e-commerce out of necessity during store closures and reported intentions to continue online purchasing post-pandemic. This shift indicates a significant broadening of the digital consumer base. The authors concluded that the coronavirus pandemic accelerated e-commerce adoption across all demographics, reshaping the profile of the typical online shopper. Their study provides valuable insights into the lasting effects of the crisis on digital consumer behaviour and highlights the importance of understanding generational preferences to effectively respond to evolving consumer demands. These generational shifts are particularly significant in understanding how e-commerce platforms had to adjust their financial and operational strategies to accommodate new consumer groups, especially older generations who had previously been less engaged with online shopping. This insight is critical for analysing the financial impact on e-commerce companies, as it underscores the need for

platforms to modify their business models to meet the demands of an expanding and more diverse digital consumer base.

Subsequently, Han et al. [2022] investigated the impact of the coronavirus pandemic on e-commerce sales and operational drivers, focusing on data from Alibaba's platform across 339 cities in mainland China. The study aimed to understand how e-commerce responded to the pandemic and identified both challenges and opportunities for platforms navigating the crisis. Using a city-day panel over three years, the authors employed year-on-year comparisons, COVID-19 intensity metrics (based on case numbers), and containment measures (such as checkpoint policies and partial or full shutdowns) to evaluate the pandemic's impact on e-commerce. Their findings revealed a distinct drop-and-recovery pattern in e-commerce sales, highlighting the sector's digital resilience. During the Wuhan shutdown (January 23–April 7, 2020), e-commerce sales decreased by 22% but rebounded in most cities within five weeks, showcasing the adaptability of digital commerce. This research provides essential insights for both platforms and policymakers, emphasizing the importance of digital strategies and robust logistics networks in ensuring resilience during crises. The authors challenged the assumption that e-commerce universally benefits from offline retail disruptions, showing that operational bottlenecks, such as limited logistics capacity, can hinder sales performance. The findings underscore the critical interplay between logistics infrastructure and e-commerce performance during a global crisis, highlighting how platforms like Alibaba leveraged adaptability and innovation to navigate challenges. This research contributes to a deeper understanding of the operational complexities faced by e-commerce platforms during the pandemic and provides actionable insights for ensuring continuity and growth in the face of uncertainty. It also makes a crucial contribution to understanding how the financial resilience of e-commerce platforms was shaped by their operational responses, which is highly relevant for analysing the financial impact of the pandemic on the e-commerce sector and companies like Amazon, Alibaba, and Asos.

Another important contribution to the discussion on e-commerce and consumer behaviour during the coronavirus pandemic was the work of Darwish and Gomes [2020], which explored the evolution of e-commerce services, including online shopping, banking, and enterprise, highlighting the accessibility these platforms provided to consumers worldwide, particularly in rural areas. The authors emphasised that e-commerce platforms needed to prioritise consumer privacy and security to build trust, addressing widespread concerns about data protection, fraud, and reliability of transactions. These issues remain key barriers to broader consumer adoption. The research applied of behavioural theories, including the theory of planned behaviour (TPB), to understand consumer adaptation to e-commerce. The findings suggested that public health laws and lockdown measures

significantly accelerated the shift toward online shopping by increasing reliance on the Internet for purchasing goods and services. The authors highlighted that fast and reliable delivery services could further encourage consumer adoption by enhancing convenience and satisfaction, particularly in markets where traditional retail access was limited. The study also underscored the coronavirus pandemic's immediate and far-reaching impact on consumer behaviour, driven by fear of physical contact and safety concerns. These shifts, the authors argued, represented not only a temporary adaptation but also a long-term transformation in purchasing habits. As e-commerce platforms adapted to meet these demands, addressing trust and security concerns was essential to sustaining growth and attracting a broader consumer base. The authors provided valuable insights into how e-commerce platforms could align their strategies with evolving consumer expectations, emphasizing that transparency, reliability, and customer-centric operations were pivotal in fostering trust. This study adds to the broader understanding of how the coronavirus pandemic reshaped consumer behaviour and highlights the steps necessary for e-commerce platforms to remain competitive in a rapidly evolving digital, commercial, and technological landscape. This long-term shift is crucial for understanding the financial implications for e-commerce companies, as these changes in consumer behaviour are likely to result in new business models, pricing structures, and customer engagement strategies that will impact long-term profitability. This shift in priorities not only affects operational costs but also influences pricing strategies and long-term revenue generation, requiring e-commerce platforms to balance their investments in innovation with maintaining competitive pricing and profitability.

A significant addition to the understanding of e-commerce dynamics was the work of Rocha et al. [2021], which utilised an evolutionary game model to analyse interactions between consumers and producers within e-commerce marketplaces. The study focused on key determinants such as the availability of delivery services and consumer preferences, and examined their effects on trade patterns and strategic decisions. By adapting the game payoff matrix, the authors explored the distinct changes in trading behaviour observed in both traditional retail and e-commerce sectors during the pandemic. The research highlighted how e-commerce platforms, through investments in logistics and warehousing, were able to adapt to growing consumer demands for faster delivery services. This adaptability allowed e-commerce to set new benchmarks for convenience and responsiveness, significantly altering consumer expectations. The findings suggest that these advancements not only addressed immediate challenges but also facilitated a long--term shift toward digital purchasing behaviours. While the study provides critical insights into the structural and strategic adjustments within e-commerce, it also underscores the financial challenges that platforms faced when adapting to shifting

consumer demands, particularly regarding the significant investments required in logistics and warehousing. These insights are directly applicable to understanding the financial resilience of e-commerce companies during the pandemic, especially in the case of Amazon, Alibaba, and Asos, where strategic financial investments are key to adapting to the new digital economy and ensuring business continuity.

The final contribution to the literature review came from Chodak [2024], who examined how e-commerce influenced both microeconomic and macroeconomic dynamics. The study highlighted the pivotal role of the coronavirus pandemic in accelerating the shift from traditional trade to e-commerce, which significantly transformed consumer behaviour and market structures. The author explored the dual impact of e-commerce on the labour market, noting that new occupations (such as digital marketing specialists and logistics managers) emerged, while certain traditional roles became obsolete as a result of automation and evolving retail practices. The analysis emphasised how e-commerce reduced barriers to entry for businesses, enabling smaller enterprises to compete in the digital markets. The author addressed consumer privacy concerns, observing how online marketing strategies had become increasingly invasive, raising issues about the balance between personalisation and data security. The study also delved into the broader implications of e-commerce on consumer habits, which shifted toward greater reliance on digital platforms for convenience and accessibility. It briefly touched on the impact of e-commerce on tax avoidance, highlighting how global digital trade presented challenges for taxation frameworks. This work provides a perspective on the multifaceted effects of e-commerce, offering valuable insights into its economic, social, and regulatory implications within a rapidly evolving digital economy. Understanding the broader economic dynamics outlined in this study enables a more accurate assessment of the financial impact of the coronavirus pandemic on e-commerce platforms, especially in terms of how companies like Amazon, Alibaba, and Asos adapted to the crisis and implemented strategies to ensure both short-term survival and long-term growth.

In summary, the e-commerce industry – as it evolved during the coronavirus pandemic – has been the subject of numerous studies, primarily focusing on changes in consumer behaviour and the adaptation strategies of e-commerce platforms. The literature highlights the e-commerce sector's resilience during the coronavirus pandemic, driven by digital transformation, operational innovation, and shifts in consumer behaviour. Platforms adapted by investing in logistics, enhancing delivery services, and addressing evolving consumer needs, fostering long-term reliance on digital commerce. These findings demonstrate the importance of innovation, adaptability, and sustainability in ensuring continued growth and competitiveness in the face of future global disruptions. However, there remains a noticeable gap in research regarding a detailed, comparative analysis of how specific e-commerce

giants such as Amazon, Alibaba, and Asos responded to the pandemic's financial and operational challenges. This research gap is particularly important because it provides an opportunity to examine how different e-commerce companies, such as Amazon, Alibaba, and Asos, developed distinct financial strategies to overcome pandemic-induced disruptions. While previous studies have explored the general impact of the coronavirus pandemic on the e-commerce sector, there is a lack of comparative analysis that focuses on the financial resilience and adaptation strategies of these key e-commerce platforms.

2. Methodology

The methodology applied in this research employs quantitative analysis to evaluate the financial performance of selected companies within the e-commerce sector. Specifically, the analysis employed in this research relies primarily on ratio analysis, a well-established methodology in financial studies. Ratio analysis provides a systematic approach to examining the relationships between financial metrics, enabling the assessment of a company's liquidity, efficiency, profitability, and overall debt management, including debt service coverage. By interpreting these ratios, the study aimed to identify patterns that indicate financial health, liquidity, operational efficiency, profitability, and debt sustainability [Suthar, 2018]. Liquidity ratios, such as the current ratio, quick ratio, and cash ratio, provide insights into the company's ability to meet short-term liabilities, ensuring financial stability in the face of immediate obligations. These ratios highlight the sufficiency of current assets in relation to liabilities, reflecting the organisation's resilience, stability, and ability to adapt during economic fluctuations. Efficiency ratios, including the asset turnover ratio and accounts receivable turnover ratio, offer a deeper understanding of how effectively companies use their assets and manage their receivables to generate revenue [Barnes, 2006]. These measures are critical for assessing whether resources are optimised or underutilised. Profitability ratios, such as return on sales and return on equity, highlight the company's ability to generate profits relative to its operational costs and equity investment. These metrics provide a benchmark for evaluating the overall success of the business in delivering value to shareholders. Lastly, debt service coverage ratios, such as the debt-equity ratio and times interest earned, are essential for understanding the company's financial leverage and ability to manage long-term obligations [Arhinful, Radmehr, 2023]. These ratios also assess the risks associated with external financing, highlighting the balance between profitability and debt management. All in all, these financial ratios allowed for a comprehensive evaluation of the companies' financial performance and strategic financial positioning.

The analysis focuses on the years 2017–2020 to ensure a comprehensive and consistent examination of the financial performance before and during the initial stages of the pandemic. The selected timeframe captures the most immediate and significant impacts of the crisis, providing a focused view of how companies responded to unprecedented challenges. Limiting the scope to this period eliminates potential distortions introduced by prolonged recovery dynamics or varying regional policy interventions in subsequent years. Furthermore, the year 2020, i.e., the first full year of the coronavirus pandemic, reflects the peak of disruption, making it a pivotal reference point for understanding short-term financial resilience [Charles, Uford, 2023]. The empirical basis of the study comprises financial statements, including balance sheets and profit and loss statements, spanning a four-year period, which are complete, verified, and unaffected by the reporting delays or adjustments that could occur in later years due to prolonged pandemic impacts or regulatory changes. These data were collected from the Thomson Reuters Eikon database, which was selected for its comprehensiveness and reliability in providing financial information on a wide range of companies [Thomson Reuters, 2022]. In addition to the database, recent scientific articles, reports, and publications were used to provide supplementary insights and theoretical grounds for the study [Sari, 2019]. This approach ensured that the research results were based on a robust and reliable data set, minimizing biases that could arise from incomplete or inaccurate financial disclosures.

The study focused on Amazon, Alibaba, and Asos, three represent major players in the industry, offering insights into various operational and financial strategies. The selection of these companies was motivated by several key factors. Firstly, the principle of market representation played a central role in the selection process. Amazon is a leading multinational corporation headquartered in the United States, widely recognised as the largest and most diversified e-commerce company globally. It operates not only in online retail but also in cloud computing, digital streaming, and artificial intelligence. Amazon's retail sector is vast, with millions of products available across various categories, from electronics to groceries. The company's cloud division, Amazon Web Services, contributes substantially to its profitability, consistently accounting for a substantial portion of the company's overall operating income. Alibaba, a Chinese multinational conglomerate, operates with a distinct business model compared to Amazon. While both companies dominate the e-commerce sector, Alibaba's focus is more on connecting buyers and sellers through its online platforms, such as Taobao and Tmall, without holding significant inventory itself, unlike Amazon. In addition to e-commerce, Alibaba has a strong presence in cloud computing through Alibaba Cloud and in fintech with Alipay, providing a more integrated digital ecosystem. This business model contrasts with Amazon's approach of owning and managing a wide array of products

and services, from retail to cloud computing. Compared to Amazon and Alibaba, United Kingdom – based Asos focuses more narrowly on fashion e-commerce. Unlike Amazon's broad range of product categories and Alibaba's diverse platforms, Asos operates exclusively in the fashion and apparel industry, offering a specialised online shopping experience for clothing, shoes, and accessories. While Amazon and Alibaba are major players in global e-commerce with a range of business divisions, Asos stands out with its niche focus on fashion, serving primarily young adult consumers. Thus, while all three companies are global e-commerce leaders, Amazon offers a highly diversified model spanning multiple industries, Alibaba focuses on a platform-driven approach with a major role in cloud and fintech, and Asos maintains a more specialised approach centred on online fashion retail. This diversity in business models provides a comprehensive basis for analysing the various strategies employed by e-commerce firms, especially in their responses to the unique and unprecedented challenges of the pandemic. Moreover, geographical diversity played a critical role in the selection of the companies. Amazon, Alibaba, and Asos represent major players in the e-commerce sector, each operating in distinct economic environments – North America, China, and Europe, respectively. These companies faced similar challenges brought on by the pandemic, such as disruptions in supply chains, shifts in consumer behaviour, and operational adjustments. However, each operated within unique regulatory frameworks, consumer behaviours, and economic conditions, providing a comprehensive view of how companies from different regions responded to the crisis. By including firms from three major global economies, this study offers valuable insights into the e-commerce sector's collective response to the pandemic. Additionally, these companies were selected due to their financial data accessibility and relevance to the research question. Amazon, Alibaba, and Asos are among the most publicly scrutinised e-commerce companies, with comprehensive and up-to-date financial reports readily available. This facilitates the comparison of key financial ratios such as liquidity, profitability, efficiency, and debt management, which are central to evaluating the companies' responses to the pandemic's economic challenges. The availability of consistent financial data across the study's timeframe further enhances analytical reliability, ensuring that the study's findings are based on comparable and verified data.

This methodological framework establishes a solid foundation for analysing the financial performance of Amazon, Alibaba, and Asos within the e-commerce sector. By leveraging financial ratio analysis and focusing on key indicators of liquidity, efficiency, profitability, and debt service coverage, the study ensures a comprehensive assessment of these companies' financial strategies. The choice of financial ratios aligns with the need to capture key aspects of financial resilience during economic disruptions, providing a comprehensive view of how the analysed companies

managed their financial resources under the extreme conditions of 2020, a year defined by peak uncertainty and operational strain. Moreover, the choice of these three specific e-commerce platforms was driven by their significant role in the sector, accessibility of comprehensive financial data, and their relevance for analysing the sector's behaviour during economically challenging times, particularly during the pandemic, as well as their representation of diverse geographic regions, which allows for a broader understanding of the global impact of the pandemic on the e-commerce sector. The approach not only allows for an in-depth understanding of individual company performance but also facilitates comparisons that reveal broader trends and patterns within the e-commerce sector, forming a critical basis for the subsequent analysis and interpretation of results.

3. Results

The results of this study provide a comprehensive analysis of the financial performance of Amazon, Alibaba, and Asos within the e-commerce sector, focusing on the key indicators of liquidity, efficiency, profitability, and debt service coverage. This section presents the detailed findings derived from financial ratio analysis over a four-year period, thoroughly incorporating data from both the pre-pandemic and pandemic year.

Table 1 presents the liquidity ratios of Amazon, Alibaba, and Asos over the examined four-year period, covering the years from 2017 to 2020. For Amazon, the quick and current ratios remained quite stable over the four-year period, indicating that the company consistently maintained the financial resources needed to meet its short-term obligations. The cash ratio increased year by year, demonstrating an improved liquidity in 2020, with cash and short-term investments exceeding current liabilities. Alibaba exhibited a similar trend in liquidity ratios, with the lowest values recorded in 2019. By 2020, the company improved its liquidity position, holding more quick assets than current liabilities and meeting its short--term obligations. However, the cash ratio exceeded the optimal range, indicating inefficiencies in the management and deployment of cash resources. Asos experienced the most significant changes in liquidity. All the three indicators measuring financial liquidity improved in 2020 compared to previous years. Before 2020, the company struggled to settle its current liabilities due to insufficient cash and cash equivalents. During the pandemic in 2020, the company enhanced its ability to meet short-term obligations, marking a noticeable improvement in financial liquidity. Overall, the pandemic had the greatest impact on Asos's liquidity. In 2020, the company covered all its short-term liabilities while retaining additional cash.

Table 1. Liquidity ratios of Amazon, Alibaba, and Asos in 2017–2020

Company	Years			
	2017	2018	2019	2020
Current ratio				
Amazon	1.04	1.10	1.10	1.05
Alibaba	1.94	1.89	1.30	1.91
Asos	0.95	0.90	0.81	1.19
Quick ratio				
Amazon	0.76	0.85	0.86	0.86
Alibaba	–	1.86	1.26	1.85
Asos	0.35	0.17	0.11	0.57
Cash ratio				
Amazon	0.54	0.60	0.63	0.67
Alibaba	1.61	1.55	0.98	1.50
Asos	0.29	0.08	0.00	0.48

Source: Own contribution.

Amazon maintained a consistent liquidity position throughout the analysed period, with slightly higher levels of cash and short-term investments compared to previous years. Similarly, Alibaba exhibited stable liquidity indicators over the years, except for a significant drop in 2019. By 2020, Alibaba improved its liquidity, holding more quick assets than current liabilities and meeting short--term obligations. The company, however, was not using cash effectively.

Table 2 presents the debt service coverage ratios for Amazon, Alibaba, and Asos over the analysed period. Amazon exhibited a notable downward trend in its first two ratios, namely the debt ratio and the debt-to-equity ratio. This pattern reflected a progressive year-by-year reduction in the company's reliance on external sources to finance its assets. In earlier years, Amazon predominantly financed its assets through debt; during the period 2019–2020, it shifted primarily to equity financing. Moreover, in 2020, Amazon posed the lowest risk to investors and creditors. Similarly, Alibaba recorded the lowest debt ratio and debt-to-equity ratio in 2020, indicating a greater dependence on equity than debt. Furthermore, compared to prior years, Alibaba reduced its reliance on borrowing to fund its operations. In contrast, Asos maintained a consistent balance between debt and equity, showing minimal leverage before 2019. However, in 2019–2020, Asos also transitioned to equity as its main source of financing. Overall, when it came to the debt service coverage ratio, Amazon and Alibaba had previously financed their assets largely through debt. When the coronavirus pandemic began, both companies shifted primarily to equity, thereby posing less risk to investors and creditors than in previous years. The pandemic did not affect Asos's debt ratio to the same extent,

Table 2. Debt service coverage ratios of Amazon, Alibaba, and Asos in 2017–2020

Company	Years			
	2017	2018	2019	2020
Debt ratio				
Amazon	0.79	0.73	0.72	0.71
Alibaba	0.44	0.49	0.48	0.42
Asos	0.66	0.56	0.64	0.59
Debt-to-equity ratio				
Amazon	1.59	1.13	0.67	0.55
Alibaba	0.33	0.34	0.27	0.17
Asos	0.00	0.00	0.17	0.39
Time interest earned				
Amazon	4.84	8.77	9.08	13.90
Alibaba	17.10	18.87	8.84	15.33
Asos	–	509.50	17.55	15.91

Source: Own contribution.

however, the company also began to finance its assets mainly with equity, whereas previously it had reported no debt.

Table 3 provides an overview of the efficiency ratios analysed in this study. Amazon exhibited a slightly lower asset turnover ratio during the pandemic, indicating somewhat less effective use of assets to generate sales. However, the accounts receivable turnover ratio, inventory turnover ratio, and accounts payable turnover ratio reached their highest levels during the period. These results suggest that Amazon collected receivables more quickly, experienced high demand for its products, and sold goods faster than in previous years. Additionally, the company repaid suppliers more quickly and managed payables more efficiently. Alibaba maintained similar values for the asset turnover ratio and accounts receivable turnover ratio compared to previous years. The accounts payable turnover ratio increased during the pandemic, reflecting faster payments to suppliers and improved debt collection processes. Nevertheless, the inventory turnover ratio decreased relative to the previous year, indicating higher inventory levels at the end of 2020. This outcome suggests challenges in demand forecasting, leading to over-purchasing and excessive stock. For Asos, almost all efficiency ratios declined during the coronavirus pandemic. The company managed its assets less efficiently and experienced difficulties in receivables collection, resulting in lower performance compared to previous years. Overall, Asos performed less effectively during the pandemic, showing lower productivity and less efficient asset management, lagging behind Amazon and Alibaba. Amazon improved its effectiveness on multiple fronts during the pandemic, including more frequent receivables collection,

Table 3. Efficiency ratios of Amazon, Alibaba, and Asos in 2017–2020

Company	Years			
	2017	2018	2019	2020
Asset turnover ratio				
Amazon	1.66	1.58	1.45	1.41
Alibaba	0.36	0.41	0.45	0.45
Asos	2.58	2.62	2.43	2.02
Accounts receivable turnover ratio				
Amazon	16.50	15.60	15.10	17.20
Alibaba	–	–	13.60	13.90
Asos	177.30	109.60	66.80	62.80
Inventory turnover ratio				
Amazon	8.10	8.40	8.80	10.50
Alibaba	–	–	31.20	23.90
Asos	3.30	3.20	3.00	3.20
Accounts payable turnover ratio				
Amazon	3.74	3.82	3.88	3.90
Alibaba	–	–	31.25	59.26
Asos	14.67	7.62	5.38	5.37

Source: Own contribution.

faster supplier repayments, and better management of receivables. Alibaba also accelerated supplier payments and improved debt collection compared to earlier years, although it ended 2020 with high inventory levels.

Table 4 exhibits profitability ratios for the analysed companies. For Amazon, the first two profitability ratios, namely return on sales and return on assets, were higher during the coronavirus pandemic than in previous years. These results indicate that the company achieved better selling prices and reduced unit costs. In 2020, Amazon operated more efficiently and generated a higher net profit. The final profitability ratio, return on equity, also increased in 2020 compared to 2019, suggesting that the company's management utilised equity more effectively. For Alibaba, the first profitability ratio, return on sales, was the lowest in 2019 and remained stable in subsequent years. However, the return on assets and return on equity ratios peaked in 2020, demonstrating that the company was able to generate a return on investment for shareholders during the coronavirus pandemic. These results also highlight Alibaba's improved productivity and efficiency in managing its economic resources. In the case of Asos, profitability ratios followed a consistent pattern. The indicators were at their lowest in 2019 but improved slightly in 2020. Compared to 2019, the company converted sales into profits more effectively in 2020, generating higher returns for its owners and reflecting

Table 4. Profitability ratios of Amazon, Alibaba, and Asos in 2017–2020

Company	Years			
	2017	2018	2019	2020
Return on sales (%)				
Amazon	1.26	4.25	4.14	5.52
Alibaba	29.22	32.85	21.15	28.66
Asos	3.33	3.41	0.90	3.47
Return on assets (%)				
Amazon	2.09	6.75	5.97	7.80
Alibaba	10.03	10.46	10.41	13.10
Asos	8.60	8.92	2.18	7.00
Return on equity (%)				
Amazon	9.55	27.83	21.95	27.44
Alibaba	17.50	19.67	20.19	23.63
Asos	26.30	22.70	5.51	17.93

Source: Own contribution.

more efficient use of its financial resources during that year. Overall, the pandemic positively influenced profitability for Amazon and Alibaba, both of which improved their efficiency in generating profits, achieving higher net profits, and providing greater returns to their shareholders. For Asos, the improvement in profitability ratios from 2019 to 2020 demonstrated that the company more effectively transformed sales into profits.

4. Conclusions and discussion

The ratio analysis has revealed that the coronavirus pandemic had significantly impacted the financial liquidity, efficiency, profitability, and debt management of major e-commerce platforms, although the extent varied across companies. The pandemic had the most notable effect on the financial liquidity of Asos, improving its ability to meet short-term liabilities and retain cash reserves. In contrast, Amazon displayed minimal changes in liquidity, maintaining consistent performance, while Alibaba's liquidity improved in 2020 following a significant drop in 2019. However, Alibaba did not use cash as effectively as expected.

In terms of the debt service coverage ratio, both Amazon and Alibaba transitioned from financing assets predominantly with debt to relying more on equity during the pandemic, thereby reducing their risk profiles. Asos, which had not heavily relied on external financing before, began financing its assets primarily with equity during this period.

Amazon demonstrated high efficiency, managing debt collection and supplier payments more effectively while experiencing robust demand for its products. However, a slight decline in asset turnover during the pandemic suggested somewhat less effective use of assets to generate sales. Similarly, Alibaba enhanced its efficiency during the pandemic by accelerating debt collection and supplier payments, although inefficiencies in inventory management, such as over-purchasing, indicated forecasting challenges. Asos experienced the greatest difficulties with efficiency ratios, reflecting challenges in managing assets and collecting payments.

For platforms such as Amazon and Alibaba, the pandemic had a positive impact on profitability. Amazon achieved better selling prices and lower unit costs, generating higher net profit and more effectively converting sales into profits in 2020. Alibaba was more productive in managing its economic resources and achieved a higher return on investment from shareholders in 2020. For Asos, profitability improved slightly in 2020 compared to 2019, suggesting better conversion of sales into profits during the pandemic.

This article demonstrates that the overall impact of the pandemic on the e-commerce sector was more positive than negative. The results confirm the hypothesis that the pandemic had a significant and varied impact on the financial performance of e-commerce platforms. The crisis accelerated the sector's growth, as restrictions and closures of physical stores pushed consumers toward online platforms. The study shows that the selected timeframe effectively captured the peak of the pandemic's financial effect, providing valuable insights into the immediate adaptations and resilience of major e-commerce platforms. By focusing on the years 2017–2020, the analysis isolates the critical period of disruption, highlighting how companies responded to unprecedented challenges.

This study provides valuable insights into the financial performance and resilience of e-commerce platforms during the pandemic, however, it is not without limitations. The analysis focuses on a four-year period, which captures the immediate effects of the pandemic but does not account for longer-term recovery trends or post-pandemic growth. Although the study examines the immediate impacts of the pandemic, it does not address the broader shifts patterns or the ongoing adjustments made by companies in later years. This deliberate limitation ensures that the findings remain centred on the crisis period, capturing the most critical phase of financial and operational disruptions. Additionally, the study examines only three companies, limiting the generalizability of the findings to the broader e-commerce sector. While these companies represent significant players in different regions, they do not fully reflect the diversity of the global e-commerce landscape, particularly smaller or emerging platforms.

Nevertheless, the article provides a foundation for exploring long-term implications of the pandemic on the e-commerce sector. Future research could expand

the scope to examine post-pandemic evolution, including the strategies employed during recovery, the structural changes that reshaped the e-commerce sector, long--term consumer behaviour changes, and the role of technological innovation in sustaining the sector's growth. The findings presented in this article provide valuable insights for understanding the impact of global crises on digital business environments. These results could serve as a basis for future studies on how e-commerce platforms adapt to challenges and leverage opportunities during periods of economic disruptions. Exploring these dynamics further will enhance the understanding of resilience and strategic agility within the industry.

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References

Arhinful R., Radmehr M., 2023, *The effect of financial leverage on financial performance: evidence from non-financial institutions listed on the Tokyo stock market*, Journal of Capital Markets Studies, no. 7, https://doi.org/10.1108/JCMS-10–2022–0038.

Barnes P.A., 2006, *The analysis and use of financial ratios: A review article*, Journal of Business Finance & Accounting, no. 14, https://doi.org/10.1111/j.1468–5957.1987.tb00106.x.

Charles I.I., Uford I.C., 2023, *Comparative analysis and evaluation of business and financial performance of Amazon.com: A three-year period critical review of exceptional success*, European Journal of Business, Economics and Accountancy, no. 11.

Chodak G., 2024, *Measuring the impact of e-commerce on the economy* [in:] G. Chodak, *The Future of E-commerce. Innovations and Developments*, Springer, Cham, https://doi.org/10.1007/978–3-031–55225–0_1.

Darwish S.Z., Gomes A.M., 2022, *E-commerce and impact of COVID-19 on consumer behaviors globally: A review* [in:] *From the Internet of Things to the Internet of Ideas: The Role of Artificial Intelligence. Proceedings of EAMMIS 2022*, eds. A.M. . Musleh Al-Sartawi, A. Razzaque, M.M. Kamal, Springer, Cham, https://doi.org/10.1007/978–3-031–17746–0_36.

Elrhim M.A., Elsayed A., 2020, *The effect of COVID-19 spread on the e-commerce market: The case of the 5 largest e-commerce companies in the world*, SSRN Electronic Journal, January, https://doi.org/10.2139/ssrn.3621166.

Han B.R., Sun T., Chu L.Y., Wu L., 2022, *COVID-19 and e-commerce operations: Evidence from Alibaba*, Manufacturing & Service Operations Management, no. 24, https://doi.org/10.1287/msom.2021.1075.

Jílková P., Králová P., 2021, *Digital consumer behaviour and eCommerce trends during the COVID-19 crisis*, International Advances in Economic Research, no. 27, https://doi.org/10.1007/s11294–021–09817–4.

OECD, 2020, *E-commerce in the time of COVID-19*, Organisation for Economic Co-operation and Development, https://www.oecd.org [access: 23.11.2024].

Pandey A., Parmar J., 2019, *Factors affecting consumer's online shopping buying behaviour*, SSRN Electronic Journal, January, https://doi.org/10.2139/ssrn.3308689.

Rocha A.B. da S., Meirim M.O., Nogueira L.C., 2021, *Trends in the e-commerce and in the traditional retail sectors during the COVID-19 pandemic: An evolutionary game approach*, arXiv preprint, https://doi.org/10.48550/arXiv.2105.06833.

Sari D.W., 2019, *Ratio analysis of financial performance of companies: Q45 index listed*, Humanities & Social Sciences Reviews, no. 7, https://doi.org/10.18510/hssr.2019.7361.

Suthar K.U., 2018, *Financial ratio analysis: A theoretical study*, International Journal of Research in All Subjects in Multi Languages, no. 6.

Thomson Reuters, 2022, *Eikon database: Comprehensive financial data for global markets*, https://www.thomsonreuters.com/en.html [access: 23.11.2024].

UNCTAD, 2021, *How COVID-19 triggered the digital and e-commerce turning point*, United Nations Conference on Trade and Development, https://unctad.org [access: 23.11.2024].

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Internationalisation of the Polish cosmetics industry: Utilizing six-digit customs codes to identify markets with the highest potential

The internationalisation of the Polish cosmetics industry is a dynamic process that plays a crucial role in the growth and competitiveness of the sector in foreign markets. This article examines the key factors influencing the expansion of Polish cosmetics companies beyond national borders, including market entry strategies, regulatory barriers, and the importance of innovation and marketing. Special attention is given to the role of product quality, brand recognition, and adaptation to local consumer preferences. The aim of this paper is to verify whether Polish entrepreneurs in the cosmetics industry are targeting markets with the highest purchasing potential and to demonstrate how six-digit customs codes can be used to analyse international markets. Additionally, the article discusses the impact of global trends, such as sustainability and digitalisation, on the internationalisation strategies of Polish enterprises. The analysis results indicate that an organisation's success depends on skilfully combining traditional values with modern business strategies and effectively utilizing available export support instruments.

Keywords: internationalisation, cosmetics industry, export, market strategy, competitiveness, Polish companies

JEL: F14, L66, M31, F23

Introduction

The Polish cosmetics industry has been developing dynamically over the last few decades and becoming an important player in international markets. Poland is one of the leading producers and exporters of cosmetics in Europe, with Polish brands increasingly recognised abroad. As globalisation intensifies and new markets emerge, it is crucial for Polish entrepreneurs to identify the most attractive destinations for their products.

The internationalisation of the cosmetics industry requires an in-depth understanding of global market trends, consumer preferences, and regulatory frameworks. One of the key tools supporting market selection is the analysis of trade

data using six-digit customs codes, which allow for precise identification of product flows across countries. By leveraging such data, businesses can make informed decisions about market entry strategies and competitive positioning.

The aim of this paper is to identify and evaluate the degree of alignment between the current export destinations of Polish cosmetic companies and global markets with the highest purchasing potential. This assessment is carried out using six-digit customs codes (HS) as a diagnostic tool for detecting untapped demand and supporting strategic market selection. To achieve this goal, the study examines trade flows, export destinations, and market potential based on available trade statistics.

The paper is structured as follows: the next section reviews the literature on international trade in the cosmetics industry, globalisation, highlighting key factors influencing market selection. Subsequently, the methodology section describes the data sources and analytical approach used in the study. The results section presents key findings regarding the export destinations of Polish cosmetics and their alignment with market potential. Finally, the discussion and conclusion sections summarise the implications of the findings and provide recommendations for businesses and policymakers.

1. International trade and globalisation

International trade is a key element of the global economy, enabling countries and businesses to specialise in the production of specific goods and services and to subsequently exchange them on international markets. According to the World Trade Organization (WTO) definition, international trade includes the export and import of goods and services exchanged between countries based on specific customs and trade regulations [Krugman, Obstfeld, 2012]. Globalisation and technological advancements have significantly contributed to market expansion of many organisations, allowing them to scale their operations and access new consumers worldwide [Kotler, 2021].

Globalisation has not only increased competition in international markets but has also provided businesses with access to a more diverse range of resources, technologies, and markets. Its impact on the cosmetics sector is particularly evident, as consumers worldwide are becoming more aware of products available in the global market, fostering the expansion of companies from various countries [Kapferer, Bastien, 2012]. Through international trade, cosmetics manufacturers can effectively reach customers in distant parts of the world while tailoring their products to local preferences.

International expansion is a crucial element of a company's growth strategy, as it allows for revenue diversification and reduces risks associated with dependence on a single market [Porter, 2008]. Research indicates that companies engaged in international trade tend to be more innovative and generate higher revenues than those operating solely in domestic markets [Dunning, 2015].

2. HS Code

In order to streamline trade processes and ensure a clear classification of goods, a system of customs codes has been established. The key global classification system is the Harmonized System (HS Code), administered by the World Customs Organization (WCO). The HS Code consists of two to six digits and serves as the foundation for tariff classification in over 200 countries [WCO, 2023]. It is standardised globally, allowing for precise customs valuation and global trade flow analysis.

The HS system covers approximately 5,000 product groups, each identified by a six-digit HS Code structured according to a standardised hierarchy [WCO, 2022]. This system ensures uniform classification in international trade and serves as the basis for customs tariffs in over 200 countries while also supporting international trade statistics. Currently, over 98% of goods in global trade are classified under the HS Code system.

Building on the HS classification, the European Union has developed the Combined Nomenclature (CN), which provides a more detailed breakdown of imported product categories. In Poland, this system replaced the Polish Classification of Goods and Services [PKWiU 2008] as of 1 April 2020. The CN number consists of eight digits, with the first six corresponding to the HS Code. Understanding the CN code structure is essential:

- The first two digits (XX000000) indicate the section to which a product is assigned. For example, Section 33 covers essential oils, perfumery, cosmetics, and toiletries,
- The next two digits (00XX0000) specify the product group within the above-mentioned section. For example, 3304 refers to beauty or skincare preparations, including manicure or pedicure products,
- The fifth and sixth digits (0000XX00) further define the product's classification. For example, 330499 refers to beauty or skincare preparations (excluding medicated products), including sunscreens and suntan preparations,
- The seventh and eighth digits (000000XX) are additional EU-specific numbers that provide further product details. For example, 33049900 indicates no further differentiation within the 330499 category.

The Polish ISZTAR system is the national counterpart to the EU's Common Customs Tariff.

For companies analysing potential export markets, the six-digit HS Code is of critical importance. It enables businesses to compare import and export data across different countries and assess trade balances, facilitating the selection of the most promising markets.

When evaluating market analysis and export strategies, six-digit HS Codes offer several advantages over four-digit classifications:

- Precise customs valuation analysis: Six-digit codes allow for a more accurate determination of a product's customs value, directly impacting transaction costs and exporters' competitiveness in international markets [Feenstra, 2017].
- Improved market segmentation: The six-digit classification system enables a more detailed analysis of product competitiveness and export potential, helping companies tailor their strategies to specific market dynamics [Helpman, 2019].
- Trade balance assessment: HS Code data helps identify net-exporting countries, which is particularly relevant for Poland's cosmetics industry. Countries such as Germany, France, Spain, and Italy are both significant importers and exporters of cosmetics, suggesting potential re-export activity or competition with premium brands.
- Comparison of global import and export trends: Analysing imports across the 50 largest markets and comparing them with Polish export data helps determine whether Poland is fully leveraging its cosmetics export potential and whether its products are reaching high-demand markets.
- Strategic export decision-making: Six-digit HS Codes enable businesses to better define their competitive advantages and select markets with the greatest growth potential.

While four-digit HS Codes provide a general market overview, six-digit classifications are essential for precisely assessing export potential and aligning trade strategies with market realities. These codes form the foundation of customs code harmonisation methodologies, facilitating more accurate business decisions on a global scale.

Recent research has underscored the strategic importance of using six-digit HS Codes in analysing international trade flows, particularly in the cosmetics sector. Choi and Shin [2020] demonstrated that the Trade Map, based on HS-coded data, enables small and medium-sized enterprises to identify export opportunities with greater precision, especially in high-growth markets. These findings align with the practical approach used in this study, emphasizing the need for granular trade data to inform export strategies in consumer product sectors such as cosmetics.

Lee and Kwon [2021] conducted a focused analysis of skincare product exports using six-digit HS codes and found that markets with high negative trade balances represent the most fertile ground for expansion. Their results highlight that such granular-level trade data not only reflects supply-demand asymmetries but also serves as an indicator of structural import dependence, particularly relevant for countries like China and Saudi Arabia. These insights provide empirical support for the methodology used in this paper.

3. Aim and Methodology of the Study

The aim of this paper is to examine whether Polish entrepreneurs in the cosmetics industry are targeting markets with the highest purchasing potential and to demonstrate how six-digit customs codes can be used to analyse international markets. The product group selected for the analysis is "Beauty or make-up preparations and preparations for the care of the skin (other than medicaments)" (CN code 330499). This product group accounts for the largest percentage share of global imports and exports.

In the context of customs tariff classification, the term "cosmetics industry" refers to the following four-digit product groups:

- CN3303 – perfumes and toilet waters,
- CN3304 – skin care preparations, manicure or pedicure preparations,
- CN3305 – hair care preparations,
- CN3306 – oral or dental hygiene preparations,
- CN3307 – shaving preparations, deodorants, bath and shower preparations,
- CN3401 – cosmetic soaps.

This classification of CN codes is in line with the definition of a cosmetic product according to Article 2 of Regulation (EC) 1223/2009:

Cosmetic product means any substance or mixture intended to come into contact with the external parts of the human body (epidermis, hair, nails, lips, and external genital organs) or with the teeth and mucous membranes of the oral cavity, whose sole or main purpose is to clean, perfume, change their appearance, protect, maintain them in good condition, or correct body conditions.

Thus, in the context of global market analysis based on CN codes, the term "cosmetics industry" encompasses all the above-mentioned four-digit customs codes. However, to conduct a more precise analysis that reflects the trade flows of a specific product group, the six-digit code is necessary. Industry reports typically do not include this extension, as four-digit codes provide a broader perspective on the sector as a whole. However, for an entrepreneur seeking to analyse the export and/or import opportunities of a particular product, the six-digit code is

more informative, as it is globally standardised (under the HS Code) and enables making a comparison of trade flows across countries.

To illustrate trade flows, data from the EU customs code database within the Trade Map was used [source: https://www.trademap.org/Index.aspx]. The Trade Map covers 220 countries and 5,300 products organised under the HS Code system (Harmonized System). The currency used for calculations is the United States Dollar (USD), as most international transactions are settled in this currency.

4. Cosmetics industry in Poland

The cosmetics industry in Poland is one of the most promising sectors, consistently achieving export successes over the years. Poland has a highly dynamic and robust sector, comprising approximately 1,200 companies ranging from large corporations to micro enterprises [Wiadomości Kosmetyczne, 2025]. The sector is consistently recognised by the Polish Investment and Trade Agency as one of the leading industries in Polish exports and is supported by special promotion programs.

According to the Polish Chamber of the Cosmetics Industry Report of July 2024 [Kosmetyczni.pl, 2024]:

- The cosmetics industry in Poland accounts for 5.5% of the gross added value of the European cosmetics market,
- Poland is the fifth-largest cosmetics market in the European Union. In 2023, its share in the EU market was 6.4%,
- During the period from 2014 to 2023, the Polish cosmetics market grew by 75.3%, significantly outpacing the entire EU27 market growth of 34.0%,
- Poland is the ninth-largest exporter of cosmetics in the world (3.8% share of global exports) and the fifth-largest in the European Union (8%),
- In 2023, Poland's cosmetics export amounted to EUR 5.7 billion, while imports totalled EUR 3.3 billion,
- 65% of cosmetics exported from Poland are destined for the European Union market, while the remaining 35% are exported outside the EU,
- From 2004 to 2023, the cumulative trade balance of cosmetics amounted to EUR 22.3 billion, with the export-to-import ratio being higher than the EU average. This overseas expansion contributes to the development of the domestic market, benefiting Polish producers.

5. Global cosmetics market

According to the adopted methodology based on customs codes, the global cosmetics market in terms of imports and exports is presented in Table 1.

Table 1. The value of cosmetics imports in 2023, broken down by four-digit codes

Code	Product label	Value of imports in 2023 (USDk)	Share (%)	Value of exports in 2023 (USDk)	Trade balance (exports minus imports) (USDk)
3303	Perfumes and toilet waters	29 222 037	18.06%	29 646 174	424 137
3304	Beauty or make-up preparations and preparations for the care of the skin, manicure or pedicure preparations	76 417 422	47.22%	75 545 784	–871 638
3305	Preparations for use on the hair	18 368 511	11.35%	17 864 701	–503 810
3306	Preparations for oral or dental hygiene	7 621 268	4.71%	6 973 696	–647 572
3307	Shaving preparations	14 455 483	8.93%	15 636 375	1 180 892
3401	Soap; organic surface--active products	15 746 133	9.73%	15 412 445	–333 688
Total		161 830 854	100.00%	161 079 175	–751 679

Source: Own analysis based on data from [International Trade Centre 2024].

The global imports of cosmetics in 2023 amounted to over USD 161.83 billion, while exports totalled USD 161.07 billion. The overall trade balance [Samuelson, Nordhaus, 2021], that is the difference between exports and imports, was negative and amounted to over USD 751.6 million. This means that, generally, the global market for cosmetics imports exceeded exports.

Only in two product groups, namely perfumes and toilet waters (code 3303) and shaving preparations (code 3307), the trade balance was positive, indicating a surplus of exports over imports.

The group with code 3304, which includes body beautifying products such as creams, accounted for the largest share of global imports. This group represents just over 47% – almost half of the total global cosmetics imports.

Moving on to further analysis, it is necessary to expand the group 3304 into a six-digit code, as shown in Table 2 below.

Table 2. Six-digit cosmetics product codes for group 3304

Code	Product label
330499	beauty or make-up preparations and preparations for the care of the skin (other than medicaments)
330410	lip make-up preparations
330420	eye make-up preparations
330491	make-up or skin care powders, incl. baby powders, whether or not compressed (excl. medicaments)
330430	manicure or pedicure preparations

Source: Own analysis based on data from [International Trade Centre 2024].

Next, it is necessary to examine the trade flows (imports/exports) in these categories, as shown in Table 3.

Table 3. Global imports and exports of group 3304 cosmetics products in 2023

Code	Product label	Value of imports in 2023 (USDk)	Share (%)	Value of exports in 2023 (USDk)	Trade balance (exports minus imports) (USDk)
330499	beauty or make-up preparations and preparations for the care of the skin (other than medicaments)	60 701 493	79.43%	59 578 774	–1 122 719
330410	lip make-up preparations	5 592 846	7.32%	5 258 860	–333 986
330420	eye make-up preparations	5 481 636	7.17%	5 148 896	–332 740
330491	make-up or skin care powders, incl. baby powders, whether or not compressed (excl. medicaments)	3 105 535	4.06%	2 920 191	–185 344
330430	manicure or pedicure preparations	1 535 912	2.01%	1 591 793	55 881
Total		76 417 422	47.22%	74 498 514	–1 918 908

Source: Own analysis based on data from [International Trade Centre 2024].

According to the data shown in the Table 3, the code 3304 product group consists of five subgroups with six-digit codes. The global import totalled over USD 76.41 billion, while exports amounted to USD 74.49 billion. The overall trade balance was negative, amounting to nearly USD 2 billion.

Exports exceeded the global imports in one subgroup only, namely the manicure and pedicure products. The surplus of exports over imports in this group was minor, amounting to USD 55.8 million. The largest and most significant subgroup consisted of code 330499 products, i.e., skin care preparations which accounted for

almost 80% of the entire six-digit subgroup. This group had the largest negative trade balance, which exceeded USD 1.1 billion. In this group, imports significantly outweighed exports, which should serve as an important indicator for exporters when planning expansion for this product category. Table 4 below shows the key data on global imports.

Table 4. Global imports of code 330499 skin care cosmetics in 2023

Variables	Value
Code	330499
Product label	beauty or make-up preparations and preparations for the care of the skin (other than medicaments)
Value of imports in 2023 (USDk)	60 701 493
Share %	79.43%
Trade balance in 2023 (USDk)	–1 122 719
Annual growth in value between 2019–2023 (%, p.a.)	6.00
Annual growth of world exports between 2019–2023 (%, p.a.)	5.00
Average distance between the supplying countries (km)	5 010
Concentration of the supplying countries	0.09

Source: Own analysis based on data from [International Trade Centre 2024].

The data shows that between 2019 and 2023, imports increased by 6%, surpassing the export dynamics, which amounted to 5% for the same period. The average distance from exporting countries was over 5,000 km, and the concentration of exporters in the global market remained relatively low (0.09). This suggests that the global market is not dominated by a few exporters.

Therefore, as mentioned at the beginning of the article, the focus of further analysis will be on products with the customs code 330499. To proceed with the analysis, we first need to look at the main global markets for code 330499 product imports, which is shown in Table 5 below for the selected 50 countries.

Explanations of Table 5 headings:

- Value of imports: the value of imports in USD thousands,
- Trade balance: the difference between exports and imports,
- Annual growth in value: the percentage growth in the value of imports,
- Share in the world's imports: the share in the global imports,
- Concentration of the supplying countries: the concentration of suppliers (exporters in the given market). A concentration index up to 0.18 indicates average concentration; above 0.18, it indicates high concentration,
- Average tariff applied: the average tariff rate applied by a given country.

Table 5. Global imports of 330499 product group cosmetics in 2023

No.	Importers	Value of imports in 2023 (USDk)	Trade balance in 2023 (USDk)	Annual growth in value between 2022–2023 (%)	Share of world imports (%)	Average distance between the supplying countries (km)	Concentration of the supplying countries	Average tariff applied by the country (%, estimated)
0	World	60 701 493	–1 122 719	1	100	5 010	0.09	–
1	China	13 217 115	–11 137 746	–21	21.8	5 925	0.18	13.3
2	Hong Kong, China	5 427 106	–2 196 328	–8	8.9	4 308	0.2	0
3	United States of America	4 640 555	57 025	7	7.6	7 232	0.12	0.6
4	Singapore	2 445 590	2 332 023	–9	4	9 024	0.25	0
5	United Kingdom	2 092 566	–279 416	19	3.4	4 234	0.09	0
6	Germany	2 029 579	1 328 397	7	3.3	2 207	0.12	0
7	France	1 744 891	8 058 723	29	2.9	3 707	0.08	0
8	Netherlands	1 569 054	962	16	2.6	1 857	0.15	0
9	Canada	1 380 118	122 634	10	2.3	3 932	0.36	1.6
10	Macao, China	1 239 781	–1 193 632	–32	2	–	0.4	0
11	United Arab Emirates	1 220 521	44 930	21	2	6 813	0.12	4.5
12	Italy	1 173 598	561 746	25	1.9	1 289	0.25	0
13	Spain	1 166 299	402 979	17	1.9	1 998	0.22	0
14	Belgium	1 100 640	–12 693	8	1.8	1 815	0.13	0
15	Poland	1 094 225	778 909	17	1.8	2 148	0.11	0

16	Japan	1 076 503	2 113 166	9	1.8	5 990	0.24	0.1
17	India	1 059 084	–321 133	191	1.7	6 712	0.22	15.7
18	Russian Federation	876 680	–778 393	35	1.4	3 589	0.16	6.3
19	Australia	860 477	–387 391	18	1.4	13 217	0.13	3.2
20	Taipei, Chinese	804 112	–532 554	9	1.3	6 691	0.17	2.5
21	Republic of Korea	744 305	5 783 161	–2	1.2	8 018	0.16	3.7
22	Saudi Arabia	740 820	–730 836	18	1.2	5 114	0.11	4.5
23	Czech Republic	736 227	86 951	2	1.2	2 178	0.11	0
24	Mexico	634 112	–334 878	24	1	6 772	0.14	9.7
25	Thailand	582 558	93 029	20	1	6 748	0.12	22.2
26	Switzerland	510 180	720 632	3	0.8	1 829	0.16	0.5
27	Malaysia	469 365	–339 582	2	0.8	5 439	0.13	0
28	Sweden	448 224	–134 531	14	0.7	2 010	0.09	0
29	Austria	437 699	–152 400	21	0.7	1 232	0.26	0
30	Türkiye	422 796	–218 753	48	0.7	3 747	0.15	0
31	Ireland	416 882	–273 888	6	0.7	2 846	0.3	0
32	Denmark	337 048	31 244	17	0.6	1 749	0.11	0
33	Norway	318 881	–287 178	10	0.5	3 104	0.1	0
34	Indonesia	317 174	–176 610	40	0.5	6 254	0.21	13.9
35	Portugal	306 656	–217 590	18	0.5	1 124	0.35	0

Table 5. cont.

No.	Importers	Value of imports in 2023 (USDk)	Trade balance in 2023 (USDk)	Annual growth in value between 2022–2023 (%)	Share of world imports (%)	Average distance between the supplying countries (km)	Concentration of the supplying countries	Average tariff applied by the country (%, estimated)
36	Viet Nam	264 067	–184 472	13	0.4	5 453	0.19	15.1
37	Kuwait	260 639	–255 962	12	0.4	5 585	0.11	4.5
38	Romania	244 098	–187 173	16	0.4	1 718	0.09	0
39	Slovakia	243 531	–148 250	28	0.4	1 592	0.12	0
40	Lithuania	223 059	–38 620	28	0.4	1 660	0.13	0
41	Ukraine	213 590	–201 146	75	0.4	3 875	0.09	5.2
42	Greece	211 669	–1 037	11	0.3	2 274	0.2	0
43	Chile	206 109	–199 795	1	0.3	10 000	0.11	3.2
44	New Zealand	199 969	–142 806	2	0.3	11 021	0.13	3.4
45	Colombia	193 599	–66 303	22	0.3	7 614	0.11	11.1
46	Hungary	189 595	–34 580	16	0.3	1 323	0.13	0
47	Iraq	182 554	–182 424	21	0.3	2 694	0.23	...
48	South Africa	175 571	111 958	3	0.3	9 678	0.12	16.6
49	Brazil	173 284	–82 750	14	0.3	9 553	0.14	17.1
50	Kazakhstan	166 004	–143 913	24	0.3	4 396	0.13	4.8

Source: Own analysis based on data from [International Trade Centre 2024].

In 2023, the global imports of HS code 330499 skin care cosmetics amounted to over USD 60.7 billion. The largest importer was Mainland China, with skin care cosmetics imports worth more than USD 13.2 billion, accounting for approximately 22% of the global imports [PKO Bank Polski, 2024]. If we include Hong Kong (ranking the 2nd) and Macao (ranking the 10th), which also belong to China, their combined imports in 2023 reached nearly USD 20 billion (USD 19.884 billion), representing one third (33%) of the total global imports of this group of cosmetics. Importantly, China, Hong Kong, and Macao all had a negative trade balance, i.e., their imports exceed exports (they are net importers).

The average distance between the exporting countries is over 5,900 km, indicating that Mainland China tends to import cosmetics from distant markets. This information is valuable for all exporters as transportation costs may affect their competitiveness. With a distance of over 5,900 km, exporters from distant markets face similar transportation costs and can remain competitive. The market concentration index of 0.18 is also noteworthy, indicating a relatively high concentration of exporters in the Mainland Chinese market. The average tariff rate is 13.3%.

The United States ranked 3rd, with imports exceeding USD 4.6 billion; at the same time, it is a net exporter with a positive trade balance of just over USD 57 million. Therefore, any exporter to the US market must keep in mind that, in addition to high imports, the US also exports the same products. This indicates significant competition in the market, but also opportunities, as the exporter concentration index stands at 0.12. In other words, there are no dominant exporters in the supplier market. The US share of the global import of skin care cosmetics is close to 9%.

Poland ranks 15th in the global imports with a significant positive trade balance (USD 778.9 million), meaning that its exports exceed imports. This confirms earlier information that Poland is an important exporter.

In 2023, all the selected 50 countries imported cosmetics under HS code 330499 worth USD 56.788 billion, accounting for 93.5% of the total global imports. It means that the remaining 200 countries included in the international statistics account for only 6.5% of the total imports value. Therefore, if exporters were deciding how many markets to target, selecting 50 markets provides a solid basis for a reliable analysis.

6. Poland's exports of cosmetics

In order to determine whether Polish exporters make the right decisions as to the export markets they are targeting, it is also necessary to examine 50 countries. The relevant data is provided in Table 6.

Table 6. Polish exports of skin care cosmetics under code 330499 in 2023

No.	Importers	Value of exports in 2023 (USDk)	Trade balance in 2023 (USDk)	Share of Poland's exports (%)	Growth in the value of exports between 2022–2023 (%, p.a.)	Ranking of partner countries in global imports	Share of partner countries in global imports (%)	Average distance between partner countries and all their supplying markets (km)	Concentration of all the supplying partner countries	Average tariffs (estimated) for Poland (%)
0	World	1 873 134	778 909	100	15	–	100	–	–	–
1	Germany	338 118	112 188	18.1	2	6	3.3	2 207	0.12	0
2	United Kingdom	179 669	125 619	9.6	50	5	3.4	4 234	0.09	0
3	Belgium	144 484	–9 425	7.7	–16	14	1.8	1 815	0.13	0
4	Czech Republic	130 267	116 863	7	–26	23	1.2	2 178	0.11	0
5	France	121 294	–47 310	6.5	37	7	2.9	3 707	0.08	0
6	Russian Federation	99 329	99 296	5.3	35	18	1.4	3 589	0.16	6.5
7	Netherlands	66 974	19 003	3.6	32	8	2.6	1 857	0.15	0
8	Ukraine	58 807	57 484	3.1	65	41	0.4	3 875	0.09	0
9	Italy	54 588	–62 113	2.9	41	12	1.9	1 289	0.25	0
10	Spain	50 806	–1 842	2.7	23	13	1.9	1 998	0.22	0
11	United States of America	38 840	–22 074	2.1	76	3	7.6	7 232	0.12	0
12	South Africa	33 472	32 462	1.8	–2	48	0.3	9 678	0.12	0
13	Switzerland	32 964	8 099	1.8	–42	26	0.8	1 829	0.16	0
14	Lithuania	32 008	31 273	1.7	41	40	0.4	1 660	0.13	0

15	Türkiye	30 271	27 417	1.6	55	30	0.7	3 747	0.15	0
16	Sweden	28 861	23 116	1.5	27	28	0.7	2 010	0.09	0
17	Romania	26 999	25 888	1.4	72	38	0.4	1 718	0.09	0
18	Slovakia	26 882	26 113	1.4	43	39	0.4	1 592	0.12	0
19	Hungary	25 804	24 971	1.4	9	46	0.3	1 323	0.13	0
20	Australia	22 790	21 557	1.2	1707	19	1.4	13 217	0.13	5
21	United Arab Emirates	22 540	22 381	1.2	13	11	2	6 813	0.12	5
22	Latvia	20 949	20 573	1.1	51	70	0.1	1 521	0.11	0
23	Hong Kong, China	17 077	17 001	0.9	–11	2	8.9	4 308	0.2	0
24	Ireland	15 464	5 418	0.8	235	31	0.7	2 846	0.3	0
25	Denmark	14 721	13 055	0.8	20	32	0.6	1 749	0.11	0
26	Estonia	13 551	9 257	0.7	66	69	0.1	3 475	0.09	0
27	Austria	13 394	6 726	0.7	11	29	0.7	1 232	0.26	0
28	Saudi Arabia	12 716	12 716	0.7	72	22	1.2	5 114	0.11	5
29	Colombia	11 443	11 423	0.6	28	45	0.3	7 614	0.11	0
30	Kazakhstan	10 110	10 107	0.5	26	50	0.3	4 396	0.13	6.5
31	Morocco	9 559	9 383	0.5	15	59	0.2	2 707	0.27	0
32	Belarus	9 231	9 231	0.5	57	84	0.06	1 895	0.15	6.5
33	Greece	8 808	2 296	0.5	11	42	0.3	2 274	0.2	0
34	Mexico	7 682	7 636	0.4	–9	24	1	6 772	0.14	0

Table 6. cont.

No.	Importers	Value of exports in 2023 (USDk)	Trade balance in 2023 (USDk)	Share of Poland's exports (%)	Growth in the value of exports between 2022–2023 (%, p.a.)	Ranking of partner countries in global imports	Share of partner countries in global imports (%)	Average distance between partner countries and all their supplying markets (km)	Concentration of all the supplying partner countries	Average tariffs (estimated) for Poland (%)
35	Portugal	6 546	5 854	0.3	12	35	0.5	1 124	0.35	0
36	Israel	6 508	3 444	0.3	91	55	0.2	4 690	0.16	0
37	Croatia	6 223	5 842	0.3	62	52	0.3	1 017	0.16	0
38	Iraq	6 157	6 157	0.3	24	47	0.3	2 694	0.23	–
39	Norway	5 821	5 814	0.3	58	33	0.5	3 104	0.1	0
40	China	5 702	–17 051	0.3	75	1	21.8	5 925	0.18	1
41	Serbia	5 394	5 368	0.3	46	68	0.1	1 917	0.15	0
42	Viet Nam	5 372	5 357	0.3	17	36	0.4	5 453	0.19	16.7
43	Bulgaria	5 348	2 573	0.3	27	57	0.2	1 710	0.08	0
44	Area Nes	4 992	4 992	0.3	54	–	–	–	–	–
45	Republic of Moldova	4 900	4 899	0.3	21	88	0.05	3 305	0.1	6.5
46	Georgia	4 563	4 462	0.2	38	72	0.09	3 642	0.1	0
47	Uzbekistan	4 494	4 494	0.2	60	103	0.04	3 679	0.15	30
48	Nigeria	4 228	4 227	0.2	118	99	0.04	5 827	0.25	20
49	Kuwait	4 193	4 193	0.2	27	37	0.4	5 585	0.11	5
50	Luxembourg	3 542	3 459	0.2	68	64	0.1	667	0.28	0

Source: Own analysis based on data from [International Trade Centre 2024].

According to Trade Map data, Poland's exports of skin care cosmetics under code 330499 to global markets in 2023 amounted to over USD 1.8 billion. The overall global trade balance was positive (Poland was a net exporter), with a balance of USD 778 million. Between 2022 and 2023, Poland's exports value increased by 15%. Poland's largest trading partner was Germany, which ranks the 6th globally in terms of the value of skin care cosmetics imports. In 2023, Poland exported cosmetics worth over USD 338 million to Germany, representing 18.1% of Poland's total exports. The second-largest trading partner, the UK, had almost half the share (9.6%). Unfortunately, Poland's exports were highly concentrated on single market i.e. Germany Poland maintained a positive trade balance with both Germany and the United Kingdom, meaning it exported more to these countries than it imported.

The share of the top ten countries in Poland's exports was 66.5%. The value of Poland's exports to these countries in 2023 amounted to over USD 1.2 billion. The remaining countries had shares ranging from 2.1% to 0.2%, as in the case with Luxembourg (ranking the 50th globally). It is evident that outside of the top ten, Poland's exports were highly diversified, with individual countries accounting for only small shares of total exports. Among the top ten countries to which Poland exported, only four were also among the top ten largest importers. Mainland China, the world's largest importer, ranked only 40th in Poland's exports. The USA, the third-largest global importer, was 11th in Poland's exports. This is most likely due to the necessity of obtaining US sanitary permits, which makes administrative issues a barrier to expanding exports to the US market.

The majority of Poland's exports are therefore directed either to the EU market or to nearby European markets such as the UK, Russia, or Ukraine. In the case of Russia and Ukraine, the values of exports are relatively small, amounting to USD 99.3 million and USD 58.8 million respectively (jointly accounting for 8% of Poland's exports). What is striking is that despite the very difficult political and economic situation in these countries, there was a noticeable high growth in sales to them during the period from 2022 to 2023. In the case of Russia, the growth reached 35%, and in Ukraine, 65%. Unfortunately, Polish exporters are not fully exploiting markets such as the United Arab Emirates, which is the 11th largest global importer but ranks only 21st in Poland's exports. The UAE imported cosmetics worth over USD 1.2 billion, while Poland's exports to this market totalled only USD 22.5 million and accounted for just 1.8% of total UAE imports.

It is clear that Polish exporters are not fully leveraging insights from global demand analysis. They mostly export to countries that are not only geographically close but also major exporters with a trade surplus. These include countries such as France, Italy, the Netherlands, and Spain. It would be worthwhile to analyse countries with the largest negative trade balance, i.e., those that are net importers (with imports exceeding exports), as illustrated in Table 7.

Table 7. Countries with the largest negative trade balance in skin care cosmetics under code 330499

No.	Importers	Value of imports in 2023 (USDk)	Trade balance in 2023 (USDk)	Annual growth in value between 2022–2023 (%)	Share in global imports (%)	Average distance between the supplying countries (km)	Concentration of the supplying countries	Average tariffs (estimated) applied by the country (%)
1	China	13 217 115	–11 137 746	–21	21.8	5 925	0.18	13.3
2	Hong Kong, China	5 427 106	–2 196 328	–8	8.9	4 308	0.2	0
3	Macao, China	1 239 781	–1 193 632	–32	2	–	0.4	0
4	Russian Federation	876 680	–778 393	35	1.4	3 589	0.16	6.3
5	Saudi Arabia	740 820	–730 836	18	1.2	5 114	0.11	4.5
6	Taipei, Chinese	804 112	–532 554	9	1.3	6 691	0.17	2.5
7	Australia	860 477	–387 391	18	1.4	13 217	0.13	3.2
8	Malaysia	469 365	–339 582	2	0.8	5 439	0.13	0
9	Mexico	634 112	–334 878	24	1	6 772	0.14	9.7
10	India	1 059 084	–321 133	191	1.7	6 712	0.22	15.7
11	Norway	318 881	–287 178	10	0.5	3 104	0.1	0
12	United Kingdom	2 092 566	–279 416	19	3.4	4 234	0.09	0
13	Ireland	416 882	–273 888	6	0.7	2 846	0.3	0
14	Kuwait	260 639	–255 962	12	0.4	5 585	0.11	4.5
15	Turkey	422 796	–218 753	48	0.7	3 747	0.15	0
16	Portugal	306 656	–217 590	18	0.5	1 124	0.35	0
17	Ukraine	213 590	–201 146	75	0.4	3 875	0.09	5.2
18	Chile	206 109	–199 795	1	0.3	10 000	0.11	3.2

19	Romania	244 098	–187 173	16	0.4	1 718	0.09	0
20	Viet Nam	264 067	–184 472	13	0.4	5 453	0.19	15.1
21	Iraq	182 554	–182 424	21	0.3	2 694	0.23	...
22	Indonesia	317 174	–176 610	40	0.5	6 254	0.21	13.9
23	Austria	437 699	–152 400	21	0.7	1 232	0.26	0
24	Slovakia	243 531	–148 250	28	0.4	1 592	0.12	0
25	Kazakhstan	166 004	–143 913	24	0.3	4 396	0.13	4.8
26	New Zealand	199 969	–142 806	2	0.3	11 021	0.13	3.4
27	Sweden	448 224	–134 531	14	0.7	2 010	0.09	0
28	Brazil	173 284	–82 750	14	0.3	9 553	0.14	17.1
29	Colombia	193 599	–66 303	22	0.3	7 614	0.11	11.1
30	Lithuania	223 059	–38 620	28	0.4	1 660	0.13	0
31	Hungary	189 595	–34 580	16	0.3	1 323	0.13	0
32	Belgium	1 100 640	–12 693	8	1.8	1 815	0.13	0
33	Greece	211 669	–1 037	11	0.3	2 274	0.2	0
34	Netherlands	1 569 054	962	16	2.6	1 857	0.15	0
35	Denmark	337 048	31 244	17	0.6	1 749	0.11	0
36	United Arab Emirates	1 220 521	44 930	21	2	6 813	0.12	4.5
37	United States of America	4 640 555	57 025	7	7.6	7 232	0.12	0.6
38	Czech Republic	736 227	86 951	2	1.2	2 178	0.11	0
39	Thailand	582 558	93 029	20	1	6 748	0.12	22.2

Table 7. cont.

No.	Importers	Value of imports in 2023 (USDk)	Trade balance in 2023 (USDk)	Annual growth in value between 2022–2023 (%)	Share in global imports (%)	Average distance between the supplying countries (km)	Concentration of the supplying countries	Average tariffs (estimated) applied by the country (%)
40	South Africa	175 571	111 958	3	0.3	9 678	0.12	16.6
41	Canada	1 380 118	122 634	10	2.3	3 932	0.36	1.6
42	Spain	1 166 299	402 979	17	1.9	1 998	0.22	0
43	Italy	1 173 598	561 746	25	1.9	1 289	0.25	0
44	Switzerland	510 180	720 632	3	0.8	1 829	0.16	0.5
45	Poland	1 094 225	778 909	17	1.8	2 148	0.11	0
46	Germany	2 029 579	1 328 397	7	3.3	2 207	0.12	0
47	Japan	1 076 503	2 113 166	9	1.8	5 990	0.24	0.1
48	Singapore	2 445 590	2 332 023	–9	4	9 024	0.25	0
49	Republic of Korea	744 305	5 783 161	–2	1.2	8 018	0.16	3.7
50	France	1 744 891	8 058 723	29	2.9	3 707	0.08	0

Source: Own analysis based on data from [International Trade Centre 2024].

Based on these insights, Polish exports should focus on identifying and targeting markets with the largest negative trade balances. As mentioned earlier, the first market worth considering is China which ranks only 40th in Polish exports. When comparing the top ten countries among Poland's main export destinations (based on Polish exports Table 6) with the Table 7of countries having the largest negative trade balances, the only country that meets this condition is Russia. It ranks 6th in terms of Polish exports and 4th by the negative trade balance. Given the current political and economic context, this represents a very interesting case that merits further analysis. As the top ten leading destinations for Polish exports – such as Germany, France, Italy, the Netherlands, the Czech Republic, or Belgium – they rank much further down when it comes to negative trade balances. Belgium is 32nd, the Czech Republic is 38th, Spain is 42nd, Italy is 43rd, Germany is 46th, and France is 50th. An untapped potential for Polish exports can be identified among European countries with stable economies and negative trade balances, such as:

– Ireland (USD –273.8 million, ranked 24th in Polish exports),
– Portugal (USD –217.5 million, ranked 35th in Polish exports).

In the author's opinion, Portugal deserves special attention, particularly because of its strong ties to Brazil, which ranks 28th in terms of trade deficit (USD –82.7 million). Unfortunately, with its significant import potential, Brazil is not even among the top fifty of Polish exports. It ranks 162nd, with exports from Poland amounting to just USD 42,000 according to www.TradeMap.org. This is a marginal figure, and it should be noted that Brazil ranks 49th in world imports, with an import value of USD 173.2 million (Table 5). The final point of this analysis will involve a comparison of the share of the first ten countries in Polish exports with Poland's share in their imports. This comparison will show the actual strength of Polish exports in these markets (Table 8).

Table 8. Comparison of the share of the value of Polish exports in the imports of a selected countries in 2023

No.	Importers	Share in Poland's exports (%)	Share in country's imports (%)
1	Germany	18.1	11.4
2	United Kingdom	9.6	5.8
3	Belgium	7.7	9.8
4	Czech Republic	7	9.7
5	France	6.5	4.6
6	Russian Federation	5.3	11.3
7	Netherlands	3.6	3.3
8	Ukraine	3.1	15.1
9	Italy	2.9	4.3
10	Spain	2.7	4.5

Source: Own analysis based on data from [International Trade Centre 2024].

As seen in the attached table, Poland's market shares in the top ten countries for Polish exports are relatively small. In the case of Germany, which accounts for 18.1% of Polish exports and is the main sales market, Poland's share in Germany's imports is smaller (11.4%). In the case of the Netherlands, Poland's share in its market is only 3.3%. Particularly notable, as mentioned earlier, are the shares of Russia and Ukraine. Poland's shares in these markets exceed these countries' shares in Polish exports. The Polish share in the Ukrainian market is 15.3%, and in Russia, it is 11.3%. Given the nearly war-like situation in these two countries, this result is astonishing. Unfortunately, in more mature and safer markets for expansion, Poland's market shares are not impressive. In order to start being competitive in the market and not just present in the statistics, market shares should be at least 10% or higher. Apart from Russia and Ukraine, this condition is only met by Germany. It should also be noted that these ten countries account for 66% of Poland's total exports (as per the conclusions from Table 6).

7. Conclusions

The analysis of Polish exports in the cosmetics sector, particularly in the category 330499, reveals that the trade is concentrated in a limited number of markets. The ten largest export destinations account for 66% of total exports, with a clear emphasis on geographically proximate countries. While this approach ensures stable trade relations, it does not fully capitalise on the potential of rapidly growing global markets.

A key observation is that Polish cosmetic companies primarily target European markets, often aligning their efforts with established trade fairs and promotional events within the region. However, a comparison between Poland's main export destinations and the world's largest importers of cosmetics suggests missed opportunities. While Germany, the United Kingdom, France, and the Netherlands are present in both rankings, major global importers such as China, the USA, and Canada remain underutilised. China, the largest global importer of this product category, records a negative trade balance of USD 11.1 billion, yet Polish exports to this market remain negligible. Similarly, Canada, a country with which the European Union has a free trade agreement (CETA), is another high-potential market that has not been effectively targeted.

The case of the United States further highlights the limited reach of Polish cosmetic exports. As the third-largest importer of cosmetics globally, with an import value exceeding USD 4.6 billion in 2023, it represents a significant market. However, Poland ranks only 11th amongst suppliers to the USA, with a modest export value of USD 38.8 million, accounting for a mere 0.7% of the market share. These figures

suggest that Polish exporters are not fully utilizing the market intelligence available in EU trade databases, focusing mainly on well-established European markets.

Furthermore, despite the presence of institutions such as the Polish Investment and Trade Agency (PAIH) and the Pomeranian Trade Office in Beijing, Poland has yet to establish a strong presence in China. Other underutilised markets include Portugal and Brazil, which, despite linguistic and cultural proximity, remain largely unexplored by Polish cosmetic brands. The findings indicate a need for a more strategic and globally oriented promotional approach. The current promotional efforts, funded largely by EU and national resources, appear to lack a cohesive long-term vision aimed at expanding into high-potential markets outside of Europe.

While this study provides valuable insights into the internationalisation patterns of Polish cosmetic exports, certain limitations must be acknowledged. First, the analysis relies on trade data categorised by six-digit customs codes, which, while useful for tracking product movements, do not capture qualitative aspects such as brand perception, consumer preferences, or regulatory barriers in specific countries. Second, the study does not account for firm-level strategies, which may influence export decisions beyond macroeconomic trade flows. Finally, geopolitical factors, such as trade restrictions, diplomatic relations, and sudden economic shifts, have not been analysed in detail but could significantly impact the feasibility of market expansion.

Future research should explore firm-level strategies and decision-making processes regarding market selection, incorporating qualitative insights from industry professionals. Additionally, an in-depth examination of non-tariff barriers, such as regulatory differences, cultural factors, and distribution challenges, could provide a more comprehensive understanding of the obstacles Polish firms face when entering new markets. Finally, further studies could assess the effectiveness of current trade promotion policies and recommend strategies for optimizing the use of available EU and national resources in supporting Polish cosmetic exports.

References

Baldwin R., 2016, *The great convergence: Information technology and the new globalization*, Harvard University Press, Cambridge, MA.

Choi Y., Shin D., 2020, *Trade Map as a Strategic Tool for SME Exporters*, International Journal of Trade and Global Markets, no. 13, https://doi.org/10.1504/IJTGM.2020.100301 [access: 1.03.2025].

Dunning J.H., 2015, *International production and the multinational enterprise*, Routledge, London–New York.

Feenstra R.C., 2017, *Advanced international trade: Theory and evidence*, Princeton University Press, Princeton, New Jersey.

International Trade Centre, 2024, *Trade Map – Trade statistics for international business development. International Trade Centre*, https://www.trademap.org [access: 2.03.2025].

Helpman E., 2019, *Globalization and inequality*, Harvard University Press, Cambridge, Massachusetts.

Johanson J., Vahlne J.E., 2009, *The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership*. Journal of International Business Studies, no. 40.

Kapferer J.-N., Bastien V., 2012, *The luxury strategy: Break the rules of marketing to build luxury brands*, 2nd ed., Kogan Page, London.

Kotler P., 2021, *Marketing Management*, Pearson, Harlow–London.

Krugman P.R., Obstfeld M., 2012, *International economics: Theory and policy*, Pearson, Boston, Massachusetts.

Lee J., Kwon H., 2021, *Application of HS Codes in trade forecasting of skincare products*, Journal of International Trade Studies, no. 17, https://doi.org/10.2139/ssrn.3957896.

PKO Bank Polski, 2024, *Raport: Branża kosmetyczna w Polsce 2024*, PKO Bank Polski, Warszawa. https://wspieramyeksport.pl/raporty-branzowe/B1.3/kosmetyki [access: 2.03.2025]

PKWiU, 2008, Polska Klasyfikacja Wyrobów i Usług Główny, Urząd Statystyczny, https://stat.gov.pl/Klasyfikacje/PKWiU_2008 [access: 5.03.2025].

Polski Związek Przemysłu Kosmetycznego, 2024, Kosmetyczna Polska. Raport o stanie branży kosmetycznej, Fundacja WiseEuropa – Warszawski Instytut Studiów Ekonomicznych i Europejskich, https://kosmetyczni.pl/wpcontent/uploads/2024/10/Kosmetyczni_Kosmetyczna_Polska_Raport_o_stanie_branzy_2024_4.pdf [access: 4.03.2025].

Porter M.E., 2008, *The competitive advantage of nations*, Free Press, New York.

Samuelson P.A., Nordhaus W.D., 2021, *Ekonomia*, 20th ed., PWN, Warszawa.

UNCTAD, 2022, *World Investment Report*, United Nations Conference on Trade and Development, https://unctad.org/publication/world-investment-report-2022 [access: 5.03.2025].

WCO, 2022, *Harmonized System Explanatory Notes*, World Customs Organization, https://www.wcoomd.org/en/topics/nomenclature/instrument-and-tools/tools-to-assist-with-the-classification-in-the-hs/explanatory-notes.aspx [access: 2.03.2025].

WCO, 2023, *Harmonized System Nomenclature and Classification*, World Customs Organization, https://www.wcoomd.org/en/topics/nomenclature.aspx [access: 1.03.2025].

Wiadomości Kosmetyczne, 2025, *Na rynku kosmetycznym robi się coraz ciaśniej. Każdy chce zarabiać na kremach i szminkach*, https://www.wiadomoscikosmetyczne.pl/rynek-kosmetyczny/na-rynku-kosmetycznym-robi-sie-coraz-ciasniej-kazdy-chce-zarabiac-na-kremach-i--szminkach-2516830 [access: 1.03.2025].

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MicroStrategy[1] and Bitcoin: The impact of corporate investments on the stability of the cryptocurrency market

The objective of this article is to identify the impact of corporate investments in Bitcoin on the stability of the cryptocurrency market, with particular emphasis on the investment strategy of MicroStrategy (currently Strategy). The first section of the paper outlines the operational mechanisms of Bitcoin, including its consensus system and the blockchain technology that underpins its security and decentralisation. The second section examines the structure of the cryptocurrency market, identifying its key participants and the mechanisms driving its volatility and dynamics. The third section is dedicated to an analysis of MicroStrategy's quarterly reports for 2023 to 2024. The final section presents the conclusions, which indicate that the company's aggressive acquisition strategy is associated with significant financial risk. The analysed data suggest that continued exposure to the highly volatile cryptocurrency market may lead to serious challenges for the firm, potentially undermining its long-term financial stability. Consequently, this may pose systemic risks to the broader cryptocurrency market, particularly by exerting substantial downward pressure on the supply side.

Keywords: cryptocurrencies, financial risk, MicroStrategy, Bitcoin

JEL classification: G32

Markets are never wrong, but opinions often are.
Jesse Livermore

Introduction

The cryptocurrency market, with Bitcoin (BTC) as the dominant player, is gaining significance as a modern form of investment and becoming a subject of interest for both individual and institutional investors. Its development, although

[1] On 5 February 2025, MicroStrategy rebranded itself as „Strategy" – a change intended to better reflect the company's innovative approach to Bitcoin investment. However, the former name is used in this article, as all reports referenced in the analysis originate from a period during which the original name was still in effect.

dynamic, is not without risks, especially considering its high volatility that presents a significant challenge for individuals and entities investing capital in this asset. This volatility arises from both the nature of the cryptocurrency market itself and from various external factors, such as legal regulations, changes in the perception of such investments, and macroeconomic decisions. In the context of the growing importance of cryptocurrencies in the financial system, the role of corporate investments is becoming increasingly visible, given their tangible impact on price formation and market dynamics. These actions not only attract media attention but also serve as an important starting point for further research into the impact of such investment strategies on the stability of the entire cryptocurrency market.

The goal of this article is to identify the impact of corporate investments in Bitcoin on the stability of the cryptocurrency market, with particular focus on the investment strategy of MicroStrategy. Through its decisions regarding large-scale Bitcoin purchases, this company has become one of the main examples of corporate investors in this asset, and its strategy serves as benchmark for other entities considering similar investments. The research question posed in this study is: "How will the sharp fluctuations in Bitcoin affect the financial stability of MicroStrategy?". The research methods used include financial analysis and market data analysis, which allow for examining the impact of Bitcoin's volatility on the company's financial performance, as well as assessing the risk associated with holding a large amount of this asset on the company's balance sheet. This analysis aims to identify potential dangers associated with concentrating investments in a single type of asset, especially in the context of their high volatility and low liquidity on exchanges.

This article aims not only to answer the research question but also to provide broader conclusions that may be useful in evaluating the risk associated with corporate investments in cryptocurrencies. Given the growing risk stemming from the high concentration of assets, it becomes crucial to understand how market volatility can affect the assumptions and outcomes of companies. The results of this research may contribute to a better understanding of the impact of corporate investments on the cryptocurrency market and serve as an important element in assessing potential threats to the stability of financial market in the era of digital assets.

1. Characteristics and operational mechanisms of Bitcoin

Bitcoin is the pioneering cryptocurrency that paved the way for the development of digital assets based on blockchain technology. The concept of a virtual currency was introduced in 2008 by an anonymous individual or group operating under the pseudonym Satoshi Nakamoto, and the network became operational in 2009 [Böhme et al., 2015, pp. 213–238]. Bitcoin was created as a decentralised

payment system, existing independently of traditional financial institutions. Its mechanism relies on a global network of computers that collectively process and validate transactions, thus eliminating the need for intermediaries in the exchange process.

Bitcoin's technology employs blockchain as the core of its system. This is a decentralised, transparent ledger in which every transaction is recorded within a structure of cryptographically linked blocks [Shi, 2016, pp. 1–8]. This architecture ensures data permanence and resistance to tampering. New blocks are added through a process known as mining, which involves solving complex mathematical problems by computers. This process is based on the Proof of Work (PoW) consensus algorithm, which requires substantial computational power and energy expenditure, thereby providing a high level of security for the entire network.

A unique feature of Bitcoin is its limited supply – only a maximum of 21 million units can be generated within the network. It is worth noting that not all the Bitcoins will ever be available on the market. Numerous wallets have been lost, and their owners lack the private keys necessary to access their capital. This makes Bitcoin a deflationary asset, setting it apart from traditional fiat currencies, which can be issued in unlimited quantities. Inexperienced investors often perceive Bitcoin as a form of "digital gold" a view reinforced by its limited supply. However, current observations suggest that Bitcoin not only retains its value over the long term; in fact, it has appreciated significantly.

The Bitcoin network utilises advanced cryptographic methods to protect data and ensure transaction security. The implementation of asymmetric cryptography enables users to sign transactions using a private key, while allowing others to verify them with a corresponding public key. Data integrity within the network is further reinforced by using the SHA-256 hashing function [Nakamoto, 2008, p. 3]. This function transforms any set of input data into a unique fixed-length string consisting of 64 characters. Even a minimal alteration in the input data, such as changing a single letter, results in a significant change in the output and the rejection of the block. This ensures the uniqueness of each hash.

SHA-256 is recognised for its high level of security due to the irreversibility of the process – it is impossible to reconstruct the original data from the hash [Nakamoto, 2008, p. 7]. Moreover, the SHA-256 function ensures that different inputs always generate distinct outputs, thereby safeguarding data integrity. Although hash generation is typically a rapid process, it can be significantly slowed down by congestion within the Bitcoin network. An increase in the volume of transactions intensifies competition among miners, who must solve increasingly complex computational problems. Additionally, the algorithm dynamically adjusts the mining difficulty to maintain the average block creation time at approximately 10 minutes.

Due to these characteristics, Bitcoin has not only revolutionised the perception of money but has also become the foundation for the development of blockchain technology and cryptocurrency systems worldwide.

2. The structure and operational mechanisms of the cryptocurrency market

The cryptocurrency market is a dynamically evolving financial domain that relies on digital assets utilizing blockchain technology to ensure the security and transparency of transactions. Within this market, there exists a wide array of tokens, with the most significant belonging to the category Layer 1 (L1), such as: Bitcoin, Ethereum, BNB, Solana, Tron, PulseChain, Toncoin and others. These projects differ in terms of their consensus mechanisms for instance, Bitcoin operates based on Proof of Work, whereas Ethereum and PulseChain rely on the Proof of Stake (PoS) [Sheikh et al., pp. 786–791].

Numerous applications, layers, and additional tokens are built on top of these networks, serving various functions within the broader cryptocurrency ecosystem. A notable example includes tokens from the DeFi (Decentralized Finance) sector, which offer users access to financial services such as lending, asset exchange, decentralised trading platforms, and staking mechanisms. Projects like Uniswap and MakerDAO enable users to actively participate in platform governance through voting rights, made possible by holding specific governance tokens.

In addition to projects with functional applications within the cryptocurrency space, there also exists a segment of more speculative assets, such as meme coins. As the name suggests, these typically emerge from jokes or popular internet trends. Their value is closely tied to speculation and community enthusiasm, and the tokens themselves lack practical utility beyond what is associated with their cultural context.

From a structural perspective, the cryptocurrency market occupies a space between perfect competition and monopoly. On the one hand, a feature of cryptocurrencies is the presence of numerous participants, which fosters competition across various segments of the market. On the other hand, Bitcoin holds a dominant position in terms of market capitalisation and exerts significant influence over the entire market, contributing to market asymmetry. Furthermore, certain areas, exhibit a concentration of power, which may give rise to quasi-monopolistic behaviour when a limited number of trading platforms dominate the market.

The cryptocurrency system relies largely on the stability and functioning of the US dollar, which stems from the dominance of stablecoins such as USDT (Tether), USDC (USD Coin – Coinbase exchanges), and DAI [Kołodziejczyk, Jarno, 2000,

pp. 155–170]. They are designed in such a way so that their value is pegged at a 1:1 ratio to the US dollar. As a result, they have gained popularity due to their capacity to minimise the risks associated with the high price volatility typical of cryptocurrencies.

The issuers of the aforementioned tokens regularly audit their reserves to verify the actual backing of assets corresponding to the value of the issued coins. Despite these procedures, this system remains susceptible to criticism and generates concerns related to potential risks. The uncertainty among potential buyers primarily revolves around the possibility of insufficient reserve coverage in extreme situations, such as a financial crisis, sudden capital outflows, or regulatory actions.

Moreover, the stability of the system is also contingent upon the health of the US economy, the monetary policy of the Federal Reserve, and the overall condition of the US dollar market. This interdependence renders cryptocurrencies, albeit indirectly, sensitive to these macroeconomic factors. Many analysts and market participants have noted that such a strong reliance on the dollar may become a significant challenge in the future, particularly in the context of regulatory shifts, such as the implementation of the Markets in Crypto-Assets (MiCA) regulation in 2025 (which governs the issuance of crypto-assets and the provision of related services within the EU), or in the event that evidence emerges of insufficient reserve backing by stablecoin issuers.

Crypto-assets highlight their dependence on the US dollar while introducing unique dynamics to the financial market. In this context, the cryptocurrency market exhibits a different response to various phases of the economic cycle. In traditional markets, changes stemming from the economic cycle, such as recessions, expansions, or modifications in monetary policy, have a predictable impact on asset prices. For instance, a period of economic slowdown typically results in a capital flow toward bonds or gold, which are considered safe havens [Iwaszczuk et al., 2021, p. 33]. In the case of cryptocurrencies, market reactions can be more complex and harder to predict. During periods of financial crisis, when trust in traditional institutions declines, Bitcoin is often perceived as an alternative asset with characteristics akin to digital gold. These narrative prompts retail investors to reallocate capital, driven largely by fear of financial loss. Such behaviour typically results in a surge in Bitcoin's valuation. A notable example of this phenomenon occurred during the COVID-19 pandemic, when a similar shift in investor sentiment was observed.

Despite the panic that prevailed in traditional financial markets during that period, substantial price increases were observed (Figure 1). One of the key drivers behind these upward movements is Bitcoin's built-in mechanism known as halving, which involves reducing the block reward for miners by half [Nakamoto, 2008, p. 3]. This event occurs approximately every four years and plays a crucial role in

shaping Bitcoin's supply dynamics [Burniske, Tatar, 2017, p. 32]. The reduction in mining rewards creates a scarcity of newly generated units, which often leads to an increase in Bitcoin's value, enhancing the appeal of this finite asset [Meynkhard, 2019, p. 72].

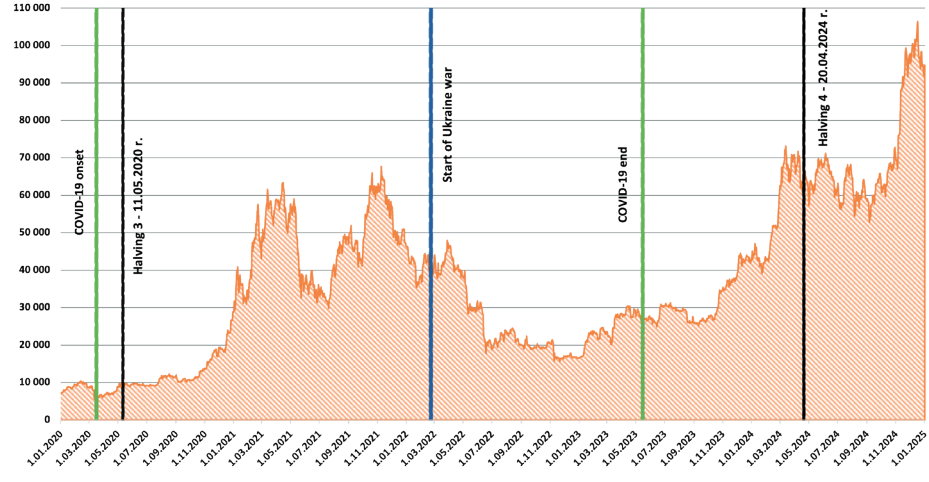

Figure 1. Bitcoin stock quotes
Sources: Own analysis based on Reuters data [Reuters, n.d.].

Historically, halvings have frequently triggered new bull cycles in the cryptocurrency market, further emphasizing their unique cyclicality compared to traditional financial markets [Zeng et al., 2020, pp. 209–220]. In this context, the phenomenon of asymmetric correlation has been observed, whereby the movements of major indices such as the S&P 500 exert a noticeable influence on Bitcoin's price dynamics. However, trend shifts within the cryptocurrency market tend to have only a marginal impact on stock market indices [Matkovskyy, Jalan, 2019, pp. 93–97]. A fundamental aspect of the idea that underpinned Satoshi Nakamoto's project is the absence of a central supervisory authority – a significant departure from traditional assets, which are subject to national and international regulatory frameworks. The blockchain technology at the core of the system enables peer-to-peer transactions without the need for intermediaries, thereby enhancing both transparency and the overall security of operations [Nakamoto, 2008, p. 2]. In parallel, there are privacy-focused projects such as Monero, which employ technologies like stealth addresses to enhance transactional anonymity [Van Saberhagen, 2013, p. 3]. The absence of regulation and central oversight entails not only benefits but also significant risks, such as vulnerability to extreme volatility, market manipulation, and fraudulent activity. Those risks are exemplified by projects that promise unrealistically high rates of return or excessive interest in staked assets, as well

as instances of misconduct and abuse (one notable example is the FTX exchange, which engaged in the misappropriation of client funds). In conventional financial systems, regulatory institutions have the capacity to implement stabilizing measures, although such actions have, at times, proven to be equally hazardous. The cryptocurrency ecosystem lacks comparable mechanisms, meaning that its dynamics are governed primarily by technological protocols and the fundamental principles of economics – supply and demand [Marwala et al., 2017, pp. 15–25].

3. MicroStrategy and BTC purchases

According to the latest report [MSTR, Q4, 2025], in the current fiscal year MicroStrategy (currently Strategy) is continuing its Bitcoin accumulation strategy. However, it is essential to closely examine the company's debt profile, both realised and projected earnings, as well as the maturity schedule of its outstanding debt instruments. The financial statements dated 30 October 2024 indicate that the company currently holds a total debt of USD 4.264 billion, with an average annual interest rate of 0.811%. The interest payments alone amount to USD 34.6 million [MSTR, Q3, 2024, pp. 4–5, 12, 15, 39–42]. In 2023, the company reported revenues of approximately USD 496.3 million; however, its expenses, excluding Bitcoin, amounted to roughly USD 611 million. In that period, MicroStrategy incurred a net loss of approximately USD 115 million, yet proceeded to acquire 56,650 BTC [MSTR, Q4, 2025, pp. 6, 10, 20, 45–48]. The company's performance in 2024 also remains subpar. Despite generating revenues of USD 469.7 million, MicroStrategy reported a record net loss of approximately USD 1.853 billion [MSTR, Q4, 2025, pp. 6, 10, 20, 45–48]. On the other hand, despite the aforementioned figures, the company acquired 258,320 BTC in 2024 at a total cost of USD 22.1 billion, corresponding to an average purchase price of USD 85,447 per Bitcoin. As a result, the total Bitcoin holdings of MicroStrategy have reached 471,107 BTC, acquired for a cumulative investment of USD 30.4 billion, at an average price of USD 64,511 per BTC [MSTR, Q4, 2025, pp. 6, 10, 20, 45–48]. It is immediately apparent that MicroStrategy's Bitcoin purchases in 2023 exceeded its annual revenues by more than threefold; and in 2024, nearly tenfold. However, the company's primary concern remains its indebtedness, which encompasses not only the interest payments but also the principal amounts on which those interests are calculated. An analysis of financial reports from the beginning of 2024–Q1_24 reveals that the maturity of the earliest debt instruments, issued in 2020, falls in December 2025, with a repayment obligation amounting to USD 650 million [MSTR, Q1, 2025, pp. 5, 12, 16, 27–30]. In turn, the Q2_24 report indicates that the liabilities have been paid [MSTR, Q2, 2024, pp. 4–5, 12, 15, 25–28], which raises a question: how did the company manage to secure

such a substantial amount of capital within a relatively short period, despite its poor financial performance? The answer lies in MicroStrategy's approach to issuing new shares to raise capital, which is then used to meet upcoming debt obligations.

In the short term, the company's strategy appears to be a brilliant plan. "Cheap" credit denominated in US dollars permits the acquisition of appreciating assets (Bitcoin) which are then followed by the repayment of debt through rising share prices rather than actual cash flows. However, over a four-year horizon, significant equity dilution occurs, as the issuance of new shares accelerates sharply (Figure 2).

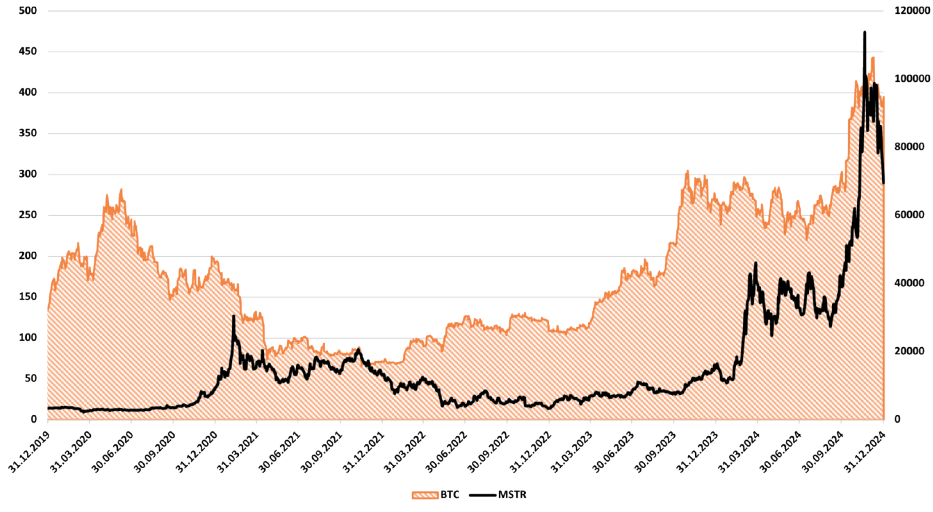

Figure 2. BTC quotes compared to MSTR (MicroStrategy's stock ticker)
Source: Own analysis based on Reuters data [Reuters, n.d.].

A continued upward trend can be observed (Table 1), driven by the company's ongoing accumulation of debt, which it also intends to repay using MSTR shares (MicroStrategy's stock ticker). It is important to note that while the company holds $30.4 billion in crypto assets, this represents unrealised gains, making the company appear profitable in theory [MSTR, Q1, 2025, pp. 5, 7, 12, 16, 27–30]. The diluted shares continue to appreciate as they are underpinned by the Bitcoin holdings, which remain in a bullish trend.

Table 1. MSTR report

Variable	6/30/2020	12/31/2020	12/31/2021	12/31/2022	3/31/2023	3/31/2024	6/30/2024	9/30/2024	12/31/2024	2/02/2025
Total Bitcoin Holdings	–	70,47	124,391	132,5	189,15	214,278	226,331	252,22	447,47	471,107
Shares Outstanding (in ,000s)										
Class A	76,51	76,23	93,22	95,85	149,041	156,83	171,03	182,995	226,138	237,191
Class B	20,35	19,64	19,64	19,64	19,64	19,64	19,64	19,64	19,64	19,64
Basic Shares Outstanding	96,86	95,87	112,86	115,49	168,681	176,47	190,67	202,635	245,778	256,831
2025 Convert Shares @ $39.80	–	16,33	16,33	16,33	16,33	16,33	3,659	–	–	–
2027 Convert Shares @ $143.25	–	–	7,33	7,33	7,33	7,33	7,33	7,33	7,33	2,883
2028 Convert Shares @ $183.19	–	–	–	–	–	–	5,513	5,513	5,513	5,513
2029 Convert Shares @ $672.40	–	–	–	–	–	–	4,462	4,462	4,462	4,462
2030 Convert Shares @ $149.77	–	–	–	–	5,342	5,342	5,342	5,342	5,342	5,342
2031 Convert Shares @ $232.72	–	–	–	–	2,594	2,594	2,594	2,594	2,594	2,594
2032 Convert Shares @ $204.33	–	–	–	–	–	–	3,915	3,915	3,915	3,845
Options Outstanding	14,81	11,57	11,67	15,77	12,936	7,03	5,916	5,678	4,956	4,956
RSU/PSU Unvested	–	740	1,05	1,2	2,359	2,57	2,244	2,034	1,845	1,807
Assumed Diluted Shares Outstanding	111,67	124,51	149,24	156,12	207,636	217,666	221,671	235,042	281,735	288,192
BTC Yield % (period-over–period)	**–**	**–**	**47.3%**	**1.8%**	**7.3%**	**8.1%**	**3.7%**	**5.1%**	**48.0%**	**2.9%**
BTC Yield % (YTD)	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**74.3%**	**2.9%**

Source: [MSTR, Q4, 2025].

4. Conclusions

An analysis of MicroStrategy's operations, led by its co-founder and Executive Chairman, Michael J. Saylor, reveals a strong correlation between the company's aggressive debt acquisition strategy and the prevailing trend in the Bitcoin market. This phenomenon is closely linked to the rising value of the company's stock, which in turn enhances its ability to secure further debt while maintaining favourable cost ratios. As a result, the debt incurred becomes less costly to maintain than the asset it is used to acquire. Within this framework, Bitcoin serves as the core of the company's investment strategy. However, such a strategy entails considerable risk, which answers the research question. In the event of a trend reversal in the cryptocurrency market, if Bitcoin's value were to decline, MicroStrategy's stock, which is largely underpinned by BTC, would probably follow the same downward trajectory. Consequently, the company may be forced to issue an increasing number of shares in order to meet its upcoming interest and principal obligations. This scenario causes a substantial dilution of existing equity, effectively flooding the market with new shares and further weakening the company's position. As these dynamics unfold, MicroStrategy may encounter growing difficulty in attracting new investors to purchase its stock. Michael J. Saylor's strategic decisions are fundamentally based on the assumption of sustained upward momentum in the Bitcoin market. However, every investor should recognise that such a dependency is inherently risky, as all markets experience bearish phases. Moreover, Bitcoin operates within recurring cycles influenced by its halving mechanism. If BTC enters a prolonged sideways trend or declines to lower levels, it could trigger a cascading drop in the value of MSTR shares, driven by an inverse correlation between the value of the underlying asset and the number of newly issued shares. In a critical scenario, where the company's financial stability and operational viability were to be threatened, it may be forced to liquidate part of its Bitcoin holdings. In accordance with the aim of the study, which was to identify the impact of corporate investments in Bitcoin on the stability of cryptocurrency market, it can be stated that the actions of such a large institutional player would likely deteriorate an already fragile market sentiment, intensifying the downward pressure on Bitcoin prices and further undermining the company's performance. Currently, a relatively small supply of BTC is available on cryptocurrency exchanges, meaning that even modest shifts in volume can significantly impact price volatility. Michael J. Saylor likens his strategy to that of real estate developers in historical Manhattan [Maldonado, 2024], an approach predicated on the assumption of continually rising property values, which allows for increasing leverage and sustained expansion. However, during times of crisis, such as the 2008 Global Financial Crisis, traditional markets were stabilised through government intervention. In contrast, a recession

in conventional markets could have a disproportionately severe impact on cryptocurrencies, which are still perceived by a large segment of inexperienced investors as a primarily speculative sector.

Ultimately, it will be the market that delivers the verdict, and time will reveal whether Michael J. Saylor is a visionary investment strategist or the architect of one of the most prominent cryptocurrency-driven financial pyramids.

References

Böhme R., Christin N., Edelman B., Moore T., 2015, *Bitcoin: Economics, technology, and governance*, Journal of economic Perspectives, no. 29(2).

Burniske C., Tatar J., 2017, *Cryptoassets: The innovative investor's guide to Bitcoin and beyond*, McGraw-Hill Companies, New York.

Iwaszczuk A., Yakubiv V., Baran J., 2021, *Popyt inwestycyjny na złoto w czasie kryzysu* [in:] *Decyzje menedżerskie w warunkach zmiennego otoczenia*, red. N. Iwaszczuk, Wydawnictwo AGH, Kraków.

Kołodziejczyk H., Jarno K., 2020, *Stablecoin – the stable cryptocurrency*, Studia BAS, no. 3.

Maldonado J., 2024, *Michael Saylor: Bitcoin może uratować USA przed długami i zrewolucjonizować gospodarkę*, https://news.bit2me.com/pl/bitcoin-puede-salvar-a-eeuu-de-la-deuda [access: 10.03.2025].

Marwala T., Hurwitz E., 2017, *Supply and demand* [in:] Marwala T., Hurwitz E., *Artificial Intelligence and Economic Theory: Skynet in the Market*, Springer Cham, New York.

Matkovskyy R., Jalan A., 2019, *From financial markets to Bitcoin markets: A fresh look at the contagion effect*, Finance Research Letters, no. 31.

Meynkhard A., 2019, *Fair market value of bitcoin: Halving effect*, Investment Management & Financial Innovations, no. 16(4).

MSTR, Q1, 2025, *Q1 2024 Financial Results*, https://assets.contentstack.io/v3/assets/bltf8d808d9b8cebd37/blt3a638719c547b2f8/6762ef7422d452540ca85d84/microstrategy-q1–2024-earnings-presentation.pdf [access: 6.03.2025].

MSTR, Q2, 2024, *Q2 2024 Financial Results*, https://assets.contentstack.io/v3/assets/bltf8d808d9b8cebd37/blt465ac41f58f1a76f/6762f0694e3eed505f4254bb/microstrategy-q2–2024-earnings-presentation.pdf [access: 6.03.2025].

MSTR, Q3, 2024, *Q3 2024 Financial Results*, https://assets.contentstack.io/v3/assets/bltf8d808d9b8cebd37/blt6e15a4e97ee52abe/6762f1a978b4023a82b28d3f/microstrategy-q3–2024-earnings-presentation.pdf [access: 6.03.2025].

MSTR, Q4, 2025, *Q4 2024 Financial Results*, https://assets.contentstack.io/v3/assets/bltf8d808d9b8cebd37/blt368a52561cca7449/67a6719e87c84dbb6c17c436/strategy-announces-fourth-quarter-2024-financial-results-presentation.pdf [access: 6.03.2025].

Nakamoto S., 2008, *Bitcoin: A Peer-to-Peer Electronic Cash System*, https://bitcoin.org/files/bitcoin-paper/bitcoin_pl.pdf [access: 10.02.2025].

Reuters, n.d., stock quotes for BTC and MSTR, https://www.reuters.com/markets/companies/MSTR.O/ [access: 17.02.2025].

Sheikh H., Azmathullah R.M., Rizwan F., 2018, *Proof-of-work vs proof-of-stake: a comparative analysis and an approach to blockchain consensus mechanism*, International Journal for Research in Applied Science & Engineering Technology, no. 6.

Shi N., 2016, *A new proof-of-work mechanism for bitcoin*, Financial Innovation, no. 2.

Van Saberhagen N., 2013, *CryptoNote v 2.0.*, https://www.getmonero.org/resources/research-lab/pubs/whitepaper_annotated.pdf [access: 28.02.2025].

Zeng T., Yang M., Shen Y., 2020, *Fancy Bitcoin and conventional financial assets: Measuring market integration based on connectedness networks*, Economic Modelling, no. 90.

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