

Volume 11 (2023)

ISSN: 2300-5947

No. 4

FORUM SCIENTIAE OECONOMIA



Wojciech Dyduch, Magdalena Dominiczewska, Jakub Kubiczek

Value Creation and Value Capture Revisited: Resource, Entrepreneurial
and Relational Perspectives

Artur Leśniak, Tomasz Surma, Katarzyna Szczepańska-Woszczyna, Krzysztof Zamasz

The Recent Development of High-Efficiency Cogeneration Units in Poland

Magdalena Szczyrba, Diána Pacsi

The Role of Serendipity in the Innovation Management Cycle

Aleksy Kwilinski, Rafal Rebilas, Dmytro Lazarenko, Nadiia Stezhko, Henryk Dzwigol

The Impact of the COVID-19 Pandemic on the Evolution of Investment Markets
in Central and Eastern Europe

FORUM
Scientiae Oeconomia

Editorial Board:

Ilan Alon, Prof. – University of Agder (Norway)
Armenia Androniceanu, Prof. – The Bucharest University of Economic Studies (Romania)
Michaela Bednarova, PhD – Pablo de Olavide University, Seville (Spain)
Joanne Bernstein, Prof. – Arts Marketing Insights (USA)
Piotr Białowolski, Prof. – Harvard University (USA)
Ryszard Borowiecki, Prof. – Cracow University of Economics (Poland)
Cagri Bulut, Prof. – Yasar University (Turkey)
Jorge Carneiro, Prof. – FGV São Paulo School of Business Administration (Brasil)
Daniele Cerrato, Prof. – Catholic University of the Sacred Heart in Milan (Italy)
Federica Codignola Bo, Prof. – University of Milano-Bicocca (Italy)
Andrzej Cwynar, Prof. – University of Economics and Innovation in Lublin (Poland)
Szymon Cyfert, Prof. – Poznan University of Economics (Poland)
Joanna Cygler, Prof. – Warsaw School of Economics (Poland)
Dan-Cristian Dabija, Prof. – Babes-Bolyai University Cluj-Napoca (Romania)
Desislava Dikova, Prof. – Vienna University of Economics and Business (Austria)
Vasile Dinu, Prof. – Bucharest University of Economic Studies (Romania)
Aistė Dovalienė, Prof. – Kaunas University of Technology (Lithuania)
Boris Durkech, Prof. – Armed Forces Academy of General Milan Rastislav Štefánik in Liptovský Mikuláš (Slovakia)
Ondřej Dvouletý, Prof. – University of Economics, Prague (Czech Republic)
Wojciech Dyduch, Prof. – University of Economics in Katowice (Poland)
Joanna Ejdys, Prof. – Białystok University of Technology (Poland)
Maria Elo, Prof. – University of Southern Denmark (Denmark)
Carlos Fernandes, Prof. – Polytechnic Institute of Viana do Castelo (Portugal)
Pantea Foroudi, Prof. – Middlesex University London (UK)
Juan J. García-Machado, Prof. – University of Huelva (Spain)
Fabio Garzia, Prof. – SAPIENZA – University of Rome (Italy)
Jolita Greblikaitė, Prof. – Vytautas Magnus University Agriculture Academy, Kaunas (Lithuania)
Philippe Gugler, Prof. – University of Fribourg (Switzerland)
Katarzyna Halicka, Prof. – Białystok University of Technology (Poland)
Kathryn Rudie Harrigan, Prof. – Columbia Business School (USA)
Vladimír Hladlovský, Prof. – Matej Bel University in Banská Bystrica (Slovakia)
Stefan Hittmar, Prof. – University of Zilina (Slovakia)
Günter Hofbauer, Prof. – Technical University Ingolstadt, THI Business School (Germany)
Shuichi Ishida, Prof. – Tohoku University, Sendai (Japan)
Adam Jabłoński, Prof. – WSB Universities (Poland)
Marek Jabłoński, Prof. – WSB Universities (Poland)
Alfredo Jimenez, Prof. – Kedge Business School, Bordeaux (France)
Svatopluk Kapouněk, Prof. – Mendel University, Brno (Czech Republic)
Anastasia A. Katou, Prof. – University of Macedonia, Thessaloniki (Greece)
Bilal Khalid, Prof. – King Mongkut's Institute of Technology Ladkrabang (Thailand)
Aleksandr Ključnikov, Prof. – University of Entrepreneurship and Law, Prague (Czech Republic)
Kim Lehman, Prof. – University of Tasmania (Australia)
Oscar Lopez de Foronda Perez, Prof. – University of Burgos (Spain)
Edit Lukacs, Prof. – „Dunarea de Jos” University of Galati (Romania)
Oleksii Lyulyov, Prof. – Sumy State University (Ukraine)

Jana Majerová, Prof. – University of Zilina (Slovakia)
Viera Marková, Prof. – Matej Bel University in Banská Bystrica (Slovakia)
Pedro A. Martín-Cervantes, Prof. – University of Almeria (Spain)
Ulrike Mayrhofer, Prof. – Université Côte d'Azur, IAE Nice – Graduate School of Management (France)
Ieva Meidute-Kavaliauskiene, Prof. – Vilnius Gediminas Technical University (Lithuania)
Nikolay Megits, Prof. – Webster University (USA)
Daniel Meyer, Prof. – University of Johannesburg (South Africa)
Navid Mollaei, PhD, MBA – Tehran Institute of Technology, Simia (Iran)
Juraj Nemec, Prof. – Masaryk University, Brno (Czech Republic)
Bogdan Nogalski, Prof. – University of Gdansk (Poland)
Judit Olah, Prof. – University of Debrecen (Hungary)
Maria Palazzo, Prof. – University of Salerno (Italy)
Marco Papa, Prof. – University of Bari (Italy)
Adrian Payne, Prof. – University of New South Wales (Australia)
Piotr Pikiewicz, PhD – WSB University (Poland)
Tetyana Pimonenko, Prof. – Sumy State University (Ukraine)
Barbara Piontek, Prof. – WSB University (Poland)
Michal Plaček, Prof. – Charles University, Prague (Czech Republic)
Jozsef Popp, Prof. – Szent Istvan University (Hungary)
Diego Francisco Quer Ramon, Prof. – University of Alicante (Spain)
Michael Radin, Prof. – Rochester Institute of Technology (USA)
Mladen Radišić, Prof. – University of Novi Sad (Serbia)
Matevž Raškovič, Prof. – Viktoria University of Wellington (New Zealand)
Nadine Roijakkers, Prof. – Open University in Heerlen (Netherlands)
Sorab Sadri, Prof. – JECRC University, Jaipur (India)
Rachel Shane, Prof. – University of Kentucky (USA)
Nestor Shpak, Prof. – Lviv Polytechnic National University (Ukraine)
Ligita Simanskiene, Prof. – Klaipeda University (Lithuania)
Viktorija Skvarciany, Prof. – Vilnius Gediminas Technical University (Lithuania)
Frantisek Sudzina, Prof. – Aalborg University (Denmark)
Jindřich Špička, Prof. – University of Economics, Prague (Czech Republic)
Adriana Roseli Wunsch Takahashi, Prof. – Federal University of Paraná (Brasil)
Vasyl Taras, Prof. – University of North Carolina at Greensboro (USA)
Didier Van Caillie, Prof. – HEC School of Management, University of Liege (Belgium)
María del Carmen Valls Martínez, Prof. – University of Almeria (Spain)
Olena Vinnychuk, Prof. – Chernivtsi National University (Ukraine)
Zuzana Virglerová, PhD – Tomas Bata University, Zlin (Czech Republic)
Ivona Vrdoljak Raguž, Prof. – University of Dubrovnik (Croatia)
Jolita Vveinhardt, Prof. – Lithuanian Sports University / Vytautas Magnus University (Lithuania)
Anna Wziątek-Staśko, Prof. – Jagiellonian University (Poland)
Jeoung Yul Lee, Prof. – Hongik University (South Korea)
Michal Zabolovsky, Prof. – University of Zilina (Slovakia)
Mirosław Zaborowski, Prof. – WSB University (Poland)
Peter Záborsky, Prof. – University of Auckland (New Zealand)
Dariusz Zarzecki, Prof. – University of Szczecin (Poland)
Hongjun Zhao, Prof. – Shanghai Normal University (China)
Jože Zupančič, Prof. – University of Maribor (Slovenia)

Editorial Team:

Editor-in-Chief

Karolina Mucha-Kuś, PhD – WSB University (Poland)

Managing Editor

Aleksy Kwilinski, Prof. – WSB University (Poland)

Deputy Editor in Chief

Katarzyna Szczepańska-Woszczyna, Prof. – WSB University (Poland)

Łukasz Wróblewski, Prof. – WSB University (Poland)

Marek Walancik, Prof. – WSB University (Poland)

Associate Editors

Marina Solesvik, Prof. – Western Norway University of Applied Sciences (Norway)

Associate Editor – Europe

Mike Szymanski, PhD – Moscow School of Management SKOLKOVO (Russia)

Associate Editor – South and Middle America

Kiminori Gamba, Prof. – Hosei University (Japan)

Associate Editor – Asia

Adnan ul Haque, Prof. – Yorkville University, Concord, Ontario (Canada)

Associate Editor – North America

Natanya Meyer, Prof. – University of Johannesburg (South Africa)

Associate Editor – Africa

Language Editors

Andrew Gillin, MA – WSB University (Poland)

Barbara Borkowska-Kępska, MA – WSB University (Poland)

Editor for Statistics

Katarzyna Dębkowska, PhD – Polish Economic Institute, Warsaw (Poland)

Secretary

Natalia Cubała, MA – WSB University (Poland)

Other Information:

Cover Design:

Wojciech Cigłło Studio DTP, www.dtp-studio.pl

Technical editor and typesetting:

Wojciech Cigłło Studio DTP, www.dtp-studio.pl

Printed by:

totem.com.pl

ISSN 2300-5947

The printed version of the journal **Security Forum** is the original one.

The electronic version of the journal is available as a copy of the original printed version.

Copyright © 2023 WSB University in Dąbrowa Górnicza. All Rights Reserved

Scientific Publishing of WSB University, Ciepłaka 1c, 41-300 Dąbrowa Górnicza, Poland

WSB University

FORUM

Scientiae Oeconomia

Vol. 11 (2023) • No. 4

Published by WSB University

Table of contents

1. Study on the Impact of Remote Working on the Satisfaction and Experience of IT Workers in Poland Edyta Bielińska-Dusza, Renato Lopes da Costa, Monika Hamerska, Agnieszka Żak	9
2. Economic Globalisation and Public Debt: What Implications does an Integrated South African Economy Hold for Fiscal Policymakers? Moitshepi Moeng, Jacques de Jongh	35
3. Value Creation and Value Capture Revisited: Resource, Entrepreneurial and Relational Perspectives Wojciech Dyduch, Magdalena Dominiczewska, Jakub Kubiczek	63
4. Driving the Image of an Electricity Supplier through Marketing Activities Dariusz Dąbrowski, Jakub Dąbrowski, Krzysztof Zamasz, Marcin Lis	83
5. Religious Values and Food Waste: A Comparative Study of Roman Catholic Believers and Non-Religious Individuals Jindřich Špička	99
6. The Recent Development of High-Efficiency Cogeneration Units in Poland Artur Leśniak, Tomasz Surma, Katarzyna Szczepańska-Woszczyńska, Krzysztof Zamasz	123

7. The Role of Serendipity in the Innovation Management Cycle	
Magdalena Szczyrba, Diána Pacsi	145
8. The Impact of the COVID-19 Pandemic on the Evolution of Investment Markets in Central and Eastern Europe	
Aleksy Kwilinski, Rafal Rebilas, Dmytro Lazarenko, Nadiia Stezhko, Henryk Dzwigol	157
9. The Long-run Response of Under-five Mortality to Corruption: Evidence from Nigeria	
Nurudeen Abu, Ben Obi, Onyewuchi Amaechi Ben-Obi	187
10. Brand Authenticity as the Basis for Creating Perceived Value in the Management of the Most Valuable Polish Brands	
Hanna Górską-Warsewicz	205

Study on the Impact of Remote Working on the Satisfaction and Experience of IT Workers in Poland

EDYTA BIELIŃSKA-DUSZA, RENATO LOPES DA COSTA,
MONIKA HAMERSKA, AGNIESZKA ŻAK

Abstract

The purpose of this study is to determine the level of employee satisfaction with the performance of tasks assigned by the employer in remote form, to explore the discrepancy between employee expectations and the experience of remote working and to identify the characteristics shaping employee preferences, together with an attempt to identify and classify the requirements of IT staff carrying out their professional duties remotely. Employee job satisfaction is a source of benefits both for the employees themselves and for companies operating in a dynamically changing environment. The issue of remote working is the subject of public debate and is a particularly current and important research topic. Satisfaction with remote working is a multidimensional phenomenon encompassing different aspects of the work experience, as well as a subjective experience that varies from person to person, considered in relation to a variety of factors. The paper is theoretical and methodological in nature, using a variety of research methods and techniques, such as a survey questionnaire, the Kano model and the Servqual approach. These methods were supported by a classical literature review, which served as a supporting tool and starting point for further analysis and critique of the literature, as well as structural and causal analysis. The primary data collected through the survey questionnaire were analysed and inferred, and the results showed that IT employees' expectations of remote working are not fully met, especially in the areas of career development and adaptation. Significant differences relate to bonuses, recognition and job stability. The largest unfulfilled expectations are related to job stability, bonuses, allowances to cover the costs of remote working and workplace flexibility. Remote working has positive aspects such as less environmental stress, higher productivity, reduced costs and commuting-related stress. Most of the identified features of remote working (20 out of 24) directly influence job satisfaction.

DOI: 10.23762/FSO_VOL11_N04_1

Edyta Bieleńska-Dusza

e-mail: bielins@uek.krakow.pl
Department of Strategic Analysis,
Institute of Management, College
of Management and Quality, Cracow
University of Economics, Poland

Renato Lopes da Costa

e-mail: Renato.Lopes.Costa@iscte-iul.pt
Department of Marketing, Operation and
Management, ISCTE Business School,
Instituto Universitário de Lisboa,
Portugal.

Monika Hamerska

e-mail: hamerskm@uek.krakow.pl

Agnieszka Żak

e-mail: zaka@uek.krakow.pl

Department of International
Management, Institute of Management,
College of Management and Quality,
Cracow University of Economics, Poland

Access to global projects attracts potential employees the most. Three features – subsidised equipment, coverage of remote working costs, and the environmental impact of remote working – are irrelevant to employee satisfaction. This study addresses a topical and relevant contemporary issue in the field of remote working and job satisfaction. It is a pioneering study focusing on the links between remote working and IT employee satisfaction. To date, research has considered the issue from the perspective of remote working, the IT sector or job satisfaction in relation to various factors. However, there is a lack of research combining these three issues. Furthermore, analysis based on the Servqual method and the Kano model has so far been used to measure service quality in various industries and to analyse and categorise customer needs in relation to satisfaction. The application of this tool to the study of employee satisfaction with remote working in the IT industry is a new and unique approach. The findings may be relevant to employers, IT employees, HR professionals and regulators alike.

Key words

remote working, personnel policy of the IT company, forms of work, employee satisfaction, information and communication technologies, remote working satisfaction factors, IT industry.

Introduction

As a result of the SARS-CoV-2 pandemic, many companies and industries have been forced to offer the possibility of working from home. Remote working has become commonplace and both companies and employees have discovered the benefits of this working model, particularly in the technology sector. As Abdulrahim and Yousif (2023) rightly point out, remote working, besides being one of the consequences of digital transformation, is also a new form of work that allows employees to work away from the company's premises. Therefore, understanding how employees adapt to remote working, what their experiences are and how these affect job satisfaction is crucial to both the further development and success of companies and the wellbeing of employees.

It is worth noting that research on remote working is complex and multifaceted, addressing a range of topics such as technologies and

tools used at work (Král et al., 2022; Wang et al., 2023; Pietruszka-Ortyl, 2020), work structure and organisational culture (Deschênes, 2023; Giauque et al., 2022; Shpak, et al., 2023), performance analysis (Kurdy et al., 2023; Hadasik and Kubiczek, 2022), and employee health, wellbeing and experience (Burr et al., 2022; Osoian and Petre, 2022; Sonnentag et al., 2023; Zampetakis, 2023). Undoubtedly, it can be crucial in terms of maintaining employability in times of change, allowing the company to function smoothly, and it depends on a wide variety of factors, shaping employee job satisfaction to varying degrees (Atobishi and Nosratabadi, 2023).

Investigating the issue of job satisfaction is important for several reasons. Firstly, it is closely linked to productivity. As research indicates, employees who are satisfied with their working conditions are more productive, engaged and motivated (Abdulrahim

and Yousif, 2023). Secondly, meeting employees' expectations influences their wellbeing and lowers turnover rates. Additionally, as J. Ma (2021) rightly points out, it is a form of distributed working that has become common practice and, importantly, is part of the future of work. Therefore, a study of employee satisfaction with remote working can be helpful in understanding this phenomenon and in indicating how companies should adapt their strategies and policies.

An analysis of the literature indicates the existence of studies on satisfaction with remote working (Golden and Gajendran, 2019). We can also note that the number of studies on remote working increased after the outbreak of the pandemic (Adekoya et al., 2022; Deschênes, 2023; Dolot, 2020; Irawanto et al., 2021; Stefanska et al., 2023; Wood et al., 2022; Xu et al., 2022). However, research on satisfaction with remote working is still limited and, as G. Xu and his team (2022), M. Grant (2021), and T. Golden and R. Gajendran (2019) emphasise, there is a need for further analysis, especially in relation to the IT industry.

The research gap identified from the analysis of the literature indicates a lack of research into the evaluation of satisfaction with remote working and expectations of IT employees in relation to Poland.

The article is structured in three parts. The first discusses the specifics of the IT industry, with a particular focus on current trends in the information technology sector. The second part focuses on presenting the essence of job satisfaction with an indication of the research results obtained to date. The final part presents the research methodology along with the results obtained. The research used an approach based on the Servqual method and the Kano model, which are not specific to remote working research, but are tools used in service quality and customer satisfaction research. However, it is worth emphasising that the incorporation of the methods used for customer satisfaction

research allows for a better understanding of employees' experiences of remote working. The results obtained can also be helpful in adapting remote working policies to employees' needs, by improving their experience and job satisfaction. Furthermore, the focus on remote working in the context of the IT industry and the application of the above approach is a novel contribution to the research literature.

1. Literature review

1.1. The IT industry in Poland

The development of information and communication technologies and the associated process of digitalisation of the economy and society is one of the most dynamic changes of modern times (Radomska, 2019). New digital technologies are spreading around the world much faster than the inventions of the industrial era (DeGusta, 2012). The ICT sector contributes to technological progress, increased production and productivity.

According to the OECD definition (2017), the term information and communication technologies (ICT), interchangeably referred to as information and telecommunication or information technology, refers to both the different types of communication networks and the technologies used therein. A narrower term is information technologies (IT). The IT sector is the industry related to information technology and related services, products and solutions. It encompasses a wide range of areas, such as the production of computer hardware, software and IT services. The development of these technologies makes the two concepts increasingly coherent, being an engine for civilisational, social and economic development (PARP, 2017).

The ICT sector brings together manufacturing and service industries whose products primarily perform or enable the function of information processing and communication by electronic means, including transmission

and display. Its impact can be studied in several ways: directly, through its contribution to production, employment or productivity growth, or indirectly, as a source of technological change affecting, for example, other parts of the economy and society (OECD, 2017). The COVID-19 pandemic has accelerated the digitalisation of many sectors of the economy and increased the demand for information technology, with a significant impact on the development of the IT industry. There are significant growth opportunities for companies in this industry, whether in software and application development or in areas related to artificial intelligence, data analytics, cyber security or robotics, education or entertainment (Baker Tilly TPA, 2023).

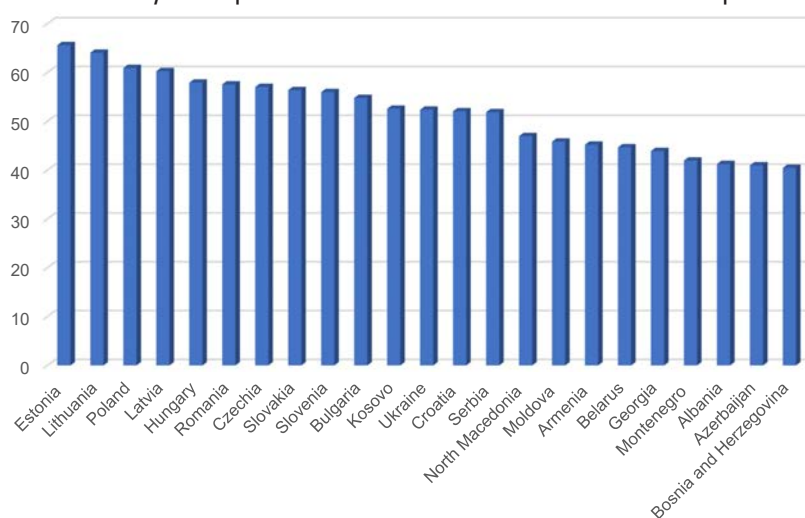
Information and communication technologies (ICT) are considered an integral part of modern society and play an important role in every field (Łada, 2021). ICT is developing very rapidly and is one of the most dynamic and innovative branches of the Polish economy.

The IT industry shows significant growth potential, promotes economic development and ensures international cooperation in

this field. Dynamic development, innovation and creativity are the fundamental characteristics of this industry (Kyrylych, 2018). The IT sector plays such a crucial role because it affects not only professional life, but every smallest part of private and everyday life, where it is visible at every turn and without which it would be difficult to imagine the functioning of the modern world (Ober, 2020).

Poland is considered the digital leader of Central and Eastern Europe (PAIH, 2021) and is one of the three most competitive markets (after Estonia and Lithuania, see Fig.1.) for the IT industry among the region's 23 markets (Emerging Europe, 2023). Research shows that there is a strong correlation between the development of the IT sector and economic growth, as measured by the sector's share of gross domestic product (Niebel, 2018). According to the Central Statistical Office, the IT sector in Poland accounted for approximately 7.4% of Polish GDP in 2020 (GUS, 2021) and currently accounts for approximately 8% (Baker Tilly TPA, 2023), demonstrating the growing role of the sector in the Polish economy.

Figure 1. IT industry – competitiveness of the Central and Eastern European markets



Source: own elaboration based on Emerging Europe (2023)

For Western companies (e.g. Microsoft, AWS and Google), an important advantage in choosing Poland over other countries is, among other things, the good education and preparation of Polish employees, including the growing number of students (50,000 in 2019 and 68,000 in 2021) and graduates (8,000 in 2019 and 13,000 in 2021) of

IT faculties or the high grades of students in PISA educational surveys (Emerging Europe, 2023). An additional advantage is Poland's 13th place among 100 countries in terms of English proficiency and other high positions in international rankings (EF, 2022), as shown in Table 1.

Table 1. Poland's position in international rankings (2021)

Index name (number of countries included)	Ranking
PISA Mathematics (78)	10
EF English Proficiency Index (111)	13
Human Development Index (190)	34
Social Progress Index (169)	39
Index of Economic Freedom (176)	40
Online Service Index (193)	43

Source: own elaboration based on Emerging Europe 2023

The Polish IT market (see Table 2) is highly diversified and fragmented (Baker Tilly TPA, 2023). IT companies account for 2.7% of all businesses operating in Poland. Although official statistics show almost

190,000 companies providing IT services, the employment figures do not reflect the actual situation, as it is common in this sector to employ experts, IT specialists and programmers on the basis of B2B contracts.

Table 2. Polish ICT in numbers (2021)

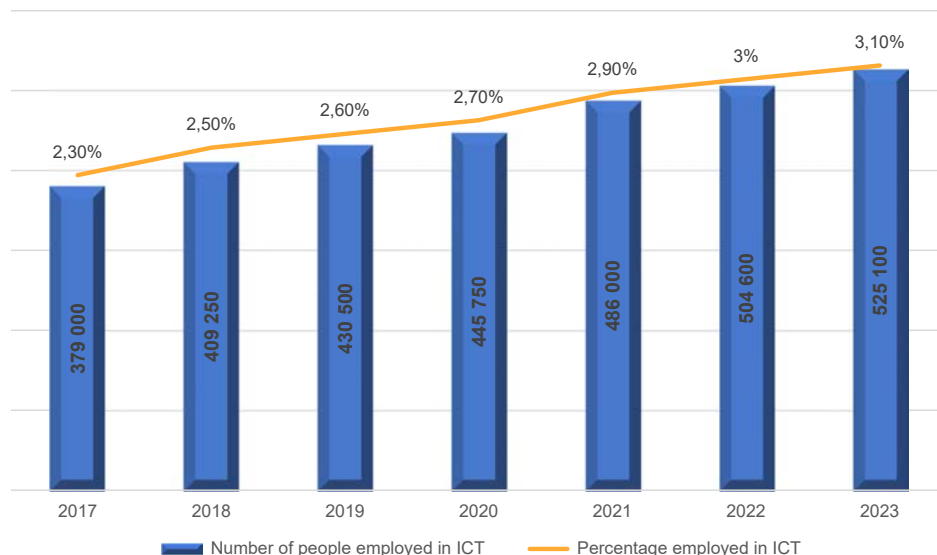
Companies	Over 100,000
employing 10 or more people	2500
introduced innovation	50%
offer ICT services	9 in 10
of which are IT services	$\frac{3}{4}$
revenues generated by the industry	EUR 46.5 billion
growth	12%
share in overall exports	7%
split between males and females in the IT sector	85% to 15%
proportion of ICT hardware manufacturers income generated through exports	2/3
number of students of IT faculties	68,000
number of graduates of IT faculties	13,000

Source: own elaboration based on The IT/ICT sector in Poland report 2023

The IT sector employs more than half a million people in Poland, whose average salary is 174% of the national average wage

(Emerging Europe, 2023). In total, approximately 3% of all working Poles are professionally connected with the IT sector (see Fig. 2).

Figure 2. ICT employment in Poland in 2017-23.



Source: own elaboration based on Emerging Europe (2023)

One of the biggest problems for the Polish IT industry is the insufficient number of specialists. Research by the Polish Economic Institute in 2022 shows that they currently account for around 3.5% per cent of all employees, which is one of the lowest figures in the EU. Another problem is the aforementioned differentiation of the Polish market – on the one hand, there are dynamically developing companies producing software for export and for multinational corporations, and on the other hand, companies operating on the domestic market. The former compete globally for projects and specialists and can offer very high remuneration rates, while the latter are digitalising slowly and have limited financial capabilities. In the medium to long term, this can be a hindrance to the country's development (Łukasik, Strzelecki, Śliwowski & Świącicki, 2022).

Currently, the Polish IT sector is exposed to a number of challenges, both global and

local, which shape the needs and expectations of companies, institutions and customer demand for new technologies (Baker Tilly TPA, 2023). Internal factors stem from the country's economic situation, such as increasing competition from other countries in the region, a lack of skilled labour, inflationary pressures or a lack of investment in research and development. External factors, on the other hand, are related to the slowdown in global digitalisation combined with downsizing of technology giants, cybersecurity, geopolitical destabilisation (such as the war in Ukraine or tensions between the West and China) or the emergence of commercial applications of artificial intelligence. These challenges require action at the political and business level to increase market competitiveness and accelerate the development of new technologies.

Technological advances represent, on the one hand, opportunities, benefits and

possibilities for development, but also new and increasing forms of risks (Wilson, 2020). These trends are widely reported in the literature (see, for example, Akundi et al., 2022; Chawla and Goyal, 2022; Dana, Salameh, Mortazavi, Hadizadeh and Zolfaghari, 2022; Leng et al., 2022; Taherdoost, 2023). As indicated by research (Antal, 2023), among the phenomena that will be of greatest importance in the information technology industry in a post-pandemic environment are cyber security (see, e.g. Alagheband, Mashatan and Zihayat, 2020; Kumar, Sharma, Vachhani and Yadav, 2022; Wilson, 2020), artificial intelligence (AI) and machine learning (see, e.g. Alimadadi et al., 2020; Das, Dey, Pal and Roy, 2015; Haefner, Wincent, Parida and Gassmann, 2021; Lu, 2019; Pfeifer and Iida, 2004; Zhang and Lu, 2021), remote working (see Antal, 2023; Prasad, Mangipudi, Vaidya and Muralidhar, 2020; Sokolic, 2022), cloud computing and edge computing (Bilal, Khalid, Erbad and Khan, 2018; Carvalho, Cabral, Pereira and Bernardino, 2021; De Donno, Tange and Dragoni, 2019), and Big Data and data science (see Frank, Dalenogare and Ayala, 2019; Gunasekaran et al., 2017; Hariri, Fredericks and Bowers, 2019; Himeur et al., 2023).

As indicated above, remote working is currently one of the main trends characteristic of the contemporary labour market in the post-pandemic period. The need for companies to adapt their operations to the sanitary and social requirements during the pandemic, the development of technology and the possibilities of working online have led to remote working contributing to the spread of this form of work.

The rapid increase in the number of employees working from home – in Poland, the percentage of people working in this way has almost doubled (Lewiatan Confederation, 2023) – forced the legislator to introduce clear regulations on the subject of remote working. This resulted in the enactment of legislation (Ustawa o zmianie Kodeksu

pracy) which introduced a separate chapter on remote working. According to Article 67, remote working may be performed wholly or partly at the place indicated by the employee and agreed with the employer in each case, including at the employee's home address, in particular by means of direct communication at a distance. The Labour Code provides for both total remote working and hybrid remote working (partly at home and partly at the company) according to the needs of the individual employee and the employer.

A 2022 survey of IT professionals and specialists from Poland, the Czech Republic, Slovakia and Hungary (No Fluff Jobs & Ringer Axel Springer, 2022) showed that after the pandemic, remote working was the preferred choice of the majority of those working in the technology sector. As many as 61% of industry professionals(s) worked fully remotely (five days a week). This rate was highest in Poland (close to 75%) and lowest in Hungary (45.5%), but was No. 1 on the list of possible work modes in every country (including the Czech Republic and Slovakia). A total of 96% of IT professionals and specialists want to work entirely remotely or in hybrid mode, with a majority of respondents (55.8%) from this group preferring fully remote work and 40% preferring to work in hybrid mode. The ability to work from home has become so important that for 56% of the CEE IT professionals surveyed, the lack of such a possibility would be reason enough to look for a new job (No Fluff Jobs & Ringer Axel Springer, 2022). These expectations of CEE IT employees coincide with the desires of Western workers (Owl Labs, 2021). Among the advantages of working remotely are improved wellbeing (as mentioned by more than 60% of respondents) and increased productivity compared to working at the office (57.7% of respondents). Respondents also highlighted that after switching to remote/hybrid working, they feel more freedom (61%) and have more time for themselves (42%); they also

enjoy not having to commute to the office (40%) and being able to work from anywhere (18.2%). Among the factors that occur infrequently or hardly at all that can be described as negative effects of remote working, the most frequently mentioned were more meetings than in a stationary job, working more hours, fatigue, physical ailments, poorer relationships with colleagues or feeling neglected at work (No Fluff Jobs & Ringer Axel Springer, 2022).

1.2. The problem of remote working satisfaction research in the literature

The concept of satisfaction is a complex term that can be considered from different perspectives and with respect to a variety of determining factors. One of the most widely recognised and quoted definitions was proposed by E. A. Locke (1976), who was one of the first to study the problem of job satisfaction, which is a positive or pleasant emotional state resulting from an evaluation of one's job or work experience. Moreover, it represents a complex construct, encompassing various aspects of work such as pay, working conditions, opportunities for advancement, relationships with colleagues and management, and a sense of personal and professional fulfilment (McFarlin and Rice, 1991).

We can see that this concept is not just a single emotional state or level of satisfaction, but a multidimensional phenomenon encompassing different aspects of work experience. It represents a subjective experience that can vary between individuals even working under the same conditions.

In contrast, the provision of remote working can have different aspects (Barriga Medina et al., 2021; Caillier, 2012; Cooper and Kurland, 2002; Deschênes, 2023; Gajendran and Harrison, 2007; Ingusci et al., 2023; Raghuram et al., 2001; Szczepanski and Zamêcki, 2021; van Zoonen et al., 2021) affecting both work motivation and work satisfaction.

It is also worth noting that employee satisfaction in the IT industry can be shaped by industry-specific factors (Al-Shammari, 2021), such as access to the latest technology, continuous learning opportunities, continuous availability requirements, time pressure to complete projects, flexibility, not having to commute to the office, or work-life balance, psychological empowerment and support from superiors (W. E. Nwagwu, 2020; Lee et al., 2018; Vennila and Vivekanandan, 2017; Kowal and Roztock, 2015b; Kowal and Roztock, 2015a; Bordin et al., 2006; Lumley et al., 2011; Yousef, 2017). Moreover, in the IT industry, where remote work is often the norm, employee expectations may be higher than in other sectors (W. Nwagwu, 2019). These may include, for example, access to high-quality hardware and software, or mental health support (Lee et al., 2018; Vennila and Vivekanandan, 2017).

A critical analysis of the literature on the subject, the experiences of researchers, and the proposal of a typology of factors influencing employees' adaptation to remote working (van Zoonen et al., 2021) formed the basis for distinguishing six dimensions (career development factors, adaptation factors, productivity factors, sustainability factors, relational factors, and structural factors) and 24 characteristics (opportunity for promotion, pay rise, opportunity for personal development, job stability, bonuses/recognition, working with modern technologies, allowance to cover remote working costs, equipment subsidy, flexibility of time and place of work, work productivity, reduced environmental impact, reduced commuting costs, reduced commuting stress, wellbeing, reduced contact with employees, communication with colleagues, communication with superiors, support from employer, clearly defined tasks, clearly defined policies and procedures, autonomy of work, no geographical restrictions, and access to global projects) that may affect employee satisfaction with remote working.

The two dimensions – structural and relational – partly overlap with the factors proposed by the researchers (Raghuram et al., 2001; van Zoonen et al., 2021), but given the context of the remote working satisfaction study, they were extended to include additional characteristics relevant to this problem.

Professional development factors refer to aspects conducive to career advancement, the acquisition of new competences and personal development, improvement of professional position and prestige, obtaining bonuses, recognition, and employment stability. The issue is important not only in the context of remote working (Stroińska, 2008; Ślęzak, 2012; Wyrwicka and Trziszka, 2019), but also in terms of job satisfaction. It seems that in the long term, these factors may influence levels of satisfaction with remote working through the possibility of employees holding higher-level positions, job security, lack of fear of losing their jobs, as well as recognition and positive evaluation from superiors and colleagues. In one study, however, researcher M. Charalampous and her team (2018) indicate that remote working can be a threat to career advancement.

Adaptation factors refer to elements that facilitate employee adaptation to new working conditions. In the context of remote working, especially in the IT industry, adaptive factors may include working with modern technologies (Battisti et al., 2022) that allow tasks to be performed effectively, provided, among other things, that they function efficiently (Åborg et al., 2002). These technologies may include the use of various tools not only for communication and collaboration, but also industry- or job-specific technologies. It is noteworthy that both the opportunity to work with new technologies and the support of the employer (Atobishi and Nosratabadi, 2023) can be a factor in increasing job satisfaction in the long term. It is important to emphasise that working from home may involve additional costs for

employees (Battisti et al., 2022) (payment for electricity, additional computer equipment, reliable internet connection, access to necessary software, or maintenance of the home office), and the lack of employer support may contribute to stress (Battisti et al., 2022; Molino et al., 2020), reduced work comfort, dissatisfaction, frustration and, consequently, lower satisfaction.

Factors related to productivity, or the performance of employees when working remotely, are a group of determinants that have enjoyed continued popularity among both researchers (Kurdy et al., 2023) and practitioners. This is because there is a correlation between job satisfaction and productivity (Abdulrahim and Yousif, 2023), with job satisfaction contributing to better performance and higher efficiency (Stefanska et al., 2023).

In the context of remote working, this factor is particularly relevant, as the rules associated with office work often do not apply or are modified. This includes work flexibility, whereby employees have the opportunity to manage their own working hours, as well as where they work (Charalampous et al., 2018). The freedom to design working hours gives the employee the chance to adjust their working hours, personal commitments, or daily rhythm, although, as C. Åborg and her team (2002) point out, long hours at a computer pose health risks. Additionally, the employee has a choice of work location, which can include working from home, coworking spaces, or working from any location with internet access. As S. Poulsen and K. Ipsen's (2017) research indicates, remote working is professionally challenging – because employees feel they have influence over their work – and fosters increased self-perceived productivity (Ali et al., 2023). Flexible working influences productivity, as employees choose times and places to work that are more comfortable and stimulating for them, as well as increasing their level of job satisfaction (Djoemadi et al., 2019). This, in turn,

influences the amount and quality of work an employee does in a given period of time. Additionally, as A. Ali and his team (2023) point out, employees who work remotely have a higher sense of self-efficacy, greater job satisfaction and are likely to have better personal wellbeing compared to others.

Sustainability factors refer to the assumptions of a sustainable economy and society, as well as to the wellbeing of employees. The concept of sustainable development is not only about protecting the environment, but also about promoting the health and wellbeing of people together with skilfully combining sustainable economic development with the wellbeing of society (Bielinska-Dusza et al., 2021). Employee wellbeing, in addition to being one of the key elements of sustainable development (European Commission, 2019), is an important research issue in relation to remote working (Atobishi and Nosratabadi, 2023; Charalampous et al., 2018; Juchnowicz and Kinowska, 2022; Park et al., 2021), as well as employee satisfaction (Ali et al., 2023), which has contributed to expanding the catalogue of moderating factors to include this dimension. Remote working reduces the need to commute to the company's headquarters resulting in lower commuting costs (fuel, public transport tickets, vehicle maintenance and depreciation), greater environmental care (lower fuel consumption, lower greenhouse gas emissions), time savings or work-life balance (Grant, 2021), and a lower degree of work-family conflict (Gajendran and Harrison, 2007; Molino et al., 2020). Moreover, commuting to the workplace often involves delays caused by traffic jams. This is a source of stress for employees, causes deterioration in their wellbeing, and reduces the time available for leisure activities and hobbies, reducing job and life satisfaction. It should also be noted, however, that remote working can lead to a blurring of the boundaries between one's work and private life (Buła et al., 2022).

Relational factors affect the interactions and relationships between employees. In the context of remote working, these include limiting contact with employees, communication with colleagues and supervisors, and support from employers. Remote working can limit direct interpersonal contact, information exchange and relationship building. It can have both a positive (Gajendran and Harrison, 2007) and negative (Poulsen and Ipsen, 2017) impact and, as A. Deschênes (2023) highlighted, it can lead to a sense of isolation (Åborg et al., 2002; Battisti et al., 2022) negatively affecting satisfaction with the remote working experience. Interestingly, research by T. Atobishi and S. Nosratabadi (2023) showed that limited communication is an effective factor in causing a decrease in employee satisfaction with remote working.

Undoubtedly, working remotely requires more organised and purposeful communication, translating into quality collaboration and team coordination (Åborg et al., 2002). Moreover, for communication with superiors to be effective and increase job satisfaction, it requires extra attention and clear instructions. Employer support improves task performance, which consequently increases task satisfaction. Additionally, it is worth noting the issue of training in new tools and technologies (Åborg et al., 2002), which can be crucial to maintaining job satisfaction when working remotely.

Structural factors refer to the organisational conditions of work, related to the definition of tasks, responsibilities and work rules, autonomy and geographic conditions, among others. Research shows that planning and clearly defined tasks and working conditions, affiliations, delegation of authority to employees (Poulsen and Ipsen, 2017) or job descriptions contribute to employees' confidence in performing remote work (van Zoonen et al., 2021) and facilitate better job performance, which can result in greater satisfaction (Grant, 2021). In contrast, unclear or undefined tasks can lead to frustration,

inefficiency and dissatisfaction. Because remote working provides the opportunity to work from anywhere in the world, it eliminates geographic limitations (Poulsen and Ipsen, 2017) and gives employees access to global projects. In addition, it allows for a sense of greater autonomy (Gajendran and Harrison, 2007), one of the key factors in job satisfaction. This can be particularly attractive to individuals who value flexibility, acquiring new competencies and working in global markets that allow them to work in different cultural contexts.

2. Methodology

The subject of the study was the evaluation of remote working performed by people employed in IT departments. The purpose of the study was to determine the level of employee satisfaction with the performance of tasks assigned by the employer in remote form, and to examine the discrepancy between the expectations of employees and the level of remote working performance they experienced. The authors also attempted to identify and classify the requirements of IT employees performing their job duties remotely.

In order to achieve the research objective thus set, an approach based on the Servqual method and the Kano model was used. The analysis was carried out according to the following stages:

Stage 1 – Determination of factors that affect remote working satisfaction of IT department employees.

Stage 2 – Preparation of a questionnaire examining the discrepancy between employees' expectations and the experience they have gained from working remotely.

Stage 3 – Identifying the discrepancy between employees' expectations of remote working and their experience based on the approach used in the Servqual method.

Stage 4 – Identification of characteristics shaping employee preferences using the Kano model.

The survey was distributed through social networks. The survey included 113 respondents who are employees of IT departments and perform their work remotely. The demographic and social structure of the respondents is shown in Table 3.

Table 3. Sociodemographic structure of respondents

Factor	Group	Share
Gender	Female	51%
	Male	49%
Age	Under 23 years of age	8%
	24–43	83%
	44–58	9%
	Less than one year	8%
Seniority	1–2 years	16%
	2–3 years	11%
	3–5 years	14%
	5–10 years	24%
	Over 10 years	27%

Factor	Group	Share
Number of days working remotely	1 day per week	3%
	2 days per week	10%
	3 days per week	11%
	4 days per week	7%
	5 days per week	69%

Source: own elaboration

In order to determine the gap between the level of satisfaction of employees with the performance of tasks assigned by the employer in remote form, an approach based on the Servqual method was used.

For this purpose, on the basis of a critical analysis of the literature on the subject, the

characteristics affecting the level of employee satisfaction with work performed remotely were identified and defined, and assigned to the six dimensions defined by the authors of the publication. Table 4 shows a summary of the characteristics categorised in six dimensions.

Table 4. Summary of the characteristics affecting the level of satisfaction with remote working among IT department employees

Dimension	Features
Professional development factors	Promotion opportunity
	Raise
	Opportunity for personal development
	Job stability
	Bonuses/recognition
Adaptation factors	Working with modern technology
	Allowance to cover the costs of remote working (electricity, etc.)
	Equipment subsidy
Productivity/performance factors	Flexibility of working hours
	Workplace flexibility
	Work productivity
Sustainability factors	Less burden on the environment
	Reduction in commuting costs
	Reduction of commuting stress
	Wellbeing
Relational factors	Reduction of contact with employees
	Communication with co-workers
	Communication with superiors
	Support from the employer

Dimension	Features
Structural factors	Structural factors
	Clearly defined tasks
	Clearly defined policies and procedures
	Autonomy of work
	No geographical restrictions
	Access to global projects

Source: own elaboration

On the basis of the characteristics shown in Table 2, a questionnaire was created in which respondents assessed, on the one hand, their expectations of remote working,

and, on the other hand, their experience with the form of work analysed. An example of the structure of the questions in the questionnaire is shown in Table 5.

Table 5. Example of questions from a questionnaire assessing the difference between expectations and experience of IT staff in terms of remote working

Questions	Response options
Remote working should enable promotion	1 – I strongly disagree 2 – I somewhat disagree 3 – I have no opinion 4 – I somewhat agree 5 – I strongly agree
Remote working allows me to advance	1 – I strongly disagree 2 – I somewhat disagree 3 – I have no opinion 4 – I somewhat agree 5 – I strongly agree

Source: own elaboration

In order to determine the discrepancy between respondents' expectations and their experience, the analysis was carried out using the Servqual approach according to the following steps:

1. Based on the average opinion of respondents for each characteristic, which are shown in Table 2, the expected and experienced levels from the remote working evaluation were determined.
2. The average score for the expected and experienced level from remote working within each dimension was calculated.

3. The gap between the experienced and expected evaluation of remote working of IT employees was calculated.

The Kano model approach was used to identify and classify the requirements of IT employees performing their job duties remotely. For this purpose, the characteristics used were those shown in Table 2. The research procedure was carried out according to the following steps:

1. Development of the KANO questionnaire;
2. Conducting surveys;
3. Determining the type of features;
4. Analysis of the results.

Table 6 shows an example of a question posed in the survey questionnaire

Table 6. Example of a question from the questionnaire assessing which characteristics influence the preference of IT employees for remote working

Questions	Response options
Remote working should enable personal development	1 – It suits me 2 – It must be so 3 – I am indifferent to it 4 – I can come to terms with it 5 – It does not suit me
How would you feel if remote working did not enable personal development?	1 – It suits me 2 – It must be so 3 – I am indifferent to it 4 – I can come to terms with it 5 – It does not suit me

Source: own study

A questionnaire based on the Kano approach formed the basis for the survey. Based on the respondents’ opinions, one of the following types was assigned to each feature:

- 1. mandatory, basic features (must have – M),
- 2. one-dimensional, functional traits (one-dimensional or more is better – O),
- 3. attractive, delightful, superlative traits, so-called lures (attractive – A),
- 4. indifferent traits, so-called without difference (indifferent – I),
- 5. questionable traits (questionable – Q),
- 6. opposite traits (reverse – R)

Based on the defined groups, the type of trait was determined by the following procedure (Malinowska et al., 2014):

- if $(A+M+O) > (R+Q+I)$, the trait takes a category from group A, M, O, with the highest value;
- if $(A+M+O) < (R+Q+I)$, the feature takes a category from the group R, Q, I, with the highest value.

In the final stage of the study, the results were analysed.

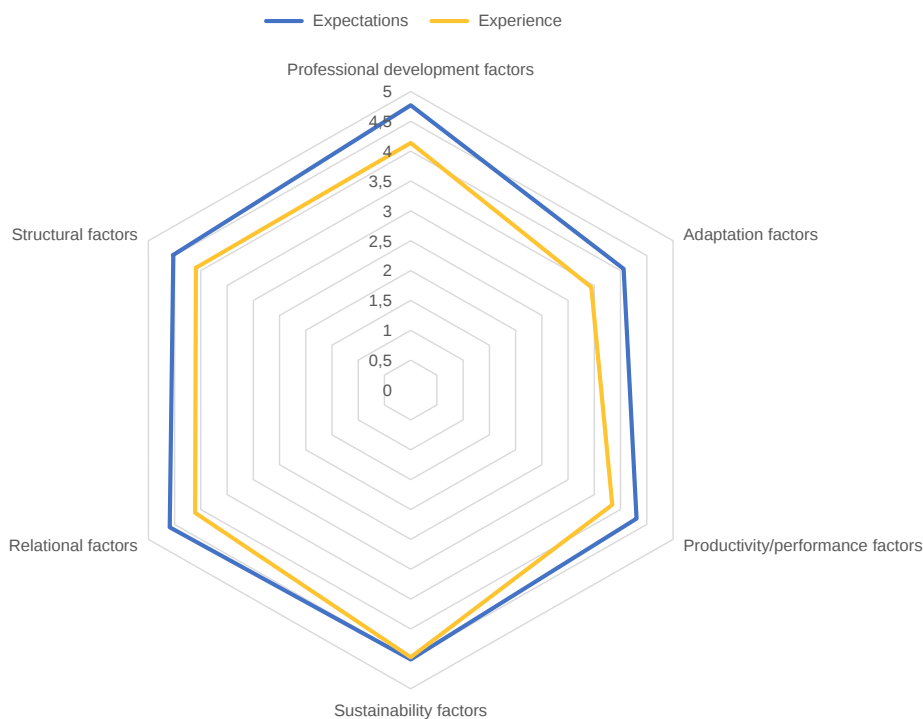
3. Research results

In the first stage of the analyses, the discrepancies between employees’ expectations of remote working and their experience were determined. To achieve such a goal, an approach based on the Servqual method was used. The authors identified the following dimensions that affect IT employees’ satisfaction with remote working, and within the dimensions they identified the following groups of factors:

- 1. professional development factors;
- 2. adaptation factors;
- 3. productivity/performance factors;
- 4. sustainability factors;
- 5. relational factors;
- 6. structural factors.

Within the indicated groups of factors, the employees’ expectations of working remotely and the evaluation related to experience are presented. The results of the analyses are shown in Figure 3.

Figure 3. Expectation and experience-related assessment of remote working of employees of IT departments



Source: own elaboration

Employees' expectations about remote working were not met, which means the presence of a negative gap for each of the analysed dimensions, i.e. the difference between the experienced and expected evaluation. The largest gap relates to the dimension related to personal development and adaptation factors. The gap for this dimension is -0.63 and -0.62, respectively. The smallest gap was indicated for the dimension related to sustainability factors (-0.04).

Analysing the factors that were identified in the area of personal development, the largest gaps between experienced and expected ratings are related to bonuses and employer recognition (-0.77) and job stability (-0.72). Within this dimension, the factor related to opportunities for personal development was rated best (-0.40).

Looking at individual factors, it should be noted that within the framework of the analyses conducted, it is possible to identify those in which the experienced rating exceeded the expected rating or was at the same level. These factors include:

1. a smaller burden on the environment (-0.21)
2. labour productivity (-0.04)
3. reduction of commuting costs (-0.02)
4. reduction of commuting stress (0.00)

On the other hand, the factors with the largest gap, meaning that expectations far exceeded the experience of IT employees, are as follows:

1. job stability (-0.72)
2. bonuses/recognition (-0.77)
3. allowance to cover the costs of remote working (electricity, etc.) (-0.77)
4. workplace flexibility (-0.96)

The detailed results of the analyses are shown in Table 7.

Table 7. Evaluation between experienced and expected value for each dimension and factor

Dimension	Features	Gap – factor	Gap – di- mension
Professional development factors	Promotion opportunity	-0.65	-0.63
	Raise	-0.62	
	Opportunity for personal development	-0.40	
	Job stability	-0.72	
	Bonuses/recognition	-0.77	
Adaptation factors	Working with modern technology	-0.52	-0.62
	Allowance to cover the costs of remote working (electricity, etc.)	-0.77	
	Equipment subsidy	-0.56	
Productivity/performance factors	Flexibility of working hours	-0.46	-0.46
	Workplace flexibility	-0.96	
	Work productivity	0.04	
Sustainability factors	Smaller burden on the environment	0.21	-0.04
	Reduction in commuting costs	0.02	
	Reduction of commuting stress	0.00	
	Wellbeing	-0.37	
Relational factors	Reduction of contact with employees	-0.58	-0.48
	Communication with co-workers	-0.50	
	Communication with superiors	-0.42	
	Support from the employer	-0.43	
Structural factors	Structural factors / Clearly defined tasks	-0.58	-0.43
	Clearly defined policies and procedures	-0.61	
	Autonomy of work	-0.03	
	No geographical restrictions	-0.42	
	Access to global projects	-0.53	

Source: own study

The next step of the analysis was to identify the characteristics that shape the preferences of IT employees working remotely. For this purpose, an approach based on the

Kano model was used. The results for the Kano method are shown in Figure 2, where the vertical axis represents satisfaction <0, 1> and the horizontal axis represents

dissatisfaction <-1, 0> with remote working. The numbers shown in Figure 4 refer to the characteristics studied. The traits and corresponding numbers are shown in Table 8.

Figure 4. Satisfaction and dissatisfaction according to the Kano model

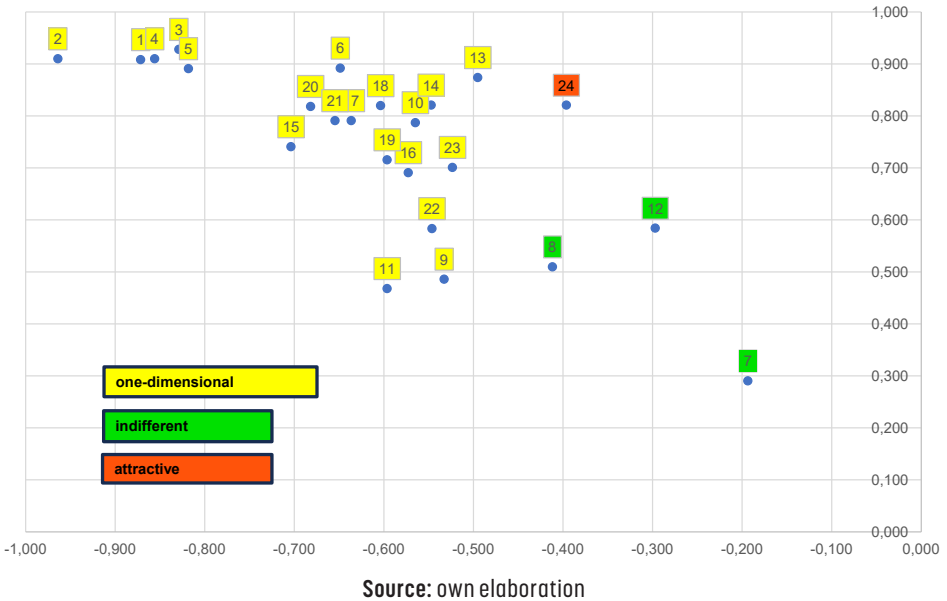


Table 8. Summary of analysis results

Dimension	No	Features	Kano model	Gap - factor	Gap - di- mension
Professional development factors	1	Promotion opportunity	0	-0.65	-0.63
	2	Raise	0	-0.62	
	3	Opportunity for personal development	0	-0.40	
	4	Job stability	0	-0.72	
	5	Bonuses/recognition	0	-0.77	
Adaptation factors	6	Working with modern technology	0	-0.52	-0.62
	7	Allowance to cover costs of remote working (electricity, etc.)	I	-0.77	
	8	Equipment subsidy	I	-0.56	
Productivity/ performance factors	9	Flexibility of working hours	0	-0.46	-0.46
	10	Workplace flexibility	0	-0.96	
	11	Work productivity	0	0.04	

Dimension	No	Features	Kano model	Gap – factor	Gap – dimension
Sustainability factors	12	Smaller burden on the environment	I	0.21	-0.04
	13	Reduction in commuting costs	0	0.02	
	14	Reduction of commuting stress	0	0.00	
	15	Wellbeing	0	-0.37	
Relational factors	16	Reduction of contact with employees	0	-0.58	-0.48
	17	Communication with co-workers	0	-0.50	
	18	Communication with superiors	0	-0.42	
	19	Support from the employer	0	-0.43	
Structural factors	20	Structural factors / Clearly defined tasks	0	-0.58	-0.43
	21	Clearly defined policies and procedures	0	-0.61	
	22	Autonomy of work	0	-0.03	
	23	No geographical restrictions	0	-0.42	
	24	Access to global projects	A	-0.53	

Source: own study

The most numerous category in terms of the number of features is the group of one-dimensional features (O). As many as 20 of the 24 features were assigned to this category. This is a group of features to which one should pay close attention and observe the activities of other employers in this area. Only one trait, access to global projects, was assigned to the category of attractive traits (A), which can be a so-called “lure” for potential employees. It should be pointed out that employees showed a gap within this trait (-0.53). On the other hand, three out of 24 factors were grouped as indifferent (I) traits. The traits related to equipment subsidies and costs associated with remote working have fairly high gaps, -0.56 and -0.77, respectively. On the other hand, within the indifferent traits, the factor related to the assessment of the impact of remote working on the environmental burden was rated higher by respondents than employees’ expectations in this regard.

Conclusions

The purpose of this research was to investigate the level of employee satisfaction with the performance of tasks assigned by the employer in remote form, and to examine the discrepancy between employee expectations and the level of performance of remote working. Our study attempted to analyse the discrepancy between employee expectations and the experience of remote working, and sought to identify the characteristics that shape employee preferences, along with an attempt to identify and classify the requirements of IT employees working remotely.

Performing job duties using ICT without the need to be physically present in the office affects both the experience and satisfaction of employees. This satisfaction, as a multidimensional and complex concept, can be studied through areas classified in six dimensions according to 24 characteristics. The results of our research show that we can

identify areas in which employees' expectations of remote working are inadequately met and employers should take appropriate steps to meet these expectations and increase employee satisfaction. In addition:

- IT employees' expectations in the context of remote working were not fully met, resulting in a negative gap for each of the six dimensions (career development factors, adaptive factors, productivity factors, sustainability factors, relational factors, and structural factors). This shows the gap between the employees' assessment of expectations and experiences;
- the largest gap is found in the dimensions of personal development and adaptive factors. The most noticeable differences in these areas relate to bonuses and recognition from the employer, as well as employment stability;
- the factors for which expectations significantly exceeded employees' actual experiences are related to employment stability, bonuses and recognition from the employer, an allowance covering the costs of remote working (e.g. electricity) and workplace flexibility;
- the positive effect of remote working has been recognised in relation to factors such as reduced environmental impact, productivity, reduced commuting costs and reduced commuting stress;
- the Kano model approach indicated that most of the characteristics we studied (as many as 20 out of 24) can be categorised as one-dimensional characteristics that have a direct impact on job satisfaction. For example, a raise or opportunity for promotion may be one example of such a trait, and implies that the greater the opportunity for a raise or promotion, the greater the employee's satisfaction. It is therefore important for organisations to focus on these one-dimensional traits while keeping an eye on competitors' activities in this area;

- only one attribute, access to global projects, was classified as an attribute of attractiveness, with the ability to attract potential employees to work there;
- three attributes related to subsidising equipment, covering the costs resulting from remote working, and the impact of remote working on environmental load, were classified as indifferent. In our case, the presence or absence of these features has no significant impact on employees' overall satisfaction with remote working.

It should also be noted that the results obtained are not free of limitations. One of these is the research sample. Our study included a sample of 113 employees providing remote working in a sample that is not representative of the entire population of employees working in the IT sector in Poland. In addition, as M. Stefanska and her team (2023) emphasise, for each subjective category, the level of satisfaction of individual employees may be shaped by different factors, and the level of perceived satisfaction may be different for each employee. In addition, in order to confirm the universality of the approach presented and the methods used, it would be necessary to repeat the study on a representative sample or in other industries. Future analyses could also be expanded to include additional aspects that were not included in our study.

The results of the study can be useful in a variety of ways. By bridging the research gap and providing insights into the impact of remote working on the experience and satisfaction levels of employees with remote working in the IT industry, they can inspire further in-depth research and analysis. Also, employers, IT HR professionals, advisors and consultants can use this information to understand how remote working affects employee satisfaction and how the remote working experience of employees can be improved, and how to shape remote working strategy, conditions and policies.

In addition, based on the results of our survey and in response to the demonstrated gaps and unfulfilled expectations of employees regarding remote work in the IT industry, it is necessary to develop practical recommendations that will improve the form of remote work and, as a result, increase the level of satisfaction of employees of IT companies in Poland. The next step in this process should be to develop a strategy for organising remote work for IT employees in the era of digital transformation. Such an approach would not only increase the efficiency of remote work, but could also be an important element in attracting and retaining talent in the industry. This provides an interesting direction for further research.

It is also worth defining and detailing the prospects for further research. The possibilities in this regard are numerous, from analysing the effectiveness of specific remote working tools and platforms, to studying the impact of different management strategies on the satisfaction and effectiveness of remote workers in the IT sector. Such an analysis could also take into account changing trends and innovations in technology that affect the way remote work is organised and executed.

References

- Abdulrahim, H., & Yousif, G. (2023). Remote Work Implications on Productivity of Workers in the Saudi Financial Sector. *International Journal of Professional Business Review: Int. J. Prof. Bus. Rev.*, 8(4), 12.
- Al-Shammari, E. T. (2021). Investigation of Factors Affecting Employee Satisfaction of IT Sector. *International Journal of Advanced Computer Science and Applications*, 12(2), 259–268. <https://doi.org/10.14569/IJACSA.2021.0120233>
- Åborg, C., Fernström, E., & Mats, E. (2002). Telework Work Environment and Well-Being: A Longitudinal Study. *Uppsala University, Department of Information Technology*, 31.
- Adekoya, O. D., Adisa, T. A., & Aiyenitaju, O. (2022). Going forward: remote working in the post-COVID-19 era. *Employee Relations: The International Journal*, 44(6), 1410-1427.
- Akundi, A., Euresti, D., Luna, S., Ankobiah, W., Lopes, A., & Edinbarough, I. (2022). State of Industry 5.0 – Analysis and identification of current research trends. *Applied System Innovation*, 5(1), 27.
- Alagheband, M. R., Mashatan, A., & Zihayat, M. (2020). Time-based gap analysis of cybersecurity trends in academic and digital media. *ACM Transactions on Management Information Systems (TMIS)*, 11(4), 1-20.
- Ali, A. D., Narine, L. K., Hill, P. A., & Bria, D. C. (2023). Factors Affecting Remote Workers' Job Satisfaction in Utah: An Exploratory Study. *International Journal of Environmental Research and Public Health*, 20(9), 5736.
- Alimadadi, A., Aryal, S., Manandhar, I., Munroe, P. B., Joe, B., & Cheng, X. (2020). Artificial intelligence and machine learning to fight COVID-19. *Physiological genomics*, 52(4), 200-202.
- Antal. (2023). Wpływ skutków pandemii koronawirusa na potrzeby kompetencyjne sektorów IT i TCB w konsekwencji rozwoju zastosowań technologii cyfrowych oraz kształtowania się nowego modelu pracy. <https://antal.pl/wiedza/arttykul/rewolucje-w-it-i-tcb-co-przyniosabranzom-kluczowe-trendy-technologiczne>.
- Atobishi, T., & Nosratabadi, S. (2023). Drivers and constraints of employee satisfaction with remote work: An empirical analysis. *Organizacija*, 56(2), 93-105.
- Baker Tilly TPA (2023). Puls rynku IT w Polsce. Firmy, ludzie, transakcje. <https://managerplus.pl/rynek-it-w-polsce-43846>
- Barriga Medina, H. R., Campoverde Aguirre, R., Coello-Montecel, D., Ochoa Pacheco, P., & Paredes-Aguirre, M. I. (2021). The influence of work–family conflict on burnout during the COVID-19 pandemic: The effect of teleworking overload. *International journal of environmental research and public health*, 18(19), 10302.

- Battisti, E., Alfiero, S., & Leonidou, E. (2022). Remote working and digital transformation during the COVID-19 pandemic: Economic-financial impacts and psychological drivers for employees. *Journal of Business Research*, 150, 38-50.
- Bielińska-Dusza, E., Hamerska, M., & Żak, A. (2021). Sustainable mobility and the smart city: A vision of the city of the future: The case study of Cracow (Poland). *Energies*, 14(23), 7936.
- Bilal, K., Khalid, O., Erbad, A., & Khan, S. U. (2018). Potentials, trends, and prospects in edge technologies: Fog, cloudlet, mobile edge, and micro data centers. *Computer Networks*, 130, 94-120.
- Bordin, C., Bartram, T., & Casimir, G. (2006). The antecedents and consequences of psychological empowerment among Singaporean IT employees. *Management Research News*, 30(1), 34-46. <https://doi.org/10.1108/01409170710724287/FULL/XML>
- Buła, P., Klecha, A., & Żak, A. (2022). Changes in the nature of teamwork and team management forced by COVID-19. *Organization and Management*, 190(1), 159-176.
- Burr, H., Lange, S., Freyer, M., Formazin, M., Rose, U., Nielsen, M. L., & Conway, P. M. (2022). Physical and psychosocial working conditions as predictors of 5-year changes in work ability among 2078 employees in Germany. *International archives of occupational and environmental health*, 1-16.
- Caillier, J. G. (2012). The impact of teleworking on work motivation in a US federal government agency. *The American Review of Public Administration*, 42(4), 461-480.
- Carvalho, G., Cabral, B., Pereira, V., & Bernardino, J. (2021). Edge computing: current trends, research challenges and future directions. *Computing*, 103, 993-1023.
- Charalampous, M., Grant, C. A., Tramontano, C., & Michailidis, E. (2018). Systematically reviewing remote e-workers' well-being at work: A multidimensional approach. *European journal of work and organizational psychology*, 28(1), 51-73.
- Chawla, R. N., & Goyal, P. (2022). Emerging trends in digital transformation: a bibliometric analysis. *Benchmarking: An International Journal*, 29(4), 1069-1112.
- Cooper, C. D., & Kurland, N. B. (2002). Telecommuting, professional isolation, and employee development in public and private organizations. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 23(4), 511-532.
- Dana, L. P., Salamzadeh, A., Mortazavi, S., Hadizadeh, M., & Zolfaghari, M. (2022). Strategic futures studies and entrepreneurial resiliency: a focus on digital technology trends and emerging markets. *Tec Empresarial*, 16(1), 87-100.
- Das, S., Dey, A., Pal, A., & Roy, N. (2015). Applications of artificial intelligence in machine learning: review and prospect. *International Journal of Computer Applications*, 115(9).
- De Donno, M., Tange, K., & Dragoni, N. (2019). Foundations and evolution of modern computing paradigms: Cloud, iot, edge, and fog. *Ieee Access*, 7, 150936-150948.
- DeGusta, M. (2012). Are smart phones spreading faster than any technology in human history. *Massachusetts Institute of Technology Review*.
- Deschênes, A. A. (2023). Professional isolation and pandemic teleworkers' satisfaction and commitment: The role of perceived organizational and supervisor support. *European Review of Applied Psychology*, 73(2), 100823.
- Djoemadi, F. R., Setiawan, M., Noermijati, N., & Irawanto, D. W. (2019). The effect of work satisfaction on employee engagement. *Polish Journal of Management Studies*, 19.
- Dolot, A. (2020). Wpływ pandemii COVID-19 na pracę zdalną-perspektywa pracownika. *E-mentor*, 83(1), 35-43.
- EF (2022). English Proficiency Index (EPI), 2022, Global Ranking of Countries and Regions. <https://www.ef.com/wwen/epi/>
- Emerging Europe (2023). The Future of IT: IT Landscape Report. <https://emerging-europe.com/future-of-it/>.

- European Commission. (2019). The European Green Deal. Brussels, COM(2019) 649 final. <https://eur-lex.europa.eu/legal-content/EN-PL/TXT/?uri=CELEX:52019DC0640>
- Frank, A. G., Dalenogare, L. S., & Ayala, N. F. (2019). Industry 4.0 technologies: Implementation patterns in manufacturing companies. *International journal of production economics*, 210, 15-26.
- Gajendran, R. S., & Harrison, D. A. (2007). The good, the bad, and the unknown about telecommuting: meta-analysis of psychological mediators and individual consequences. *Journal of applied psychology*, 92(6), 1524.
- Giauque, D., Renard, K., Cornu, F., & Emery, Y. (2022). Engagement, exhaustion, and perceived performance of public employees before and during the COVID-19 crisis. *Public Personnel Management*, 51(3), 263-290.
- Golden, T. D., & Gajendran, R. S. (2019). Unpacking the role of a telecommuter's job in their performance: Examining job complexity, problem solving, interdependence, and social support. *Journal of Business and Psychology*, 34(1), 55-69.
- Grant, M. (2021). Remote working and its impact on employee job satisfaction during COVID-19. *Leadership Education Capstones*, 1-39.
- Gunasekaran, A., Papadopoulos, T., Dubey, R., Wamba, S. F., Childe, S. J., Hazen, B., & Akter, S. (2017). Big data and predictive analytics for supply chain and organizational performance. *Journal of Business Research*, 70, 308-317.
- GUS (2021). Społeczeństwo informacyjne w Polsce w 2021 r. https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5497/1/15/1/spoleczenstwo_informacyjne_w_polsce_w_2021_r_3.pdf
- Hadasik, B., & Kubiczek, J. (2022). E-commerce market environment formed by the COVID-19 pandemic – a strategic analysis. *Forum Scientiae Oeconomica*, 10(3), 25-52.
- Haefner, N., Wincent, J., Parida, V., & Gassmann, O. (2021). Artificial intelligence and innovation management: A review, framework, and research agenda. *Technological Forecasting and Social Change*, 162, 120392.
- Hariri, R. H., Fredericks, E. M., & Bowers, K. M. (2019). Uncertainty in big data analytics: survey, opportunities, and challenges. *Journal of Big Data*, 6(1), 1-16.
- Himeur, Y., Elnour, M., Fadli, F., Meskin, N., Petri, I., Rezgui, Y., Bensaali, F., & Amira, A. (2023). AI-big data analytics for building automation and management systems: a survey, actual challenges and future perspectives. *Artificial Intelligence Review*, 56(6), 4929-5021.
- Ingusci, E., Signore, F., Cortese, C. G., Molino, M., Pasca, P., & Ciavolino, E. (2023). Development and validation of the Remote Working Benefits & Disadvantages scale. *Quality & Quantity*, 57(2), 1159-1183.
- Irawanto, D. W., Novianti, K. R., & Roz, K. (2021). Work from home: Measuring satisfaction between work-life balance and work stress during the COVID-19 pandemic in Indonesia. *Economies*, 9(3), 96.
- Juchnowicz, M., & Kinowska, H. (2022). Komponenty dobrostanu pracowników w warunkach pracy hybrydowej, in: Tabor-Błażewicz, J. & Rachoń, H. (Eds.), *Wyzwania kierowania ludźmi w systemie hybrydowej organizacji pracy* (pp. 33-45). SGH Oficyna Wydawnicza.
- Lewiatan Confederation (2023). Better Skilled. <https://lewiatan.org/praca-zdalna-i-jej-wplyw-na-rynek-pracy-wnioski-z-raportu-w-ramach-better-skilled/>
- Kowal, J., & Roztocki, N. (2015a). Do organizational ethics improve IT job satisfaction in the visegrád group countries? Insights from Poland. *Journal of Global Information Technology Management*, 18(2), 127-145. <https://doi.org/10.1080/1097198X.2015.1052687>
- Kowal, J., & Roztocki, N. (2015b). Job satisfaction of IT professionals in Poland: does business competence matter? *Journal of Business Economics and Management*, 16(5), 995-1012. <https://doi.org/10.3846/16111699.2014.924988>

- Král, P., Janoskova, K., & Dawson, A. (2022). Virtual Skill Acquisition, Remote Working Tools, and Employee Engagement and Retention on Blockchain-based Metaverse Platforms. *Psychosociological Issues in Human Resource Management*, 10(1), 92–105.
- Kumar, R., Sharma, S., Vachhani, C., & Yadav, N. (2022). What changed in the cyber-security after COVID-19? *Computers & Security*, 120, 102821.
- Kurdy, D. M., Al-Malkawi, H. A. N., & Rizwan, S. (2023). The impact of remote working on employee productivity during COVID-19 in the UAE: the moderating role of job level. *Journal of Business and Socio-economic Development*. 1-14.
- Kyrylych, T. (2018). Economical aspects of IT-market in several Central and Eastern European countries. *Pragmata tes Oikonomias*, 12, 139-150.
- Lee, P. C. B., Chan, B. W. H., & Lee, J. C. M. (2018). Emotional intelligence and information technology professionals. *IEEE International Conference on Industrial Engineering and Engineering Management*, 2017-December, 140–144. <https://doi.org/10.1109/IEEM.2017.8289867>
- Leng, J., Sha, W., Wang, B., Zheng, P., Zhuang, C., Liu, Q., Wuest, T., Mourtzis, D., & Wang, L. (2022). Industry 5.0: Prospect and retrospect. *Journal of Manufacturing Systems*, 65, 279-295.
- Locke, E. A. (1976). The nature and causes of job satisfaction. *Handbook of industrial and organizational psychology*. 1297–1349
- Lu, Y. (2019). Artificial intelligence: a survey on evolution, models, applications and future trends. *Journal of Management Analytics*, 6(1), 1-29.
- Lumley, E. J., Coetzee, M., Tladinyane, R., & Ferreira, N. (2011). Exploring the job satisfaction and organisational commitment of employees in the information technology environment. *Southern African Business Review (Unisa Press)*, 15(1), 100–118.
- Łada, M. (2021). Znaczenie sektora ICT w państwach Unii Europejskiej–analiza klastrowa. *Przegląd Prawno-Ekonomiczny*, (3), 95-110.
- Łukasik, K., Strzelecki, J., Śliwowski, P., Świącicki, I. (2022), Ilu specjalistów IT brakuje w Polsce?, Polski Instytut Ekonomiczny, Warszawa. <https://pie.net.pl/na-polskim-ryнку-pracy-brakuje-blisko-150-tys-specjalistow-it/>
- Ma, J. (2021). Telework triggered by epidemic: Effective communication improvement of telecommuting in workgroups during COVID-19. *American Journal of Industrial and Business Management*, 11(2), 202-214.
- Malinowska, E., Wiśniewska, M., & Grudowski, P. (2014). Pomiar jakości usług edukacyjnych z wykorzystaniem metody Kano. *Prace Naukowe Uniwersytetu Ekonomicznego We Wrocławiu*, 354, 235–247.
- McFarlin, D. B., & Rice, R. W. (1991). Determinants of satisfaction with specific job facets: A test of Locke's model. *Journal of Business and Psychology*, 6, 25-38.
- Molino, M., Ingusci, E., Signore, F., Manuti, A., Giancaspro, M. L., Russo, V., Zito, M., & Cortese, C. G. (2020). Wellbeing costs of technology use during Covid-19 remote working: An investigation using the Italian translation of the technostress creators scale. *Sustainability*, 12(15), 5911.
- Niebel, T. (2018). ICT and economic growth–Comparing developing, emerging and developed countries. *World development*, 104, 197-211.
- No Fluff Jobs & Ringer Axel Springer (2022), Praca zdalna i hybrydowa w IT. <https://nofluffjobs.com/insights/praca-zdalna-i-hybrydowa-w-it/>
- Nwagwu, W. (2019). Job Satisfaction of Information Technology Artisans in Nigeria. *Mousaion: South African Journal of Information Studies*, 36(2). <https://doi.org/10.25159/2663-659X/2373>
- Nwagwu, W. E. (2020). Determinants of Motivation and Job Satisfaction of Information Technology Artisans in Lagos, Nigeria. *African Journal of Library, Archives and Information Science*, 30(2), 143–164.
- Ober, J. (2020). Innovation adoption: Empirical analysis on the example of selected factors of organizational culture in the IT industry in Poland. *Sustainability*, 12(20), 8630.

- OECD (2017). OECD Digital Economy Outlook. https://www.oecd-ilibrary.org/science-and-technology/information-and-communication-technology-ict/indicator-group/english_04df17c2-en
- Osoian, C., & Petre, A. (2022). Employee Engagement and Job Burnout in the Context of Teleworking. *Studia Universitatis Babeș-Bolyai Oeconomica*, 67(3), 14-26.
- Owl Labs. (2021). State of remote work 2021. <https://owllabs.com/state-of-remote-work/2021/>.
- PAIH (2021). Invest in digital Poland 2021, Digital Poland Foundation. (<https://www.paih.gov.pl/publikacje/inwestycje>)
- Park, S., Jeong, S., & Chai, D. S. (2021). Remote e-workers' psychological well-being and career development in the era of COVID-19: challenges, success factors, and the roles of HRD professionals. *Advances in Developing Human Resources*, 23(3), 222-236.
- PARP (2017). Perspektywy rozwoju polskiej branży ICT do roku 2025. Warszawa
- Pfeifer, R., & Iida, F. (2004). Embodied artificial intelligence: Trends and challenges. *Lecture notes in computer science*, 1-26.
- Pietruszka-Ortyl, A. (2020). Determinants of the knowledge diffusion process among professionals in the IT sector. *Forum Scientiae Oeconomica*, 8(3), 73-97.
- Poulsen, S., & Ipsen, C. (2017). In times of change: How distance managers can ensure employees' wellbeing and organizational performance. *Safety science*, 100, 37-45.
- Prasad, D. K., Mangipudi, D. M. R., Vaidya, D. R., & Muralidhar, B. (2020). Organizational climate, opportunities, challenges and psychological wellbeing of the remote working employees during COVID-19 pandemic: A general linear model approach with reference to information technology industry in Hyderabad. *International Journal of Advanced Research in Engineering and Technology (IJARET)*, 11(4).
- Radomska, E. (2019). Rozwój gospodarki cyfrowej i społeczeństwa cyfrowego w aspekcie dynamicznych zmian w otoczeniu zewnętrznym na przykładzie Wielkiej Brytanii. *Economic & Political Thought/Mysl Ekonomiczna & Polityczna*, 64(1).
- Raghuram, S., Garud, R., Wiesenfeld, B., & Gupta, V. (2001). Factors contributing to virtual work adjustment. *Journal of Management*, 27(3), 383-405.
- Ślęzak, A. (2012). Przegląd badań dotyczących telepracy. *Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania*, 30, 219-232.
- Sokolic, D. (2022). Remote work and hybrid work organizations. *Economic and social development: Book of proceedings*, 202-213.
- Sonnentag, S., Tay, L., & Nesher Shoshan, H. (2023). A review on health and well-being at work: More than stressors and strains. *Personnel Psychology*.
- Stefańska, M., & Grabowski, G. (2023). Zaangażowanie pracowników a satysfakcja z pracy w warunkach pracy zdalnej. *e-mentor*, 98(1), 13-21.
- Stroińska, E. (2008). Telepraca-szansą na aktywizację zawodową kobiet. *Societas/Communitas*, (06 (2)), 299-312.
- Szczepański, J., & Zamecki, Ł. (2021). Praca zdalna w administracji publicznej w czasie pandemii COVID-19. Raport. www.inop.edu.pl
- Shpak, N., Karpyak, A., Rybytska, O., Gvozdz, M., & Sroka, W. (2023). Assessing the Business Models of Ukrainian IT Companies. *Forum Scientiae Oeconomica*, 11(1), 13-48.
- Taherdoost, H. (2023). An overview of trends in information systems: emerging technologies that transform the information technology industry. *Cloud Computing and Data Science*, 1-16.
- Ustawa o zmianie Kodeksu pracy, Ustawa z dnia 1 grudnia 2022 r. o zmianie ustawy – Kodeks pracy oraz niektórych innych ustaw (Dz. U. z 2023 r. poz. 240), <https://dziennikustaw.gov.pl/DU/2023/240>

- van Zoonen, W., Sivunen, A., Blomqvist, K., Olsson, T., Ropponen, A., Henttonen, K., & Vartiainen, M. (2021). Factors influencing adjustment to remote work: Employees' initial responses to the COVID-19 pandemic. *International journal of environmental research and public health*, 18(13), 6966.
- Vennila, M., & Vivekanandan, K. (2017). A study on how emotional dissonance impacts work exhaustion, job satisfaction, and turnover intention among IT professionals. *International Journal of Management (IJM)*, 8(1), 1–12.
- Wang, W. B., Shieh, C. J., Al-Khafaji, H. M. R., Sevbitov, A., Ismael, A. M., Chetthamrongchai, P., Suksatan, W., & Bahrami, P. (2023). Predicting Antecedents of Employee Smart Work Adoption Using SEM-Multilayer Perceptron Approach. *Human Behavior and Emerging Technologies*, 2023.
- Wilson, S. (2020). The pandemic, the acceleration of digital transformation and the impact on cyber security. *Computer Fraud & Security*, 2020(12), 13–15.
- Wood, S., Michaelides, G., Inceoglu, I., Niven, K., Kelleher, A., Hurren, E., & Daniels, K. (2022). Satisfaction with one's job and working at home in the COVID-19 pandemic: A two-wave study. *Applied Psychology*.
- Wyrwicka, M., & Trziszka, M. (2019). Telepraca-przesłanki stosowania w branży IT w Polsce. *Przedsiębiorczość i Zarządzanie*, 20(6), cz. 3. Zarządzanie kapitałem ludzkim-aspekty teoretyczne i praktyczne), 373–383.
- Xu, G., Wang, X., Han, X., Huang, S. S., & Huang, D. (2022). The dark side of remote working during pandemics: Examining its effects on work-family conflict and workplace well-being. *International Journal of Disaster Risk Reduction*, 79, 103174.
- Yousef, D. A. (2017). Organizational Commitment, Job Satisfaction and Attitudes toward Organizational Change: A Study in the Local Government. *International Journal of Public Administration*, 40(1), 77–88. <https://doi.org/10.1080/01900692.2015.1072217>
- Zampetakis, L. A. (2023). Employees' fear at work, job crafting, and work engagement on a daily basis: The case for fear of COVID-19. *Applied Psychology*, 72(2), 535–558.
- Zhang, C., & Lu, Y. (2021). Study on artificial intelligence: The state of the art and future prospects. *Journal of Industrial Information Integration*, 23, 100224.

The research was funded by the Cracow University of Economics under the auspices of the POTENTIAL grant. Project number: 066/ZZN/2022/POT. Total amount of funding: 44,601.72 PLN.

Edyta Bielińska-Dusza, PhD in economics in the field of management science, is an Assistant Professor in the Dept. of Strategic Analysis of the Cracow University of Economics. She is the director of postgraduate studies in the “MBA in Community Management” area at the Cracow Business School of the Cracow University of Economics. Her research revolves around strategy, technology, artificial intelligence, innovation, digitalisation, internal audit, and inter-organisational phenomena. She leads the project “The transformative impact of artificial intelligence on replacing people in innovation processes in the research and development activities of Life Science companies”, which is supported financially by the National Science Centre. Her lectures are dedicated to strategy management, technology audit, and technology design and forecasting, including management methods and tools. She has been a co-organiser of scientific conferences and has served as an expert in various projects (“Revolution 4.0. Regional Initiative of Excellence,” “Innovation Brokers as a tool for effective development,” “First Business – Support to start,” “The Rapid Response Instrument”). She

has also participated in study visits and scientific workshops (Stanford University, University of Berkeley) and has earned certificates from École Polytechnique Fédérale de Lausanne, Switzerland; ISIS Innovation Ltd, Oxford; Strategic Business Insights, Stanford; and PRINCE 1&2. ORCID no. <https://orcid.org/0000-0003-2007-8828>

Renato Lopes da Costa, PhD in General Management, Strategy and Business Development at ISCTE (Portugal), has published articles in several journals in the East, the United States, Canada, Africa, South America and Portugal. He is currently a researcher and member of the Scientific Council of BRU-UNIDE and a professor at ISCTE where he guides master's and PhD theses and teaches Business Strategy. Since 2016 he has been the MscBA director at ISCTE, a master's listed in the Financial Times report. During the 2013/2014 school year he began working as a guest professor at the Military Academy. ORCID no. <https://orcid.org/0000-0001-9364-534X>

Monika Hamerska, PhD in Economics, is a researcher and academic teacher. She is an assistant at the Cracow University of Economics in the Department of International Management. She received her PhD in social science from the Cracow University of Economics in 2019. The topic of her doctoral dissertation was related to the identification of determinants and modelling of scientific productivity. Her main research areas are scientific productivity, knowledge transfer and decision optimisation. ORCID no. <https://orcid.org/0000-0003-1042-8636>.

Agnieszka Żak is a graduate of the Cracow University of Economics (MA) and the Jagiellonian University (PhD), with a PhD in economics in the field of management science (2008). She is an assistant professor and employee of the Department of International Management at the Cracow University of Economics, as well as the director of postgraduate studies in the field of "Enterprise management – MBA management studies" at the Cracow Business School of the Cracow University of Economics (since 2008). Her research interests and article topics include sustainable development, smart cities, corporate social responsibility (CSR), corporate community involvement (CCI), cross-sector social partnerships, international management, intercultural communication, and remote teams. Social activities: Zacztyani.org Foundation – Coordinator in Krakow (since 2018). ORCID no. <https://orcid.org/0000-0003-1602-1757>.

Economic Globalisation and Public Debt: What Implications does an Integrated South African Economy Hold for Fiscal Policymakers?

MOITSHEPI MOENG, JACQUES DE JONGH

Abstract

DOI: 10.23762/FSO_VOL11_N04_2

Globalisation is a deep-rooted phenomenon that has significantly shaped developed and developing economies alike. Characterised by its controversial past, South Africa provides a unique case when considering how global integration has affected the country's economy. Among the more intriguing relationships has been the interlinkage between the country's public debt levels and the manner in which it has globalised. On one hand, advocates suggest that economic integration has enabled the government to provide greater social assistance in the hope of rectifying its controversial past. On the other hand, however, globalisation is believed to increase pressure on the fiscal budget with increased levels of debt needed to mitigate the pressure of external shocks. The primary objective of this study was to analyse the relationship between public debt and economic globalisation in South Africa. It followed a quantitative research approach using secondary time-series data from 1980 to 2020. Long-run relationships were evaluated through the use of a Bayer–Hanck combined cointegration test, while FMOLS, DOLS and CCR estimation techniques were employed to estimate elasticity relationships. The results corroborate the existence of a positive relationship between higher levels of economic globalisation and public debt. Moreover, the causality results revealed a unidirectional causal link between these variables emanating from the economic integration of the country. This implies significant consequences for fiscal policymakers towards balancing its role as a crucial macroeconomic role player. The findings in fact point to noteworthy implications surrounding the restricting effects of the integration process, pertaining to higher borrowing costs, increased external vulnerability and limited fiscal capability in the context of improving the country's social environment.

Key words

economic globalisation, government spending, public debt, KOF globalisation index, South Africa

Moitshepi Moeng

e-mail: 31281907@mynwu.ac.za

Jacques de Jongh¹

e-mail: Jacques.dejongh@nwu.ac.za

North-West University, School of
Economic Sciences,
TRADE research focus area

¹ Corresponding author

Introduction

Globalisation is a powerful force that has had a profound impact on shaping modern economic and social life (World Economic Forum (WEF), 2019). Generally, it is referred to as the integration of economies marked by the free flow of trade and capital, along with easy access to foreign resources and labour markets (Lutkevich, 2022). Friedman (2000, 9) describes it as “the inexorable integration of markets, transport systems, and communication systems to a degree never witnessed before – in a way that is enabling corporations, countries, and individuals to reach around the world farther, faster, and cheaper.” However, as time has progressed, its understanding has been inextricably linked to a multidimensional concept, characterised mainly by three dimensions, focusing on the interconnectedness of the economic, social, and political landscapes of countries across the globe (Gygli et al., 2019). Among these, the former (i.e. economic globalisation) has arguably been the most pertinent, pertaining to aspects such as the establishment of lower transportation costs, comparative and competitive advantages, the liberalisation of trade and the irrepressible rise of modern technology (Figge and Martens, 2014). As such, it has influenced a myriad of factors, including aspects relating to the mobility of resources, an enhanced division of labour and the impact that the liberalisation of current accounts and capital markets have had on the wider socioeconomic wellbeing of economies.

In light of the influence of said process, the rationale for countries to integrate has been firmly based on the advantages it has to offer (Tsunekawa, 2019). On the one hand, advocates suggest that economic globalisation has brought with it greater levels of knowledge spillovers, consumption smoothing, and financial development, as well as greater levels of foreign investment (Raeskyesa and Suryandaru, 2020). On the other hand, however, sceptics point to specific deleterious

effects, raising issues of the skill-biased nature of the process, the systemic core-periphery aspects of global networks, and the creation of higher levels of external economic vulnerability, especially in developing countries (Jenserud, 2018). While these debates have been rife, they have likewise manifested in the body of knowledge directed towards understanding the influence of global economic integration on the role and capacity of fiscal policymakers (Calitz, 2000; Wu et al., 2022). Acknowledging the fact that this process has both enabling and adverse consequences on the socioeconomic landscapes in this regard has raised important questions about the ability of fiscal policy to act as a key Keynesian spender in a macroeconomic framework. In fact, contrasting views have played out in the shape of two alternative theories. On the one hand, the efficiency theory maintains that economic globalisation has induced governments to reduce spending while maintaining important public goods through lower tax rates to ensure competitive financial conditions and attract foreign investment (Porto et al., 2016:02). However, on the other side of the spectrum, the compensation hypothesis suggests the opposite, emphasising that policymakers are set to increase government spending to respond to the potential adverse effects of economic globalisation (Sener et al., 2015).

Research into these debates has increased substantially over the last decade (Bataka, 2021; Wu et al., 2022). However, while the greatest focus in this regard has been directed towards understanding increases in government size and spending patterns, insight into the implications this has had on the sustainability of governments’ fiscal budgets has remained largely unexplored (Yildiz and Sağdic, 2021). The relationship between economic globalisation and government debt in this respect has been a rather perplexing topic, given that it not only acknowledges

the impact of globalisation on spending, but so too revenue generation and the consequential dynamics between these two processes. This has further been complicated by the different motivations for countries to carry large levels of debt, their specific positions in the global economic network, and the consideration of their specific development trajectories (Kim et al., 2018). South Africa in particular presents an intriguing case. Unlike other countries, it has had a unique process of integration (Sebake, 2017). While most of its African counterparts were subjected to economic integration through the policies of the Bretton Woods Institutions, the apartheid regime left the country subject to multiple economic sanctions, excluding its participation in the global economy. It was only after 1990 that an internal adoption of the integration process started as the country transitioned to a democratic state and the adoption of the neoliberal framework that has become so closely associated with an increasingly interdependent world (de Jongh, 2022).

Since then, South Africa has seen notable progress in eradicating the wrongs of its past, in which fiscal policymakers have played a significant role (Inman and Rubinfeld, 2013). Much like most of its sub-Saharan African partners, national budgets have largely been directed towards the social spheres of its society, including health and education (Barro, 2013). Moreover, it has established arguably one of the more advanced social security systems on the African continent, with more than 33% of the population being the beneficiaries of social grants. However, while its fiscal position has been relatively sound in the last four decades, recent trends in mounting fiscal debt have become a serious concern. From 2000 until 2019, the debt-to-GDP ratio in the country averaged 41.45%, reaching a low of 27.80% in 2008 (National Treasury, 2023). Since the end of the financial crisis in 2008, debt levels have continuously increased, reaching a high of 66.32% at the end of 2022 (IMF, 2023). During the course

of that period, the country experienced significant changes in its economic integration as well. Considered a moderate globaliser, it has had to contend with a relatively volatile exchange rate, significant fluctuations in FDI inflows, and a poor current account performance (Ngondo and Khobai, 2018). In addition, it has consistently struggled to participate in emerging global value chains, faced additional social pressures associated with the COVID-19 outbreak (Kose et al., 2021), and struggled to move from its peripheral global position based on a lack of economic diversification.

While these trends have been intriguing from a practical viewpoint, various methodological considerations have made further insight into the dynamics between these two processes rather difficult. Key among these has been the fact that, where evidence has been provided, studies have mainly used proxies such as FDI and trade openness to measure globalisation, failing to capture the underlining multidimensionality of the process (Gygli et al., 2019). So too have these measures solely provided insight into the disturbances of actual flows or *de facto* processes. Evidence of the influence of these flows in conjunction with the policies (*de jure*) and institutions that enable them has rather been ignored by the extant literature (Leal et al., 2021). Taking this into account, the primary objective of the study was to examine the relationship between economic globalisation and public debt in South Africa. In doing so, the contribution of the study is threefold. On a theoretical level, it is among the first that seeks to place South Africa within this particular discourse, providing alternative context-specific insight into the debates on whether economic integration has either benefitted or deterred fiscal sustainability. Secondly, from a methodological perspective, the study aims to overcome the aforementioned shortcomings, using more comprehensive and holistic measures of the globalisation process. This would include

accounting for both *de jure* and *de facto* dynamics using the KOF Swiss Economic Institute's globalisation indices. It also aims to utilise alternative econometric techniques, with limited application within this field of study. Finally, the study also holds particular relevance for policymakers. Research providing notable insight into this relationship has the ability to act as a reference point for government strategies, not only in managing its finances within the interconnected global economic landscape, but also identifying areas in which the integration thereof requires alternative thinking.

1. Literature review

1.1. Relationship between public debt and economic globalisation

Constructing a working definition for globalisation has proved to be a challenging endeavour over the years. While some authors argue that it cannot be done, others claim that doing so would constrain the meaning; more venturesome authors disregarded these beliefs and have attempted to define globalisation in various ways, with reasonable success (Al-Rodhan and Stoudman, 2006). In economic terms, globalisation generally refers to the growing integration, mainly through real and financial economic flows (Haelg, 2020), of economies throughout the world (IMF, 2002). According to Gygli et al. (2019) and Dreher (2006), economic globalisation can be referred to as the process that creates a network of connections between participants at both multi-continental and inter-continental distances, through various economic flows encompassing capital, trade, portfolio investment, and FDI along with all the information linked to such flows. In essence, it contributes to the removal of national borders and allows for access to technology that leads to interdependence and the integration of economies (Bataka, 2021). While struggling to find the ideal

definition for this phenomenon, academics and policymakers also found themselves at odds with one another on the best way to measure globalisation.

As a matter of fact, most scholars have used proxies and single indicators such as capital flows and international trade (volume of exports and imports) to measure globalisation (Zafar and Butt, 2008; Çolak and Özkaya, 2020). While these single indicators have mostly been used in empirical literature as they provide insight into the key aspects of globalisation processes (Dreher et al., 2008), they do not paint a holistic picture of the globalisation processes (Mikalauskiene et al., 2016). Other measures that were previously used include the AT Kearney/Foreign policy (KFP) globalisation index, the DHL connectedness index, and the New Globalisation Index (NGI). However, when a phenomenon such as globalisation includes various aspects that, taken together, may have a considerable effect, it would be more logical to assess these effects in unison to avoid providing partial answers (Dreher et al., 2008). The KOF globalisation indices (KOF Swiss Economic Institute, 2023), which are regarded as the most comprehensive measures, offer a holistic measurement of globalisation. In relation to economic globalisation *per se*, the *de jure* aspect measures the conditions and policies that guide economic activities and flows in reality, while the *de facto* aspect measures the actual international economic activities and flows of a country (Leal and Marques, 2019).

Based on the aforementioned economic flows, some studies have shown the mixed theoretical relationship between economic globalisation and public debt (Lane and Milesi-Ferretti, 2000; Azzimonti et al., 2014). Public debt, interchangeably known as government debt, is often described as the sum of a central government's fixed-term contractual obligations to others

outstanding on a specific date (World Bank, 2022). While the existing literature indicates that the primary influence on public debt comes from socioeconomic, macro-economic, structural, and institutional factors (Mothibi and Mncayi, 2019), it is often unclear whether public debt is also influenced by the economic flows that are encouraged by the integration of economies (Holtfrerich et al., 2016). When it comes to explaining this relationship between economic globalisation and public debt, theoretical literature also indicates that economic globalisation affects public debt levels by encouraging spending from governments that care to protect the well-being of their population from volatilities and uncertainties brought about by economic globalisation by raising their spending (through public debt) rather than increasing taxes (Bataka, 2021). If anything, they would rather decrease taxes in support of economic recovery or attract external investment. Additionally, uninsured idiosyncratic risks within the context of economic globalisation also tend to increase public debt in order to allow for consumption smoothing, as shown by Azzimonti et al. (2014), while trade liberalisation prompted by economic globalisation contributes to public debt because of the abolition of the trade tax (Zafar and Butt, 2008). Globalisation is a rather controversial phenomenon, and these relationships have sparked a new debate on whether economic globalisation is indeed worth the uncertainties it comes with, especially in developing countries that do not benefit from globalisation to the same extent as industrialised developed countries.

In support of economic globalisation, proponents have argued that trade liberalisation and FDIs are a source of financial assistance and can be a worthwhile contribution to solving the public debt issues of a country – if the additional revenue that is generated from improved domestic

productivity, growth and exports is used to lighten the public debt and its service costs (Ostadi and Ashja, 2014). In sync with this argument is the perspective of hyper-globalists, who support globalisation on the basis that it is a positive phenomenon that uplifts the economy and allows for an increase in government spending through simplified external borrowing (Held et al., 1991). While increased expenditure through debt might not sound ideal, the Keynesian school of thought suggests that it is good for a government to possess some form of debt that is fully justified as a way of stabilising an economy (Keynes, 1937), especially one that is affected by external shocks. In contrast to these perspectives, opponents and sceptics question the benefits derived from globalisation by mainly focusing more on its costs, expecting them to exceed the benefits (Dreher et al., 2008). They argue that globalisation creates costs that tend to be centralised within a particular segment of the population who become vocal about their burden (Cuervo-Cazurra et al., 2020). For example, lower tariffs that are accompanied by lower prices and result in uncompetitive domestic firms may be beneficial to consumers who enjoy lower prices, but not to the uncompetitive domestic firms that close down, leading to job losses and threatening livelihoods. These costs not only encourage government spending, but further impede the government's ability to service existing debt (Burrie et al., 2020). Dreher et al. (2008) assert that globalisation restrains governments by prompting high budgetary pressure, consequently forcing governments to redirect their expenditures away from capital expenditures, such as the repayment of loans, and in favour of subsidies and transfers.

The efficiency and compensation hypotheses in this regard reiterate how the free flow that comes with globalisation affects the markets and social policy of

a country, which, in turn, affects government expenditure. The efficiency hypothesis (also known as the race-to-the-bottom hypothesis) predicts that moving production between countries where employment regulations are flexible and corporate taxes are moderate pressurises the local government to decrease corporate taxes and deregulate the labour market to attract those who are most likely to contribute rather than be a cost to the economy (de Jongh, 2020). Consequently, this affects the government's ability to sustain their debt and leaves the government with less income to spend on social policy, thereby encouraging an increase in their debt stock to bridge the gap to the lost income initially used for social spending (Lammers et al., 2018). Research studies on developing countries have mostly supported the efficiency hypothesis (Kaufman and Segura-Ubiergo, 2001; de Jongh, 2020). Contrastingly, the compensation theory holds that globalisation intensifies economic competition, inducing more volatile domestic economic environments that lead to open economies having larger public sectors (Bergh, 2021). In a globalised world, this implies that demand for social policy and protection increases in domestic economies so as to compensate those who are losing out due to increased economic competition brought about by globalisation (Rodrick, 1998). Consequently, this forces the government to increase its spending on education, human development, and employment benefits, to name a few (Lammers et al., 2018). In this case, governments have the option of increasing their social expenditure, which, if not managed appropriately, may lead to an increase in debt. While the efficiency theory and the compensation theory are naturally in competition with each other, they both have the ability to explain why the public debt of economies increases on account of globalisation.

1.2. Economic globalisation and public debt in the South African context

In relation to these theoretical arguments, the nature of the relationship between economic globalisation and public debt in South Africa has proven to be more complex. Characterised by its controversial past in the form of the apartheid regime, South Africa has shown an idiosyncratic, internally driven economic integration, unlike other countries where integration was externally imposed through structural adjustment programmes (de Jongh, 2020). Following the rise of democracy in 1994, several policies that reinforced integration into the global economy were implemented by the South African government (Ijeoma, 2008), whereby globalisation reflected a growing interdependence caused by an increase in the international trade of products and services, technologies, the flow of information, investment, and people (Salahuddin et al., 2020). Naturally, this has left the small open economy of South Africa susceptible to external shocks that have brought about both positive and negative effects on the economy.

To be sure, the country has enjoyed the fruits of globalisation. Knowledge transfers have enabled South Africa and other developing nations to improve the standard of living by “leapfrogging” to new technologies (Rodrik, 2018), and through an increase in the demand for South African commodities and natural resources due to incomes rising around the world (Okonjo-Iweala and Coulibaly, 2019). In some way, this has mirrored the benefits reaped by East and Southeast Asian economies. Though Asian economies also benefitted from lasting wage increases, poverty alleviation, and expanded trade (Nabi, 2016), this is not to say that there have not been any disadvantages associated with integration and interdependence on the socioeconomic environment of countries.

Studies that provide evidence from developing economies tend to show that globalisation has also caused increases in levels of poverty, unemployment, and inequality, which have inevitably affected their social policies and fiscal budgets (Ukpere and Slabbert, 2009; Awad, 2019). Ukpere (2011) asserts that in the era of global integration, there have been issues of job losses, intense global competition, labour immobility, and wage reductions, while the technological displacement of workers has increased the global unemployment rate, the repercussions of which have been high levels of poverty and inequality in Africa.

Against this backdrop, South Africa's socioeconomic environment seems to have consistently deteriorated over the last 18 years despite efforts made by the government to provide a secure social safety net. While unemployment continues to rise, South Africa remains the most unequal country in the world, with a Gini coefficient of 63% (World Bank, 2023). To date, social assistance provided by the government has managed to keep this figure from growing further (Leibbrandt and Shipp, 2019). Furthermore, poverty patterns remain dismal and skewed by gender and race (Marais, 2018). Stats SA (2019) maintains that adult females and males endure a 52.0% and 46.1% headcount, respectively, when using the upper-bound poverty line headcount by sex. Meanwhile, the most recent national budget shows R5.2 billion in tax relief in support of economic recovery, while the largest portion of the budget goes to social spending followed by debt service costs (National Treasury, 2023). Indeed, debt accumulation has been a typical feature of developing countries with open capital markets that are characterised by issues of deficient resources and moderate savings that have to be fulfilled through some form of external capital (IMF, 2003). The public finances of South Africa remain in a perilous state due to low or nonexistent

economic growth, the mediocre performance of SOEs, low tax revenue collection, and the rapidly rising debt levels that are now at their peak in the post-apartheid era (Muller, 2019). By 1994, the country's public debt had dramatically increased from 32% of GDP in 1990 to an average of 44.8% of GDP (World Bank, 2023). According to the Debt Management Report (National Treasury, 2021), the gross debt stock of the country is expected to escalate from R4.35 trillion in 2021/22 to R5.43 trillion in 2024/25, even though a large percentage of the budget goes towards debt repayments. Debt levels and social expenditure by the government have increased concurrently while tax rates have remained stagnant.

1.3. Empirical review

Bearing in mind these ambiguities, the relationship between globalisation and public debt has been investigated in various studies. Some have reported a positive link between globalisation and public debt, while others have found that globalisation either lowers government debt or does not affect it at all. For example, a study by Kim et al. (2018) used panel heterogeneous cointegration techniques for 53 developing and developed countries from 1980 to 2011 and found that government debt increased with financial and trade openness on average. This study also utilised KOF indices and showed that the efficiency hypothesis is predominant. Also looking at a combination of high-income and middle-income countries over the periods from 1993 to 2008 and 1980 to 2008, respectively, Sinha et al. (2011) used panel regressions and found that the public debt of middle-income countries decreased with FDI, whereas FDI did not influence the public debt of high-income countries. Swamy (2020) investigated the macroeconomic determinants of government debt for 252 countries encompassing the BRICS countries, OECD countries, high-income economies (HIC), the least developed countries

(LDC), middle-income economies (MIC), low-income economies (LIC), and heavily indebted poor countries (HPC). The author used data spanning from 1980 to 2009 and the generalised method of moments (GMM) approach, finding that trade openness increased government debt while FDI decreased it.

Some studies have focused on developing countries. In an attempt to determine whether external debt influences trade liberalisation in Pakistan, Zafar et al. (2008) employed secondary data from 1972 to 2007 using an ARDL modelling approach. The results showed a significant long-run positive relationship. Additionally, using FDIs and trade openness as proxies for globalisation and economic globalisation as a control variable, Çolak and Özkaya (2020) studied the influence of military spending on the government's external debt from 1997 to 2016 from some transition economies by using a fixed-effect panel threshold regression model. The authors found that the economic globalisation variable increased the external debt of some transition economies. Kim (2003) used data from 54 industrial and developing countries from 1950 to 1989, 20 OECD countries from 1950 to 1994, and OECD countries from 1951 to 1990 to determine whether capital account liberalisation disciplined the budget deficit. The study found that capital account liberalisation disciplined budget deficits, consequently decreasing government debt. Meanwhile, Combes and Saadi-Sedik (2006) used a GMM-system estimator and focused on 66 developing countries from 1974 to 1998 to determine whether trade openness affects budget deficits. They concluded that trade openness would lead to higher budget deficits and an accumulation of more central government debt.

Moreover, some authors have attempted to investigate this relationship in African economies. Utilising data from 1980 to 2017 on sub-Saharan African countries, Bataka (2021) conducted one of the first studies to focus on the continent, empirically investigating how economic globalisation affects public debt. Differentiating among the KOF globalisation indices, the author used secondary panel data tests and found that financial globalisation increases public debt in the short and long run, but trade globalisation boosts public debt in the short run and lowers it in the long run.

2. Methodology

2.1. Empirical study and data sources

The main objective of this study was to analyse the impact of economic globalisation on public debt levels in South Africa. To achieve this, a quantitative research design and a functional research philosophy were adopted. Secondary time-series data from 1980 to 2020 was utilised. The selected time period was chosen based on data availability and allowed for more accurate results considering the start of the country's integration process only began in the early 1990s when the apartheid sanctions were being lifted. A total of 41 annual observations were included with data sourced from the World Bank Development Indicators (World Bank, 2023), the South African Reserve Bank (SARB, 2023), and the KOF Swiss Economic Institute (KOF Swiss Economic Institute, 2023). The variables under consideration are shown in Table 1 below and included central government debt (as a percentage of GDP) as the dependent variable in the model.

Table 1. Description of variables and data sources

Variable	Measure	Database
Public debt (DEBT)	Gross national government debt total (% of GDP)	SARB (2023)
Economic globalisation (EGL)	Composite KOF economic globalisation index ranging from 0 to 100. The index is based on levels of trade and financial globalisation. A high score indicates a higher level of economic globalisation.	KOF Swiss Economic Institute (2023)
Inflation (INF)	Consumer price index (CPI annual %)	SARB (2023)
Government expenditure (GEP)	General government final consumption expenditure (% of GDP)	World Bank (2023)
Gross domestic product per capita (GDP)	Real GDP per capita (in constant prices, US\$ PPP)	World Bank (2023)

Source: own elaboration

To capture the levels of the key explanatory variable, i.e. economic globalisation, the study used an overall (a combination of the de jure and de facto) economic globalisation sub-index developed by the KOF Swiss Economic Institute. Additionally, inflation (consumer price index), government expenditure (as a percentage of GDP) and real GDP per capita were used as control variables. These variables were selected based on their inclusion in similar studies (Swamy, 2020; Bataka, 2021) as well as their established theoretical importance in affecting public debt levels (Zafar and Butt, 2008; Sener et al., 2015). Prior to their inclusion in the modelling, all the variables were transformed to their natural logarithms to ensure consistency of measurement and avoid the possibility of heteroscedasticity.

2.2. Econometric method of analysis and model specification

To carry out the analysis, the study first provides a descriptive overview of the included

variables. Thereafter, various econometric techniques were used to analyse the relationships. This included the use of the Zivot–Andrews (1992) unit root test, employed with the goal of testing the stationarity properties of the data. As opposed to conventional unit root tests such as the augmented Dickey–Fuller (ADF) unit root test and Phillips–Peron (PP) tests, this particular unit root test was employed based on its ability to provide more robust results in the presence of possible structural breaks (Fahmi et al., 2019). Based on South Africa’s past and the country’s significant political and structural changes since its transition to democracy, the use of this particular test provides the opportunity to avoid any inefficiency and bias in the determination of the data’s stationarity properties. Consequently, the analysis benefits in the sense of ensuring a more accurate selection in the estimation technique. From this, the equation for the test can be provided as follows:

$$\Delta y_t = \rho + \rho y_{t-1} + \sigma t + \theta DU_t + \sum_{j=1}^k d_t \Delta y_{t-j} + \mu_t \quad (1)$$

$$\Delta y_t = \rho + \rho y_{t-1} + \sigma t + \pi DT_t + \sum_{j=1}^k d_t \Delta y_{t-j} + \mu_t \quad (2)$$

$$\Delta y_t = \beta + \beta y_{t-1} + \beta t + \tau DU_t + \tau DT_t + \sum_{j=1}^k d_t \Delta y_{t-j} + \mu_t \quad (3)$$

where DU_t is indicative of the dummy variable, a particular shift arises at a point t , and DT_t indicates the trend in shift. As such:

$$DU_t = \begin{cases} 1 & \text{.... if } t > TB \\ 0 & \text{.... if } t < TB \end{cases} \text{ and } DT_t = \begin{cases} t - TB & \text{.... if } t > TB \\ 0 & \text{... .. if } t < TB \end{cases} \quad (4)$$

Subsequent to these tests, if unit root analyses confirm the stationarity of the variables, all as integrated at first order, this would suggest the possibility of cointegration of the variables. For the purposes of determining possible cointegration, the analysis made use of the Bayer–Hanck (2013) combined test for cointegration. Compared to other cointegration tests, this method overcomes the shortcomings of conventional cointegration testing by

avoiding the use of unrelated multiple tests. Moreover, by integrating various test statistics, including those developed by Engel and Granger (1987), Johansen (1991), Boswijk (1995), and Banerjee et al. (1998), it provides a more comprehensive and efficient procedure. In doing so, the test makes use of a Fisher-type formula to construct the equation for the BH test, expressed in the following manner:

$$EG - JOH = -2[\ln(P_{EG}) + \ln(P_{JOH})] \quad (5)$$

$$EG - JOH - BO - BDM = -2[\ln(P_{EG}) + \ln(P_{JOH}) + \ln(P_{BO}) + \ln(P_{BDM})] \quad (6)$$

where P_{EG} , P_{JOH} , P_{BO} and P_{BDM} are indicative of the test probabilities of the Engel and Granger (1987), Johansen (1991), Boswijk (1995), and Banerjee et al. (1998) tests, respectively.

In an effort to estimate the elasticity coefficients between the variables and the impact of economic globalisation and public debt, three separate estimation techniques were utilised. These included the fully

modified ordinary least squares (FMOLS) (Phillips and Hansen, 1990), dynamic ordinary least squares (DOLS) (Saikkonen, 1992) and canonical cointegration regression (CCR) techniques (Park, 1992). The use of these tests was based on several factors. Firstly, employing multiple estimation techniques would assist in ensuring the robustness of the results. Secondly, each test provided various advantages towards

overcoming possible shortcomings in the estimation of the model. For example, the utilisation of both the FMOLS and DOLS estimation techniques has the ability to accommodate nuisance parameters (Adusei, 1990; Yildirim and Orman, 2018). This assists in overcoming possible estimation bias and endogeneity as well as serial correlation. The former likewise makes use of both leads and lags, avoiding the influence of small

sample bias and simultaneity. In addition to this, the use of CCR estimation, as with the FMOLS method, transmutes the data, and uniquely, so too the parameters, providing a more accurate estimation by mitigating the problem of omitted variable bias (Wu *et al.*, 2018). Therefore, based on these estimation techniques, the following model was specified:

$$LDEBT_t = \beta_0 + \beta_1 LECG_t + \beta_2 LGEP_t + \beta_3 INF_t + \beta_4 LGDP_T + \varepsilon_T \quad (7)$$

where LDEBT refers to the natural logarithm of public debt levels, LECG the natural logarithm of economic globalisation, LGEP the natural logarithm of levels of government expenditure and both LINF and LGDP the natural logarithms of inflation and GDP per capita, respectively. The latter three variables served as control variables in the estimation. Moreover, β_1 , β_2 , β_3 and β_4 represent the coefficients of the included explanatory variables, while ε_t is indicative of the error term. Finally, given the possibility of cointegration of the variables, causality analysis was undertaken by means of the Toda–Yamamoto Granger causality test (Toda and Yamamoto, 1995). This technique provides the ability to accommodate different orders of integration, specifically when variables are either stationary at level or first difference. In the analysis of causal relationships, it makes use of a modified Wald test providing robust results by overcoming possible problems associated with conventional causality methods, including the influence of both power and size (Rahman *et al.*, 2015).

3. Empirical results and discussion

3.1. Descriptive analysis

As a first step in the analysis, the study presents a synopsis of the attributes of each of the variables that are included. This descriptive insight is presented in Table 2. Prominent among these results, firstly, are

the mean values of the included variables for the past four decades. Here, average scores for the CPI index, government expenditure (as a percentage of GDP) and the GDP per capita level (constant prices in dollars) were all calculated at 37.35, 24.01% and US\$12,180.36, respectively. As for the main variables under consideration, the mean values for government debt levels suggest that on average government debt has been approximately estimated at 34.47% of GDP over the last 40 years. While this might seem on a par with similar developing regions, the recent sharp rises have been concerning. This is shown by the maximum value for the period under consideration, estimated at 57.20% in 2020. Considering the results for the economic globalisation index, the median has been slightly higher than the mean, suggesting a slight leftward distribution. On average, levels of economic globalisation have been below the 50-mark threshold. This can be explained by the country's unique integration path. Considering the imposition of various racial segregation policies prior to the early 1990s and the subsequent economic sanctions, the country only started to meaningfully integrate economically with the transition to democracy after this period. The minimum value of 28.98 here was recorded in 1989, while the maximum value of 56.57 was attained in 2016, showcasing the progress the country has made.

Table 2. Descriptive statistics

Statistic / variable	DEBT/GDP (%)	KOFECG	CPI	GEP	GDP
Mean	34.475	44.867	37.347	24.014	12,180.860
Median	31.900	51.317	31.992	24.000	11,991.110
Maximum	57.200	56.571	93.292	29.700	14,049.390
Minimum	23.600	28.820	3.475	17.665	10,256.750
Std. Dev.	8.410	10.139	27.218	2.496	1289.839
Skewness	0.743	-0.219	0.539	-0.180	0.157
Kurtosis	2.671	1.282	2.130	2.963	1.563
Jarque-Bera	3.961	3.371	3.283	0.229	3.692
Probability	0.137	0.168	0.193	0.891	0.157
Observations	41	41	41	41	41

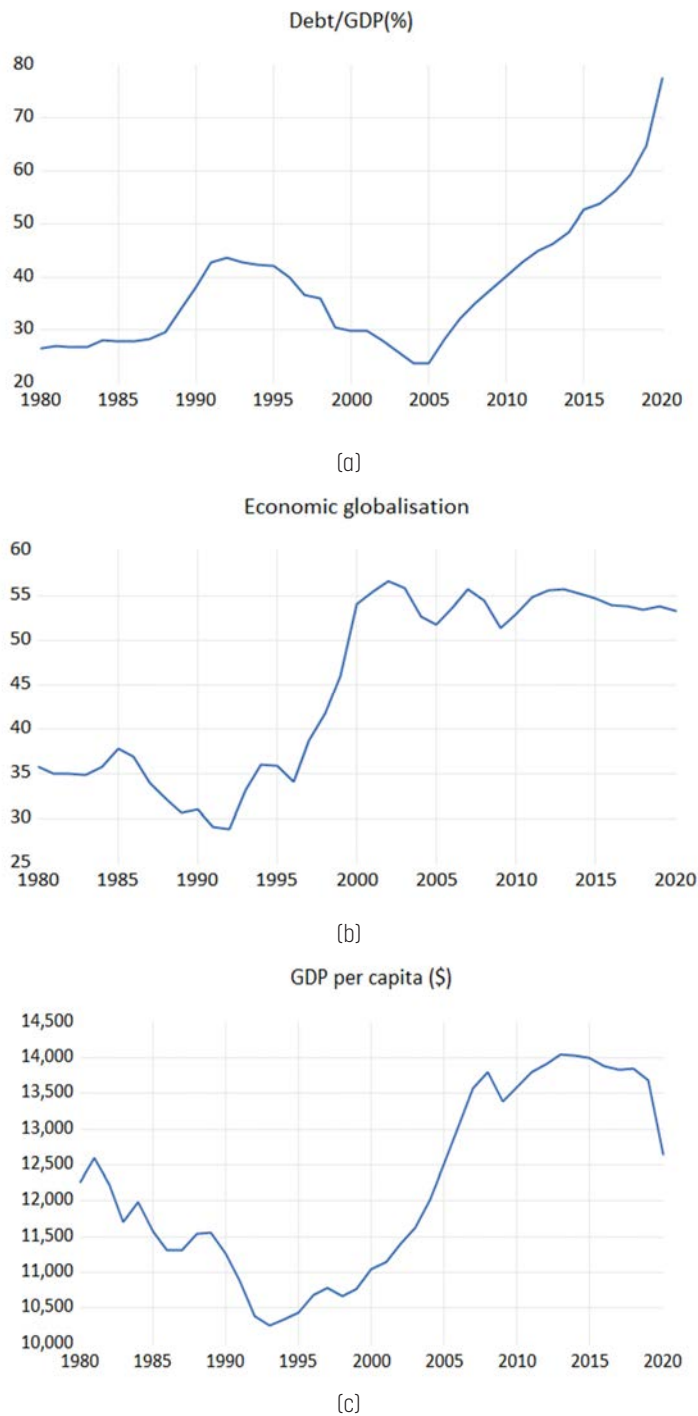
Source: own elaboration

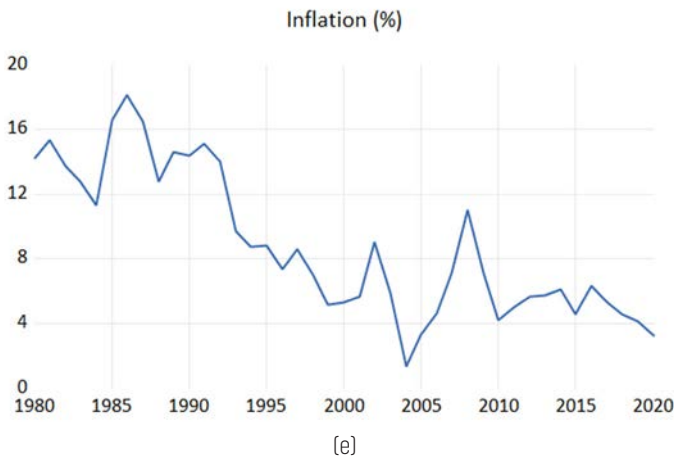
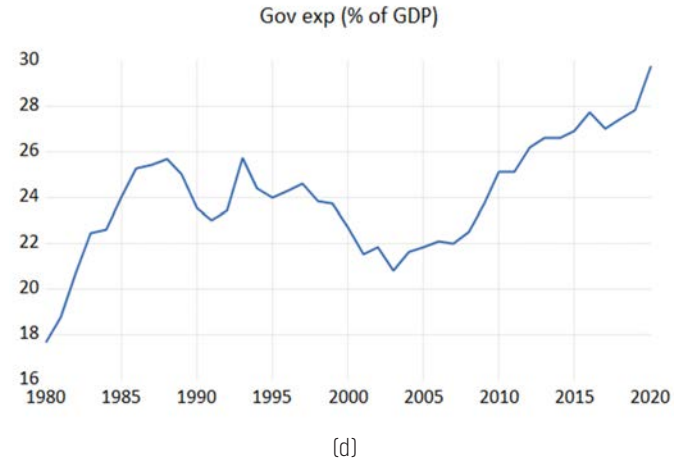
In addition to these insights, the Jarque-Bera statistics for all the variables suggest a normal distribution with all p-values estimated above the 0.1 threshold. Moreover, upon review of the standard deviations, when compared to the mean values, these were relatively small, apart from those for the CPI figures. This would suggest that most of the variables were well represented by their average scores. Additionally, it also shows a degree of lower volatility.

On the basis of these dynamics, it was also deemed critical to provide an understanding of the trends in the selected variables. In this respect, Figure 1(a-e) provides an overview of the changes in the five variables under consideration. Of these, arguably the

most striking feature has been the excessive increase in debt-to-GDP ratios South Africa has seen over the last 15 years, the estimated levels of which increased from just above 20% to close to 80% of the country’s economy. These continuously increased levels were also replicated considering the levels of economic globalisation of the country. However, upon reflection on the timeframes, these increases coincided with the end of the apartheid regime in the early 1990s and the adoption of more neoliberal economic policies, affording the country a notable gateway into the global economic network. Whilst these increases lasted for at least 10 years, economic integration levels notably stagnated after the early 2000s.

Figure 1 (a-e). Trends in the selected variables (1980–2020)





Source: own elaboration

Whilst the focus on these two variables alludes to interesting dynamics, so too do the included trends for the control variables. Considering the important role played by economic growth attributes within the nexus, the trends from Figure 1(c) allude to two tales. The first is particularly evident in the decreasing economic output from 1980 to the early 1990s, when, amongst other factors, the country faced significant economic sanctions, whilst likewise adopting import substitution industrialisation (ISI) policies that afforded little advantage to the levels of innovation. Nonetheless, after the advent of democratic rule, progress in this respect seemed much more positive with the influx

of many new labour market participants and a concentrated effort to move away from the inherited economic structure. Concerningly, much like the country’s endeavour to integrate meaningfully, it seems to have fallen into a middle-income growth trap, with income levels stagnating and even deteriorating over the last 12 years.

Finally, considering the trends in both levels of expenditure and inflation, both Figure 1(d) and (e), respectively, afford insight into other factors concerning levels of price stability and spending patterns from officials. The latter points to a notable driver of increasing debt levels for national treasury. Substantial increases relative

to the size of the economy have occurred since the early 2000s. In contrast, however, average increases in prices have subsided significantly over the course of the past four decades, which is most probably strongly related to the adoption of a more sound monetary policy regime at the turn of the century.

3.2. Correlation analysis

Upon completion of the descriptive analysis, the study proceeded to determine the associations between the variables under

consideration. Whilst this affords some understanding of how changes in one variable are correlated with those in another, so too does it provide notable insight into the possible presence of collinearity between the independent variables. Relating to the former, results for the correlation analysis as shown in Table 3 provide evidence of positive and statistically significant (at least at the 5% level) correlations between LGDP and LDEBT, LGEP and LDEBT, LGDP and LGEP, and LECG and LGDP.

Table 3. Correlation analysis

Probability	LDEBT	LGDP	LGEP	LINF	LECG
LDEBT	1.000 -----				
LGDP		1.000 -----			
	0.396** (0.010)				
LGEP	0.706*** (0.000)	0.308** (0.049)	1.000 -----		
LINF	-0.394** (0.010)	-0.424*** (0.005)	-0.305* (0.052)	1.000 -----	
LECG	0.280* (0.075)	0.687*** (0.000)	0.219 (0.168)	-0.697*** (0.000)	1.000 -----

Note: *** indicates significance at the 1% level of significance, ** at the 5% level of significance, * at the 10% level of significance.

Source: own elaboration

In contrast to these dynamics, three relationships were found to be inversely correlated. Here LINF and LDEBT, LINF and LGDP, and LECG and LINF all exhibited statistically significant (at least at the 5% level) negative correlation coefficients. In addition to this, none of the correlation coefficients were estimated higher than the suggested threshold, implying no initial signs of multicollinearity between the regressors (Belinda and Peat, 2014).

3.3. Unit root analysis

Following the descriptive analysis, the study sought to determine the order of integration of the variables by using the ZA unit root test and checking whether the variables were indeed integrated at I(1). Additionally, it helped to identify whether there might be any variable that might possibly be integrated at the second order of integration, since these would influence the use of specific causality analysis. Table 4 below depicts the results thereof, distinguishing between

those properties with only intercept and those with intercept and trend with a single structural break. Among the five variables included, the test confirmed that in both cases, as mentioned above, at level, all variables attribute to the unit root. However, at first difference, these variables were stationary.

Table 4. Zivot–Andrews unit root test results

Variable	Intercept	Break year	Intercept and trend	Break year	Stationary
LDEBT	-3.454	1998	-2.856	2003	No
LECG	-4.838	1997	-2.464	2007	No
LGEP	-3.795	2009	-4.667	2005	No
LINF	-3.179	1989	-3.329	1992	No
LGDP	-3.480	2004	-1.919	2014	No
ΔLDEBT	-7.776***	2003	-6.789***	1988	Yes
ΔLECG	-5.192**	1993	-4.388*	1998	Yes
ΔLGEP	-5.804***	1987	-6.242***	1990	Yes
ΔLINF	-4.484	1993	-5.329***	2000	Yes
ΔLGDP	-4.218	1994	-5.172***	2007	Yes

Note: *** indicates significance at the 1% level of significance, ** at the 5% level of significance, * at the 10% level of significance.

Source: own elaboration

3.3. Bayer–Hanck results for cointegration

In light of the properties identified in the previous section, the analysis ensued with the testing of the long-run relationship between the variables using the BH cointegration technique. The results, as shown in Table 5 below, show that the calculated F-statistics for both the combined EG-J test (F-Stat = 11.962) and the EG-J-Ba-Bo test (F-Stat. = 39.313) exceeded the critical values at a 5% level of significance.

Table 5. Bayer–Hanck combined cointegration results

Model	Bayer–Hanck test	F-statistic	Critical value (5%)	Cointegration
$LDEBT = f(LECG, LGEP, LINF, LGDP)$	EG-J type test	11.962**	10.576	Yes
	EG-J-Ba-Bo test	39.313**	20.143	Yes

Note: ** indicates significance at the 5% level of significance.

Source: own elaboration

The results from Table 5 therefore confirmed the rejection of the null hypothesis of no cointegration between the variables under consideration. From this perspective, it would suggest significant long-run associations and meaningful effects between economic globalisation and public debt levels in South Africa for all the variables included in the study.

3.4. Regression results

Subsequent to the confirmation of the long-run relationships, the analysis ensued by estimating the elasticity of the relationships between each of the independent variables and the country's public debt. Here three different estimation techniques were employed, namely FMOLS, DOLS and CCR. The results from these estimations are shown in Table 6 with most being congruent to the others, with few exceptions. Among the estimations shown, economic globalisation has a significant and positive impact on rising fiscal debt in the country. Here, all three models show a positive and significant (at the 1% level of significance) influence, corroborating the idea that the manner in which the country has integrated into the global economy has contributed to sustained increases in the level of fiscal debt policymakers have incurred. Elasticity coefficients, in this regard, range from a minimum of 0.500 to 0.749, suggesting that a 1% increase in levels of economic globalisation would suggest increases ranging from 0.5% to 0.749% in the government debt levels of the country, *ceteris paribus*. The results in this respect support the findings of Bataka (2021) and those of Combes and Saadi-Sedik (2006), who also found that economic globalisation, or at least proxies for the

process, have a positive influence on central government debt levels.

While these findings are unable to definitively state whether the compensation or efficiency hypothesis holds in this scenario, considering that corporate tax rates have remained marginally higher in South Africa (28%) compared to other developing areas around the globe (OECD average = 23.05; Asian average = 21.13; South American average = 27.36) (KPMG, 2023), and while the labour market has been consistently characterised as notably rigid (Loewald et al., 2021), it would appear that these findings do lend support to the former. In this respect, probable causes of the pressure that integration has brought with it to the fiscal budget can be explained on various fronts. Empirical evidence in this regard has pointed to the increased need for higher social protection from the state in order to account for the associated risks and protection of the social environment brought on by the induced volatility in economic conditions, as well as financial and social crises (Bergh, 2021). Within this context, the skill-biased technological changes and intensified demand directed towards high-value-added service sectors through both foreign trade and financial capital flows seem to have exacerbated the country's problems of a large surplus of a low-skilled workforce and a lack of economic diversification (World Bank, 2022). This has consequently increased the social challenges of unemployment, poverty, and inequality. In this respect, levels of government debt have been driven by changing the composition of spending away from capital-oriented foci towards social expenditure that prioritises transfers and subsidies, all with the purpose of mitigating the social impact of these challenges.

Table 6. Regression results of FMOLS, DOLS and CCR estimation

Variable	FMOLS			DOLS			CCR		
	Coeff.	t-stat. (Prob.)	Cen. VIF	Coeff.	t-stat. (Prob.)	Cen. VIF	Coeff.	t-stat. (Prob.)	Cen. VIF
LECG	0.749	[8.087] (0.000***)	4.971	0.677	[7.800] (0.000***)	4.120	0.500	[7.387] (0.000***)	3.971
LGEP	-0.170	[-0.729] (0.471)	2.446	0.724	[2.521] (0.019**)	2.240	0.474	[1.651] (0.107)	2.446
LINF	0.624	[16.780] (0.000***)	1.249	0.433	[6.868] (0.000***)	1.296	0.526	[10.733] (0.000***)	1.249
LGDP	-0.769	[-2.230] (0.032**)	3.178	-1.039	[-0.990] (0.333)	3.645	0.753	[1.167] (0.251)	3.178
C	3.408	[1.309] (0.198)	-----	-1.317	[-0.359] (0.722)	-----	-7.686	[-3.421] (0.001***)	-----
R ²		0.923			0.905			0.932	
Adjusted R ²		0.910			0.892			0.930	

Note: **** shows the significance at 1% level and ** significance at the 5% level; [] shows the t-stats.; () shows the p-values; estimated centred VIF values for all independent variables across the three estimations between 1.249 and 4.971 all below the 5 point threshold (Menard, 2001), indicating no serious presence of collinearity.

Source: own elaboration

While these examples can suggest the indirect nature of debt levels, other more direct considerations should also be acknowledged. In turn, the increased trade liberalisation of the South African economy and its selection of major trading partners could have contributed to decreased customs revenue. Moreover, from a financial point of view, Asongu and Nnanna (2020) state that higher levels of political instability and corruption also induce the probability of significant levels of capital flight. This comes on the basis of investors shying away from economic environments where disrespect for the rule of law is systemic. Financial liberalisation in the face of higher levels of economic globalisation in this respect has increased the

elasticity of capital flows for such governance risks. The loss of valuable financial resources in this respect poses considerable problems in terms of possible tax revenue that is foregone (Fisseha, 2022). In both these instances, government debt levels can be aggravated not so much by invoking induced spending to relieve social pressure, but rather restricting the capability of fiscal policy to garnish sufficient levels of revenue. This might definitely be considered a plausible cause within the South African context, with the country grappling with high levels of corruption involving the political elite, the private sector, and more recently other prominent international financial networks (Ndikumana et al., 2020).

In relation to the main findings, estimates for inflation confirm a significant (at the 1% level of significance) and positive relationship with public debt levels, confirmed across all three different estimation procedures. Here, coefficients shown for the LINF variable in Table 6 range from 0.433 to 0.624. This would indicate that a 1% increase in the inflation rate would cause an increase in the real value of public debt by between 0.433% and 0.624%. This finding is intriguing as it contrasts with those of Fukunaga et al. (2022) and Manalo et al. (2022). While these studies suggest that price pressures erode the value of debt obligations by transferring the burden from the borrower to the lender, this does not seem to hold in the South African case. Rather, findings here must be considered in the context of the long-term nature of the analysis. As Neely (2022) states, considering the temporal nature of the dynamics between inflationary pressures and government debt levels, while mounting price pressures can reduce the value of debt in the actual term, on the basis of expectations of future higher inflation, inflation induces higher interest demands from bond holders. In this respect, real debt stock levels are set to increase as interest payments become more expensive in the long term.

Furthermore, upon reviewing the relationships between the dependent variable and the remaining control variables, the estimates of government expenditure and GDP per capita seem to validate the expected relationship. In this case, government expenditure in two of the three estimations shows a positive relationship with public debt. However, only in the DOLS estimation does it seem to exhibit a statistically significant (at the 5% level of significance) impact. These findings support the aforementioned insights in which debt is believed to be aggravated through the pressure and need for greater social assistance (Rodrik, 1998; Dreher et al., 2008) as the country has integrated, pointing to more

unproductive spending objectives. The implications from this perspective, especially within the context of a globalised South African economy, are significant. Given that economic globalisation has driven social expenditure, it implies that government spending directed towards enabling capital investment has been restricted. This could have significant adverse consequences in a number of realms pertaining to the attraction of much-needed FDI, job creation and the ability of government to enable investment and asset formation, all which have the ability to stimulate future additional revenue streams and economic growth. Again, this points to the long-run consequences of adverse global integration. While social spending in the short run mitigates adverse external shocks, a widening budget deficit constrains the ability of the public sector to provide an enabling environment through its other spending objectives (investment in school infrastructure, public transport, renewable energy, healthcare, etc.).

Finally, the results from Table 6 also provide an insight into the relationship between the natural logarithm of economic growth (GDP per capita) levels and the logarithm of levels of public debt. As the last control variable added to the model, the results would be expected to show a negative relationship between these estimates (Van Cauwenbergh and Laleman, 2018). This *a priori* supposition derives its logic from both sides of the revenue and spending spectrums of levels of government debt. On the one hand, greater levels of income are believed to induce less pressure (required social expenditure) on fiscal policy to provide a more egalitarian social environment (Pettinger, 2019). On the other hand, greater levels of income, based on consumer spending (C), higher levels of infrastructure development (I), and export performance (X), would suggest greater levels of tax revenue on the basis of the Keynesian framework (Ayenew, 2016). The results here, much like those for levels of

government expenditure, are somewhat inconclusive. From the three models estimated, two (FMOLS, DOLS) support the *a priori* result, with the FMOLS estimation suggesting a statistically significant (at the 5% significance level) impact of GDP per capita levels on public debt levels. The coefficient from the model in fact infers that a 1% increase in income levels would reduce public debt levels by approximately 0.77%. Similar findings have also been found by Mothibi and Mncayi (2019) and Swamy (2020). From this finding, the analysis showcases just how important it is to ensure that fiscal objectives, especially when budget deficits and spending are considered, should be directed towards optimising the capacity of the economy for growth. While social expenditure directed towards alleviating problems such as poverty and inequality is crucial, governments must understand the sustainable impact that the creation of an inclusive and expanding economic structure has through increasing levels of infrastructure.

3.5. Toda–Yamamoto Granger causality analysis

Following the regression analysis, the Toda–Yamamoto Granger causality analysis was performed. This was done after confirming co-integration relationships that implied the potential of underlying causal effects (Granger, 1988). Insights from this type of analysis are especially noteworthy for policymakers. Understanding the causal effects would allow for better comprehension and strategic action in the globalisation–debt nexus. The results of the analysis are provided in Table 7 below. It can be concluded that there is a unidirectional relationship between economic globalisation and public debt; that is, causality runs from economic globalisation to public debt, suggesting that changes in government debt levels are

consequential to changes in the levels of economic globalisation. In fact, the associated *p*-value of 0.000 is indicative of the rejection of the null hypothesis (no causality) at the 1% significance level. In this respect, the findings confirm that the manner in which the country has integrated has increased its susceptibility, at least considering its fiscal finances, to external economic shocks. This can possibly be explained by its dependence on a narrow range of export commodities (Signé and Johnson, 2021) and a deterioration in institutional strength to adequately mitigate the associated effects of these shocks (Thakoor, 2020).

In addition to these findings, the results shown in Table 7 also suggest the presence of a causal relationship that runs from levels of public debt to government expenditure. The statistically significant (at a 10% significance level) and unidirectional nature links well with the regression results. For example, given the significant positive impact of expenditure on debt levels, the causal link here can be explained based on the constraining effects of high and rising debt levels, particularly towards stimulating investment. As Jeločnik et al. (2016) explain, with higher debt levels, invoked partly by higher levels of integration, the government is required to direct a large portion of its budget to debt servicing costs. In the South African case, this has meant that fiscal policy has been limited in its ability to pursue notable investment spending. This has indeed been true, with the SARB (2021:1) reporting that debt service costs have been the fastest growing expenditure category over the last decade. In fact, these costs as a percentage of total government expenditure have more than doubled since the onset of the global financial crisis (GFC) of 2007–2008, increasing from 8.9% in 2008 to 18% in 2023 (National Treasury, 2023).

Table 7. Toda–Yamamoto Granger causality results

Variable	Dependent variable				
	LDEBT	LECG	LGEP	LCPI	LGDP
LDEBT	-----	0.012 (0.993)	5.646 (0.059*)	1.981 (0.371)	4.123 (0.127)
LECG	16.480 (0.000***)	-----	4.484 (0.106)	1.569 (0.456)	2.455 (0.293)
LGEP	1.924 (0.382)	0.605 (0.739)	-----	2.018 (0.364)	5.141 (0.076*)
LCPI	2.584 (0.274)	5.035 (0.081*)	0.916 (0.632)	-----	0.381 (0.826)
LGDP	0.736 (0.692)	2.713 (0.257)	0.321 (0.851)	8.747 (0.012**)	-----

Note: *** indicates significance at the 1% level of significance, ** at the 5% level of significance, * at the 10% level of significance.

Source: own elaboration

Further results from Table 7, as with those in the tables above, signify two statistically significant unidirectional relationships. These include those emanating from levels of economic growth to inflation (significant at the 5% level of significance), as well as government expenditure to levels of growth (significant at 10% level of significance). The former is testament to the notion that changes in higher price levels are concomitant to changes in growth within the frameworks of countries considered to still be largely intertwined in the developing process (Di Pietro and Sawhney, 1999). The latter, however, confirms that over the last four decades, changes in government expenditure have brought about changes in GDP per capita levels. For this, again, the results speak to just how noteworthy it is for fiscal spending to be directed prudently, focusing more on expanding key social infrastructure and industrial sectors of the economy, especially within the South African context. As Barro (1990) reiterates, these represent important contributions not only to a more stable and financially capable fiscal policy (reducing the fiscal deficits), but

also higher levels of labour productivity and employment.

Conclusion and recommendations

In both the theoretical review and empirical analysis, the study has shown just how noteworthy the influence of connected and integrated economic processes is. Globalisation from this point of view has arguably been among the most influential occurrences of modern life. On the one hand, the processes, specifically from an economic perspective, have afforded countries various advantages, among which are significant influxes of FDI, the formation of key trade partnerships and the knowledge spillovers and technological innovation that have accompanied these flows. This insight has also shown that the process, in certain circumstances, has afforded fiscal policymakers the potential to act as meaningful and enabling role players in their social environments. On the one hand, this comes from the supplementary foreign injections that have offered additional revenue streams, affording governments the financial capability to invest in

key infrastructural and social areas such as education, healthcare, and wider industrial projects. Likewise, based on the manner in which countries have integrated economically, especially considering the East Asian case, globalisation presents an opportunity to improve social environments (by spurring industrialisation, lowering unemployment levels, and creating inclusive growth environments), consequently reducing the need for greater social assistance and fiscal financial pressure.

Despite this overarching positive potential, the study has shown that the nexus between economic globalisation and public finances is a much more complex phenomenon. The findings in this regard point to various significant considerations. Among the first of these lies the fact that the manner in which economic globalisation affects public debt is not only dependent on external forces, but also on the endogenous environments of economies. The South African case, from this perspective, provided an intricate event. The results in this respect pointed to the fact that the economy's unique integration process has largely aggravated its debt levels. This has several possible causes, including aspects relating to its positioning in world systems as a small middle-income economy struggling to position itself far from the periphery of global economic processes. Lacklustre positions in GVCs, the lack of sufficient economic diversification and the formation of foreign trade and financial relationships, at least qualitatively, have not contributed to more enabling social environments in any meaningful sense. More so, it has remained particularly susceptible to external economic shocks, all of which have imposed serious pressure on fiscal policymakers. So too has the country's domestic environment, with large surpluses of low-skilled labour, significantly high levels of poverty and ever-increasing levels of corruption, posed noteworthy concerns considering the

skill-biased technological nature of global economic processes as well as the mobility of capital in an increasingly competitive financial system.

All of these dynamics have posed noteworthy implications for fiscal policymakers and the country's fiscal budget. As public debt levels continue to rise, it has largely restricted their ability to act as a meaningful role player not only in alleviating social pressures in the short term, but more importantly providing the required capital stimulus to create a more inclusive economy – one that could also be better equipped to take advantage of the benefits that the globalisation process has to offer. Based on this, the study therefore suggests the prioritisation of policies that aim to reduce both the pressure on the revenue and spending sides of the current challenge. For the former, key strategies directed towards the diversification of the economic base, the strengthening of key domestic industries, and the promotion of greater levels of regional partnership formation must be pursued to better position the country in the global economic framework and attract additional revenue streams. Moreover, on the spending side, investment in key infrastructure, human capital development, and fostering an inclusive growth environment should be prioritised. These initiatives, together with sound fiscal accountability and the better management of debt through alternative sources of financing, would all help the country to take better advantage of its economic integration and subsequently improve its fiscal outlook in the long run. While this study afforded notable insight, based on its limitations, future areas of research into this dynamic can also be pursued. This should include the differentiation between the influence of both *de jure* and *de facto* globalisation, as well as analyses directed towards further understanding possible non-linear relationships between the variables under consideration.

Moreover, studies could also expand on the role of more regional partnerships, especially within the African context, to better comprehend these dynamics when considering the interconnectedness of similar economic structures.

References

- Adusei, M. (2012), Financial development and economic growth: is Schumpeter right? *British Journal of Economics, Management and Trade* 2(1), 265–278.
- Al-Rodhan, N.R., Stoudmann, G. (2006), *Definitions of globalization: a comprehensive overview and a proposed definition*, Geneva: Geneva Centre for Security Policy.
- Asongu, S.A., Nnanna, J. (2020), Governance and the capital flight trap in Africa, *Transnational Corporations Review*, 12(3), 276–292. DOI: <https://doi.org/10.1080/19186444.2020.1771123>
- Awad, A. (2019), Economic globalisation and youth unemployment: evidence from African countries, *International Economic Journal*, 33(2), 252–269. DOI:10.1080/10168737.2019.1604787
- Azzimont, M., de Francisco, E., Quadrini, V. (2014), Financial globalization, inequality, and the rising public debt, *The American Economic Review*, 104(8), 2267–2302. DOI:10.1257/aer.104.8.2267
- Banerjee, A, Dolado, J., Mestre, R. (1998), Error-correction mechanism tests for cointegration in a single-equation framework, *Journal of Time Series Analysis*, 19(1), 267–283. DOI:
- Barro, R. J. (2013), Health and economic growth, *Annals of Economics and Finance*, 14(2), 329–366. DOI: <https://doi.org/10.1111/1467-9892.00091>
- Barro, R.J. (1990), Government spending in a simple model of endogenous growth, *Journal of Political Economy*, 98(5), 103–125. DOI: <https://doi.org/10.1086/261726>
- Bataka, H. (2021), Economic globalization and public debt in Sub-Saharan Africa, *International Journal of Finance & Economics*, 2021, 1–16. DOI: <https://doi.org/10.1002/ijfe.2506>
- Bayer, C., Hanck, C. (2013), Combining non-cointegration tests, *Journal of Time Series Analysis*, 34(1), 83–95. DOI: <https://doi.org/10.1111/j.1467-9892.2012.00814.x>
- Belinda, B., Peat, J. (2014). *Medical statistics: a guide to SPSS data analysis and critical appraisal*. 2nd ed. London: Wiley.
- Bergh, A. (2021), The compensation hypothesis revisited and reversed, *Scandinavian Political Studies*, 44(2), 140–147. DOI: <https://doi.org/10.1111/1467-9477.12191>
- Boswijk, P. (1995), Efficient inference on cointegration parameters in structural error correction models, *Journal of Econometrics*, 69(1), 133–158. DOI: [https://doi.org/10.1016/0304-4076\(94\)01665-M](https://doi.org/10.1016/0304-4076(94)01665-M)
- Burrie, P., Checherita-Westphal, C., Jacquinot, P. Schön, M., Stähler, N. (2020), *Economic consequences of high public debt: evidence from three large scale DSGE models*, ECB working paper no. 2450, Frankfurt: European Central Bank.
- Calitz, E. (2000), *Fiscal implications of the economic globalisation of South Africa*, *South African Journal of Economics*, 68(4), 252–269. DOI: <https://doi.org/10.1111/j.1813-6982.2000.tb01270.x>
- Cerna, L. (2013), *The nature of policy change and implementation: a review of different theoretical approaches*, Paris: OECD publishing.
- Çolak, O., Özkaya, M. H. (2020), The nexus between external debts and military expenditures for the selected transition economies: a panel threshold regression approach, *Defence and Peace Economics*, 32(7), 882–898. DOI: <https://doi.org/10.1080/10242694.2020.1736779>
- Combes, J., Saadi-Sedic, T. (2007), How does trade openness influence budget deficits in developing countries? *The Journal of Development Studies*, 42(8), 1401–1416. DOI: <https://doi.org/10.1080/00220380600930762>
- Cuervo-Cazurra, Á., Doz, Y., Gaur, A. (2020), Scepticism of globalization and global strategy: increasing regulations and countervailing strategies, *Global Strategy Journal*, 10(1), 3–31. DOI: <https://doi.org/10.1002/gsj.1374>

- de Jongh, J. (2020), Economic globalisation and government size: testing the compensation hypothesis in South Africa's public sector, *International Journal of Business and Management Studies*, 12(1), 66-83.
- de Jongh, J.J. (2022), How has economic globalisation affected industrialisation in South Africa? Answers from an ARDL approach, Proceedings of the Social Sciences International Research Conference, 18-21 October, 2022, Mauritius. Retrieved from: <https://commerce.nwu.ac.za/sites/commerce.nwu.ac.za/files/files/SSIRC/SSIRC-2022-Proceedings-M-2023-ISBN.pdf> (accessed: 18 April 2023).
- Dreher, A. (2006), Does globalization affect growth? Evidence from a new index of globalization, *Applied Economics*, 38(10), 1091-1110. DOI: <https://doi.org/10.1080/00036840500392078>
- Dreher, A. Gaston, N., Martens, P. (2008), Measuring globalisation: gauging its consequences, New York: Springer.
- Engle, R., Granger, C. (1987). Co-integration and error correction: representation, estimation, and testing, *Econometrica: Journal of the Econometric Society* 2(1), 251-76. DOI: <https://doi.org/10.2307/1913236>
- Fahmi, M.S., Geetha, C., Mohidin, R. (2019), Testing for unit roots and structural breaks in Malaysia unanticipated macroeconomic variables, *Malaysian Journal of Business and Economics (MJBE)*, 6(2), 1-12. DOI: <https://doi.org/10.51200/mjbe.v0i0.2161>
- Figge, L., Martens, P. (2014), Globalisation continues: the Maastricht globalisation index revisited and updated, *Globalisations*, 11(6), 875-893. DOI: <https://doi.org/10.1080/14747731.2014.887389>
- Fisseha, F.L. (2022), Tax revenue potential and effort in Ethiopia: a comparative analysis of stochastic frontier analysis vs utility maximisation function as a new measure of tax effort, *African Multidisciplinary Tax Journal*, 2022(1), 307-328. DOI: https://hdl.handle.net/10520/ejc-jlc_amtj_v2022_n1_a17
- Friedman, T. I. (2000), *The Lexus and the olive tree: understanding globalisation*, New York: Springer.
- Fukunaga, I., Komatsuzaki, T., Matsuoka, H. (2022), Inflation and public debt reversals in advanced economies, *Contemporary Economic Policy*, 40(1), 124-137. DOI: <https://doi.org/10.1111/coep.12537>
- Granger, C.W. (1988), Some recent development in a concept of causality, *Journal of Econometrics*, 39(1-2), 199-211. DOI: [https://doi.org/10.1016/0304-4076\(88\)90045-0](https://doi.org/10.1016/0304-4076(88)90045-0)
- Gygli, S., Haelg, F., Potrafke, N., Sturm, J. E. (2019), The KOF globalization index: revisited, *The Review of International Organizations*, 14(3), 543-574. DOI: <https://doi.org/10.1007/s11558-019-09344-2>
- Haelg, F. (2020), *The KOF globalization index: a multidimensional approach to globalization*. *Jahrbücher für Nationalökonomie und Statistik*, 240(5), 691-696. DOI: <https://doi.org/10.1515/jbnst-2019-0045>
- Held, D., McGrew, A., Goldblatt, D., Perraton, J. (1999), *Global transformations: politics, economics and culture*, in: C. Pierson and S. Tormey (Eds.), *Politics at the edge* (pp. 14-28), London: Palgrave Macmillan.
- Holtfrerich, C. Feld, L., Heun, W., Illing, G., Kirchgässner, G., Kocka, J., Schularick, M., Streeck, W., Wagschal, U., Walter, S., von Weizsäcker, C. C. (2016), *Government debt: causes, effects and limits*, Berlin: Berlin-Brandenburg Academy of Sciences and Humanities.
- Ijeoma, E.O.C. (2008), Globalisation and reflective policy: making in South Africa, *Journal of Public Administration*, 43(3.1), 99-112. DOI: <https://hdl.handle.net/10520/EJC51639>
- IMF (International Monetary Fund), (2002), *Globalization: threat or opportunity?* Retrieved from: <https://www.imf.org/external/np/exr/ib/2000/041200to.htm#II> (accessed 26 July 2022).
- IMF (International Monetary Fund). (2003), *Effects of financial globalization on developing countries: some empirical evidence*, IMF occasional paper no. 220, Washington, D.C.: International Monetary Fund.

- IMF (International Monetary Fund). (2023), World economic outlook database. Retrieved from: <https://www.imf.org/en/Publications/SPROLLS/world-economic-outlook-database?s#sort=%40imfdate%20descending> (accessed: 31 March 2023).
- Inman, R.P., Rubinfeld, R.L. (2013), Understanding the democratic transition in South Africa, *American Law and Economics*, 15(1), 1-38. DOI: <https://doi.org/10.1093/aler/ahs023>
- Jeločnik, M., Zubovic, J. & Djukic, M. (2016), *Implications of globalization on growing external debt in eight transition economies*, in: M. Jeločnik, J. Zubovic and M. Djukic (Eds.), *Global perspectives on trade integration and economies in transition* (pp.80-104), Pennsylvania: IGI Global.
- Jenserud, I. (2018), *Analysing measurements of international transportation costs*, Potchefstroom: North-West University, (Dissertation – MCom).
- Johansen, S. (1991), Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models, *Econometrica: Journal of the Econometric Society*, 2(1), 1551-1580. DOI: <https://doi.org/10.2307/2938278>
- Kaufman, R.R., Segura-Ubiergo, A. (2001), Globalization, domestic politics, and social spending in Latin America: a time-series cross-section analysis, *World Politics*, 53(4), 553-587. DOI: [doi:10.11353/wp.2001.0016](https://doi.org/10.11353/wp.2001.0016)
- Kim, D., Seun, Y., Lin, S., Hsieh, J. (2018). Government size, government debt and globalization, *Applied Economics*, 50(52), 2729-2803. DOI: <https://doi.org/10.1080/00036846.2017.1409418>
- Kim, W. (2003), *Does capital account liberalization discipline budget deficit?* Review of International Economics, 11(5), 830-844. DOI: <https://doi.org/10.1046/j.1467-9396.2003.00420.x>
- KOF Swiss Economic Institute. (2023), KOF globalisation index, Retrieved from: <https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html> (accessed 1 April 2023).
- Kose, M. A., Nagle, P., Ohnsorge, F., Sugawara, N. (2021), *What has been the impact of COVID-19 on debt? Turning a wave into a tsunami*, World Bank working paper no. 99, Washington, D.C.: World Bank Group.
- KPMG. (2023), Corporate tax rates table, <https://kpmg.com/za/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html#:~:text=In%20general%20C%20the%20corporation%20tax,public%20and%20private%20limited%20companies>. Date of access: 12 March 2023.
- Lammers, I., van Gerven-Haanpää, M.M., Treib, O. (2018), Efficiency or compensation? The global economic crisis and the development of the European Union's social policy, *Global Social Policy*, 18(3), 304-322. DOI: <https://doi.org/10.1177/1468018118790957>
- Lane, M. P. R., Milesi-Ferretti, M. G. M. (2000), *External capital structure: theory and evidence*, IMF working paper no.152, Washington, D.C: International Monetary Fund.
- Leal, P.H., Marques, A.C., Shahbaz, M. (2021), The role of globalisation, de jure and de facto, on environmental performance: evidence from developing and developed countries, *Environment, Development and Sustainability*, 23(5), 7412-7431. DOI: <https://doi.org/10.1007/s10668-020-00923-7>
- Leibbrandt, M., Shipp, T. (2019), *Reducing inequalities in South Africa: progress on equality thwarted by slow growth and success of top earners*, WIDER policy brief no. 2019/2, Helsinki: UNU-WIDER.
- Loewald, C., Makrelov, K., Wörgötter, A. (2021), *Addressing low labour utilisation in South Africa*, SARB working paper no. 21/09, Pretoria: South African Reserve Bank.
- Lutkevich, B. (2022), *What is globalisation?* Retrieved from: <https://www.techtarget.com/searchcio/definition/globalization> (accessed 22 April 2023).
- Manalo, J.L., Villamiel, M., Cruz, E.D. (2022), Macroeconomic determinants of public debt in the Philippines, *Journal of Economics, Finance and Accounting Studies*, 4(1), 530-551. DOI: <https://doi.org/10.32996/jefas.2022.4.1.40>
- Marais, H. 2018. *The climate crises: South African and global democratic eco-socialist alternatives*, Johannesburg: University of the Witwatersrand.
- Menard, S. (2001). *Applied logistic regression analysis*. 2nd ed. New York: SAGE Publications.

- Mikalauskiene, A., Streimikiene, D., Mulagalejeva, K. (2016), Assess the impact of globalisation processes by indices, *Economics & Sociology*, 9(4), 82-100. DOI: 10.142 54/2071-789X.2016/9-4/5
- Mothibi, L., Mncayi, P. (2019), Investigating the key drivers of government debt in South Africa: a post-apartheid analysis, *International Journal Of eBusiness and eGovernment Studies*, 11(1), 16-33. DOI: 10.34111/ijebeg.20191112
- Muller, S. M. (2019), *South Africa's finances are in bad shape: it's running out of time to fix them*, Retrieved from: <https://theconversation.com/south-africas-finances-are-in-bad-shape-its-running-out-of-time-to-fix-them-121464> (accessed 7 July 2022).
- Nabi, I. (2016), *Globalization: what the West can learn from Asia*, Brookings, 30 Jun. Retrieved from: <https://www.brookings.edu/blog/future-development/2016/06/30/global-ization-what-the-west-can-learn-from-asia/#:~:text=Globalization%20has%20been%20hugely%20beneficial,exchanges%2C%20and%20rapid%20economic%20growth.> (accessed 11 August 2022).
- National Treasury. (2021). *Debt management report*, Retrieved from: <http://www.treasury.gov.za/publications/other/Debt%20Report/Debt%20Management%20Report%202020-21.pdf> (accessed 9 May 2022).
- National Treasury. (2022), *Budget 2022*, Retrieved from: <http://www.treasury.gov.za/documents/national%20budget/2022/speech/speech.pdf> (accessed 9 May 2022).
- National Treasury. (2023), *Budget 2023: budget review*, Pretoria: Government Printer.
- Ndikumana, L., Naidoo, K., Aboobaker, A. (2020), *Capital flight from South Africa: a case study*, PERI working paper no. 516, Amherst, MA: Political Economy Research Institute.
- Neely, C. (2022), *Inflation and the real value of debt: a double-edged sword*, Retrieved from: <https://www.stlouisfed.org/on-the-economy/2022/aug/inflation-real-value-debt-double-edged-sword> (accessed 12 February 2023).
- Ngondo, M., Khobai, H. (2018), *The impact of exchange rate on exports in South Africa*, Retrieved from: https://mpira.ub.uni-muenchen.de/85079/1/MPRA_paper_85079.pdf (accessed 21 February 2023).
- Okonjo-Iweala, N., Coulibaly, B. S. (2019), *Making globalization work for Africa*, Brookings. Retrieved from: <https://www.brookings.edu/opinions/making-globalization-work-for-africa/> (accessed 12 February 2023).
- Ostadi, H., Ashja, S. (2014), *The relationship between external debt and foreign direct investment in D8 member countries (1995–2011)*, *WALIA Journal*, 30(S3), 18–22.
- Park, J. (1992), Canonical cointegrating regressions, *Econometrica*, 60(1), 119–143. DOI: <https://doi.org/10.2307/2951679>
- Porto, A., Porto, N., Garbero, N. (2016), The impact of globalization on subnational expenditures: efficiency and compensation effects, *Journal of Finance and Economics*, 4(2), 1–22. DOI: <http://dx.doi.org/10.12735/jfe.v4n2p01>
- Pyeman, J., Noor, N. H. H., Mohamad, W. M. F. W., Yahya, A. A. (2016), Factors affecting external debt in Malaysia: an empirical investigation, *International Journal of Economics and Financial Issues*, 7(1), 234–240. DOI: https://doi.org/10.1007/978-981-287-426-9_39
- Raeskysa, D.G.S., Suryandaru, R.A. (2020), Competitiveness and FDI inflows in ASEAN member countries, *International Journal of Business and Economic Sciences Applied Research*, 1(2), 14–20.
- Rahman, M.S. Junsheng, H., Shahari, F., Aslam, M., Mehedi, M., Hasanul Banna, M., Liya, M. (2015), Long-run relationship between sectoral productivity and energy consumption in Malaysia: an aggregated and disaggregated viewpoint, *Energy* 86(1), 436–45. DOI: <https://doi.org/10.1016/j.energy.2015.04.049>
- Rodrik, D. (1998), Why do more open economies have bigger governments? *Journal of Political Economy*, 106(5), 997–1032. DOI: <https://doi.org/10.1086/250038>

- Rodrik, D. (2018), *New technologies, global value chains, and the developing economies*, NBER working paper no. 25164, Cambridge, MA: National Bureau of Economic Research.
- Saikkonen, P. (1992), *Estimation and testing of cointegrated systems by an autoregressive approximation*, *Econometric Theory*, 8(1), 1–27. DOI: 10.1017/S0266466600010720
- Salahuddin, M., Vink, N., Ralph, N., Gow, J. (2020), *Globalisation, poverty, and corruption: retarding progress in South Africa*, *Development Southern Africa*, 37(4), 617–643. DOI:10.1080/0376835X.2019.1678460
- SARB (South African Reserve Bank). (2021), *Government debt-service costs dilemma: quarterly bulletin*, Pretoria: South African Reserve Bank.
- SARB (South African Reserve Bank). (2023), Online statistical query, Retrieved from, <https://www.resbank.co.za/en/home/what-we-do/statistics/releases/online-statistical-query> (accessed 12 February 2023).
- Sebake, B.K. (2017), *Neoliberalism in the South African post-apartheid regime: economic policy positions and globalisation impact*, Retrieved from: http://ulspace.ul.ac.za/bitstream/handle/10386/1860/sebake_neoliberalism_2017.pdf (accessed: 12 March 2023).
- Sener, S., Bayrakdar, S., Hacıoglu, V. (2015), The analysis for the validity of compensation and efficiency hypotheses in Turkey between 1975 and 2013, *Procedia – Social and Behavioral Sciences*, 195 (2015), 624–631. DOI: <https://doi.org/10.1016/j.sbspro.2015.06.143>
- Signé, L., Johnson, C. (2021), *Africa's mining potential: trends, opportunities, challenges, and strategies*, Policy paper no. 21/10, Rabat: Policy Center for the new South.
- Sinha, P., Arora, V., Bansal, V. (2011), *Determinants of public debt for middle income and high-income group countries using panel data regression*, MPRA working paper no. 32079, Munich: University Library of Munich.
- Solakoglu, O. (2016), Three different perspectives on the role of the nation-state in today's globalized world, *European Scientific Journal*, 20(1), 1–8.
- Stats SA (Statistics South Africa). (2019), *Five facts about poverty in South Africa*, Retrieved from: <https://www.statssa.gov.za/?p=12075> (accessed 4 July 2022).
- Swamy, V. (2020), Debt and growth: decomposing the cause-and-effect relationship, *International Journal of Finance & Economics*, 25(2), 141–156. DOI: <https://doi.org/10.1002/ijfe.1729>
- Thakoor, V. (2020), *Market power, growth, and inclusion: the South African experience*, IMF working paper no. 20/206, Washington, D.C.: International Monetary Fund.
- Toda, H., Yamamoto, T. (1995), Statistical inference in vector autoregressions with possibly integrated processes, *Journal of Econometrics*, 66(1), 225–50. DOI: [https://doi.org/10.1016/0304-4076\(94\)01616-8](https://doi.org/10.1016/0304-4076(94)01616-8)
- Tsunekawa, K. (2019), *Globalisation and the emerging state: past advance and future challenges emerging states and economies*, in: T. Shiraishi and T. Sonobe (Eds.), *Emerging states and economies* (pp. 31–71), Singapore: Springer.
- Ukpere, W.I., Slabbert, A.D. (2009), A relationship between current globalisation, unemployment, inequality and poverty, *International Journal of Social Economics*, 36(1/2), 37–46. DOI: 10.1108/03068290910921172
- Van Cauwenbergh, L., Laleman, J.P. (2018), *Rapid public debt build-up in sub-Saharan Africa*, Retrieved from: <https://www.credendo.com/country-news/rapid-public-debtbuild-sub-saharan-africa> (accessed 12 April 2023).
- WEF (World Economic Forum). (2019), *5 hidden ways that globalisation is changing*, Retrieved from: <https://www.weforum.org/agenda/2019/02/5-hidden-ways-that-globalization-is-changing> (accessed 9 May 2022).
- World Bank. (2022), *New world bank report assesses sources of inequality in five countries in Southern Africa*, Retrieved from: <https://www.worldbank.org/en/news/pressrelease/2022/03/09/new-world-bank-report-assesses-sources-of-inequality-in-five-countries-in-southern-africa> (accessed 4 July 2022).

- World Bank. (2023), World development indicators, Retrieved from: <https://databank.worldbank.org/source/world-development-indicators> (accessed 1 April 2023).
- Wu, J, Bahmani-Oskooee, M., Chang, T. (2018), Revisiting purchasing power parity in G6 countries: an application of smooth time-varying cointegration approach, *Empirica* 45(1), 187–96. DOI: <https://doi.org/10.1007/s10663-016-9355-1>
- Wu, W., Zhang, L., Mahalik, M.K., Wan, Q., Gozgor, G., Lu, Z. (2022), Revisiting the globalisation-welfare state nexus: what about the quality of the social welfare? *Economic Research-Ekonomska Istraživanja*, 1, 1-29. DOI: <https://doi.org/10.1080/1331677X.2022.2147978>
- Yildirim, D., Orman, E.E. (2018), The Feldstein-Horioka puzzle in the presence of structural breaks: evidence from China, *Journal of the Asia Pacific Economy*, 23(1), 374–392. DOI:
- Yildiz, F., Sağdıç, E.N. (2021), *The effects of globalisation on public expenditures, tax revenues, and public debt: empirical evidence from the European countries*, in: F. Yildiz, and E.N. Sağdıç (Eds.), *Handbook of research on institutional, economic and social impacts of globalisation and liberalisation* (pp.287-305), Pennsylvania: IGI-Global.
- Zafar, S., Butt, M. S. (2008), *Impact of trade liberalization on external debt burden: econometric evidence from Pakistan*, MPRA working paper no. 9548, Munich: University Library of Munich.
- Zivot, E., Andrews, D. (1992), Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis, *Journal of Business and Economic Statistics*, 20(1), 25–44. DOI: <https://doi.org/10.1198/073500102753410372>

Moitshepi Moeng, MCom candidate in Economics. She is a student at the North-West University and fellow researcher in the TRADE research focus area. She completed her honours degree in Economics in 2022 Cum Laude. Her research interests include, public debt management with a particular focus in globalisation studies. ORCID no. <https://orcid.org/0000-0001-5109-843X>

Jacques de Jongh, holds a PhD in Economics and currently serves as a Senior Lecturer and Programme Leader for the Economics Subject Group at the North-West University. He is a senior researcher of the TRADE research focus area. His primary research focus is on globalisation and economic development and research contributions extend across several domains, including labor market studies, macroeconomics, and small business development. Jacques has published over 30 peer-reviewed and accredited manuscripts and has attended several national and international conferences. He serves as a reviewer for a number of Scopus and WoS-listed journals within his area of expertise. ORCID no. <https://orcid.org/0000-0001-8672-0292>

Value Creation and Value Capture Revisited: Resource, Entrepreneurial and Relational Perspectives

WOJCIECH DYDUCH, MAGDALENA DOMINICZEWSKA, JAKUB KUBICZEK

Abstract

The essence of conducting any organisation's activities is the implementation of strategic actions that will enable value creation and value capture (VCVC), resulting in the effective achievement of set objectives. Although scholarly discussion has scrutinised the subject of VCVC, the crises of recent years, as well as the consequences thereof, make it necessary to revise the research area of VCVC. The purpose of this study is to demonstrate the literature search from the past five years that identifies three dominant perspectives in approaching value creation: resource-based view (RBV), entrepreneurial orientation (EO) and relational view (RV). Seen as the strategic orientations of firms, these three perspectives can be applied in times of uncertainty to optimise the value creation and capture processes. The search results showed that to date the most significant means of improving value creation have been digitalisation, adopting new technologies, attracting external partnerships, patenting, forming alliances, and using entrepreneurial orientation and dynamic capabilities to quickly shift the necessary resources in order to seize opportunities.

Key words

value, VCVC, resource-based view, entrepreneurial orientation, relational view, stakeholders.

DOI: 10.23762/FSO_VOL11_N04_3

Wojciech Dyduch

e-mail: wojciech.dyduch@ue.katowice.pl

Magdalena Dominiczewska

e-mail: magdalena.dominiczewska@ue.katowice.pl

Department of Entrepreneurship,
University of Economics in Katowice,
Poland

Jakub Kubiczek¹

e-mail: jakub.kubiczek@edu.uekat.pl

Department of Economic
and Financial Analysis,
University of Economics
in Katowice, Poland

¹ Corresponding author

Introduction

The prosperity of an organisation requires effective strategic actions (Dunn, 2022). In a complex, dynamic and unpredictable environment, the firm's ability to adapt to changes, both static and dynamic, is increasingly

important (Panico, 2023). This skill, understood as dynamic capability, leads organisations to strive to create and capture more value (Dunn, 2022), as it translates to overall performance (Dawidow, 2018).

Although it has been demonstrated that firm performance is influenced by a multitude of variables, e.g. innovation (Rass et al., 2013), entrepreneurship (Rauch et al., 2009), or the size of an organisation (Pervan and Višić, 2012), the considered effect often takes the relatively stable position of the company into account (González-Padilla et al., 2023). Contemporary approaches to strategic management recognise organisational dynamic capabilities as a way to adapt to the environmental changes (Teece, 2007). Enterprises can create value when they allocate resources in a flexible manner according to changes in their environment, which enables them to take advantage of these changes (Teece et al., 2016). Therefore, the significance of VCVC capabilities is emphasised by the fact that successful VCVC enables efficient competition.

Besides finding opportunities in resource orchestration as ways to increase efficiency, the VCVC process also takes the perspective of stakeholders and their role in achieving competitive advantage into consideration (Kyprianou, 2018). By involving them in business operations, the organisation learns about market expectations and is able to increase its effectiveness through better VCVCs (Oliveira et al., 2012). More efficient companies are those which are driven to take stakeholders' needs into account and involve them in the co-creation and sharing of values from the beginning of developing and implementing the strategy (Priem et al., 2022). Businesses use entrepreneurial orientation to develop their adaptability, or the capacity to generate and seize the potential value concealed in novel and risky prospects (Eshima and Anderson, 2017). Recognising opportunities and utilising them are two different things; the former is related to value creation and the latter is related to value capture.

The strategies of enterprises aim to increase efficiency through VCVC in various ways (Davidow, 2018). First, competition should be based on many aspects,

creating a sustainable competitive advantage. Through a better response to the changing environment, the organisation is able to compete more effectively. It should be emphasised that basing competition on only one factor or focusing on improving only selected aspects may lead to the loss of market position as a result of the impact of other factors directly or indirectly causing disturbances (Stout, 2012).

In recent years, as mentioned above, the COVID-19 pandemic was one major event representing such a disturbance. The consequences of the pandemic brought about not only "turbulent changes in the environment", but it can be said that they created completely new conditions for doing business. As a result, it was possible to assess the dynamic capabilities of organisations, allowing for effective VCVC. Many sectors with stable development processes were disturbed with huge losses recorded (Kubiczek and Derej, 2021). However, the situation related to the COVID-19 pandemic also opened up opportunities for success, which were used by many enterprises, including in sectors experiencing crisis.

Consequently, in order to identify and specify the research problem, the revision of value creation and value capture processes is required, specifically from the perspective of developing dynamic capabilities. This study expands upon the most recent subject literature (Panico, 2023; Dunn, 2022; Dyduch, 2022). Therefore, its purpose is to revise how the managerial decisions and strategic actions for value creation and capture concerning resource-based view (RBV), entrepreneurial orientation (EO) and relational view (RV) have evolved over the past five years. To do so, the following research questions were posed:

1. What VCVC methods have companies used in the past five years?
2. Has the COVID-19 pandemic affected the way companies pursue VCVC? If so, how?

3. Did progressive digitalisation become more significant as a VCVC method during the COVID-19 pandemic?

1. Methodology

In this paper, a critical analysis of the literature, combined with a systematic review, was used as the research method, targeting studies addressing the topic of value creation and value capture (VCVC). Scopus was used as the publication database, and the keywords used were: 'value creation and capture', 'value creation', 'value capture', 'resource-based view', 'relational view', and 'entrepreneurial orientation', in various configurations. In all cases, the search was limited to the subject area of 'Business, Management and Accounting' and the timeframe to the last five years, e.g. 2017-2022, as the purpose was to obtain research papers from before and after the COVID-19 pandemic. This restriction was due to the objectives of this study – to systematise knowledge of contemporary VCVC methods. The next step in the selection of articles was the assessment of the consistency of a given article with the issue under consideration. This evaluation was made on the basis of abstracts. Thus, we could reject papers that, despite containing the previously declared keywords, did not focus on the defined research area.

The structure of the main body of this article has been divided into RBV, EO and RV, which corresponds to the typology of VCVC approaches commonly used in the literature as a way to increase efficiency (Dydych, 2022). The strategic importance of value creation and value capture calls for studies in this area of management, but also for orienting a strategy in a certain way for uncertain times. Therefore, the theoretical approaches to the study of value creation and capture will be investigated as strategy approaches. RBV is assumed to develop firm resource orientation: adding novel resources, orchestrating resources, organising

complementary resources, acquiring human, IT, and other necessary resources, and shifting resources for opportunity exploitation, e.g. dynamic capabilities. EO is understood traditionally as the combination of levels of innovativeness, proactiveness and risk taking, coupled with autonomy and competitive aggressiveness, which allow for the introduction of innovations, the generation of new products, and the capture of value from them. The RV can be used to develop relational orientation that allows one to attract stakeholders, build partnerships, enter coalitions, create alliances, use relationships to acquire complementary resources, IT solutions or new technologies, and benefit from stakeholder synergy when 'dividing the pie' (e.g. sharing the created value correspondingly and properly among all the stakeholder groups that were involved in creating value (Schoenmaker & Schramade, 2023)).

2. Research results

Value creation arises from consumer interactions and experiences. Nevertheless, over the past three decades the focus has changed from the interactive nature of value creation to a more dynamic, dialectic, transformative, multi-actor (Blocker and Barrios, 2015; Tsiotso, 2021), strategic (Gans & Ryall, 2017) and multi-level structure of value creation (Tsiotso, 2021). It is crucial to differentiate between value creation and value capture, as "although value is created by organisational members, value capture is determined by the perceived power relationships between economic actors" (Bowman and Ambrosini, 2000). Value is dynamic because it undergoes continuous change as a result of dialectics. It is formed between different actors involved (such as customers, employees, other customers, and technologies) that interact at different levels of a service ecosystem (micro, meso, and macro) and can lead to profitable and sustainable

changes (e.g. improving the quality of life for consumers and society) (Tsiotou, 2021).

Contemporary changes introduce new ways of creating and capturing value, which are significant to the present perception of the concept. Value creation is concerned with how consumers perceive products and what is valued. Future value creation therefore differs from what is currently executed in the ecosystem, both in degree and nature (Oghazi et al., 2022). However, the key to achieving the desired outcome, namely profitability, is not only creating value but retaining and capturing it. The protection and development of created value are crucial in the process of achieving competitive advantage (Dyduch, 2016). This aspect is particularly important because the dynamic capabilities of the organisation allow for the use of emerging opportunities, and inadequate protection of value leads to a reduction in the value retained by the organisation.

Understanding the competitive environment within which the organisation evolves is also crucial in any decent analysis of value creation and capture for ecosystems to continue to improve in terms of value creation, collaboration and competition, which must be in balance together (Hannah and Eisenhardt, 2018). All ecosystems have different conditions for value creation and capture. Therefore, the appearance of new ecosystem actors and changes to the already existing ones, as well as the introduction of new technologies and other digital factors, undoubtedly influences the already existing value creation and capture processes (Hadasik and Kubiczek, 2022).

Oghazi et al. (2022) state that the fundamental idea is that value is captured by the “technology and its subsequent transformation by actor responses in new or changed ecosystems”. Furthermore, continuous improvement, organisational learning and innovation implementation are perceived as efficient VCV methods for organisations within its ecosystems. As a consequence,

entrepreneurs could better sense and seize opportunities and orchestrate the available resources. Moreover, the character of the resources held by certain companies can define ways to create and capture value, which has a significant impact on their performance. Even though labour is the source of value, bargaining relationships control how value is captured (Bowman and Ambrosini, 2000). However, companies which are successful in retaining or capturing more value compared to others not only use their bargaining position or stakeholders’ dependence, but also their valuable, rare, inimitable and non-substitutable resources (VRIN) (Dyduch, 2016).

Dynamic changes require entrepreneurs to use dynamic capabilities to achieve and maintain their market position. Within the last five years, the world’s unstable economic situation caused by external factors such as the COVID-19 pandemic has had an enormous effect on the business environment. The spread of COVID-19 has reduced economic activity around the world and has created new threats to companies. To remain competitive, organisations have been forced to react adequately to the new and difficult situation on the market by using their available resources, for example through digitalisation, which constitutes a distinctive role in the RBV, the RV as well as the strategic view based on EO. The new perspectives in researching value creation and value capture processes require to update the state-of-the-art in the subject, which may bring interesting conclusions and new scientific paths to explore.

2.1. Value creation and value capture: The resource perspective

From the RBV perspective, value creation is perceived as the result of successfully bargaining in the competitive environment for economic gain (Chatain and Zemsky, 2011; Skilton, 2014) or the outcome of orchestrating the resources necessary to exploit

opportunities, develop innovations and create more value (Teece, 2018).

Among recently published papers analysing value creation and capture in organisations according to the resource-based perspective, one trend is clearly visible, namely digitalisation. It plays a significant role in the change in how value is created and captured and may help companies in this respect as it influences and drives companies to adopt innovative solutions. It also empowers novel and innovative resource configuration models as well as the associated resource configuration processes (Reddy and Reinartz, 2017).

Integrating digitalisation in company strategies is essential from the resource-based point of view, as IT resources and complementary non-IT resources may be sufficient to obtain desired organisational performance outcomes (Schweikl and Obermaier, 2022). IT resources alone may not be sufficient to create value but configuring them with complementary non-IT resources makes it possible to meet the VRIN conditions and create a sustainable competitive advantage, as well as increasing economic rates (Schweikl and Obermaier, 2022). The digitalisation of companies allows entrepreneurs and managers alike to rethink the limitations of their resource configurations, thereby enhancing the value-creating potential of company resources.

The immanence of digitalisation in doing business for almost every branch has resulted in a need to create a framework for resource configuration in the digitally developing environment (Amit and Han, 2017). This demonstrates the importance of applying a system-based and value-creation-centric view that takes into consideration the expectations and resources of all value-creating stakeholders in the resource configuration processes. Resource configuration prototypes identify explicit means of value creation which are empowered by digitalisation. Based on the resource

orchestration approach and business model design, distinct sources of value creation have been identified, e.g., discovering new needs and resources, matching needs with resources, bridging needs and resources, but also the process that stimulates value creation. Organising access to resources that are owned by a variety of value co-creators is the main concern of value creation in the digitally-driven resource configuration (Amit and Han, 2017).

It seems evident that IT resources, as well as technological resources, are related to the sustainability of competitive advantage. Stratopoulos and Wang (2022) suggested a framework for calculating the anticipated duration of competitive advantage from the adoption of an emerging technology by combining aspects from RBV and the literature on technology adoption. What is more, this study introduced an important control variable and theoretical justification for further studies on the effects of technology adoption on competitive advantage. Digitalisation streamlines processes related to the configuration and orchestration of resources. From the RBV perspective, proper resource configuration results in measurable effects, creating competitive advantage in the long term. To sum up, as it is possible to estimate the effect and duration of technology implementation, new prospects of developing digital resources open up.

Recent research on value creation among Chinese firms operating in the sharing economy identified three resource orchestration mechanisms: (1) on-demand resource adaptation, (2) resource sharing within network, and (3) ecosystem resource coordination. These mechanisms confirm the emergent need to analyse digitalisation as a significant variable from the RBV perspective. However, it should be emphasised that digitalisation is not the only process that influences resource configuration. Research by Zhang et al. (2022) demonstrates that research and development

(R&D), the resulting patents and successful innovations translate into sustainable, e.g. social, environmental, and economic, performance. The summary of recent findings from the RBV perspective of value creation is presented in Table 1.

Table 1. Summary of RBV concepts on VCV

Authors	Research topic	Objective	Scope of research	Conclusions
Amit and Han, 2017	A conceptual framework for examining the value-creation potential embedded in novel, digitally powered resource configurations	To find out how firms create value through resource configurations in a digitally enabled world.	Literature review and conceptual work	Business digitalisation calls for firms to adopt a system-based, value-creation-centric perspective for designing and organising their resource configurations.
Zeng et al., 2021	Approaches to resource orchestration in sharing economy platform firms (SEP)	To examine the value creation process of sharing economy-based firms operating in emerging markets.	Inductive multiple exploratory qualitative case studies, 37 face-to-face interviews from July 2016 to September 2017	The primary source of value creation for SEPs is not driven by the core technology or know-how generated through ‘high upfront R&D costs’, but by the cost linked to attracting large numbers of external individuals and/or small businesses to interact via the platform.
Schweikl and Obermaier, 2022	IT business value research and resource complementarity	To present a converging definition of complementary non-IT resources and specify their role in the value creation process from IT by viewing it through three distinct lenses: microeconomic theory, RBV, and contingency theory.	Literature review: 227 studies by keyword search	IT should not be viewed as an isolated resource that leads to substantial improvements in firm performance on its own.

Authors	Research topic	Objective	Scope of research	Conclusions
Stratopoulos and Wang, 2022	Duration of competitive advantage from technology adoption	To propose a method for estimating the expected duration of competitive advantage from emerging technology adoption for the average adopting firm.	Literature review and for the framework testing proxies such as web search, news articles, book titles and corporate disclosures, to test our propositions by estimating the duration of competitive advantage for ERP and cloud computing	A framework is developed for predicting technology diffusion and expected duration of competitive advantage.
Zhang et al., 2022	Role of innovation in sustainable SME performance	To explore, through the lens of the RBV and Schumpeter's innovation theories, the role of innovation in sustainable performance in the context of small and medium-sized enterprises that comprise the circular economy.	Literature review and the two-step system generalised method of moments (GMM) to investigate the impact of innovation on sustainable performance in small and medium-sized enterprises (SMEs)	R&D and patents are positively related to sustainable performance. Innovation is positively related to social and environmental performance.

Source: own study

2.2. Value creation and value capture: The entrepreneurial perspective

EO is another perspective that is closely linked with value creation and capture processes. EO is a strategic approach based on innovativeness, proactiveness, and risk-taking, which, coupled with employee autonomy, empowerment and competitive aggressiveness (Lumpkin and Dess, 1996), can result in value creation (Criado-Gomis and Iniesta-Bonillo, 2020; Keil et al., 2017; Zeng and Khan, 2018) as entrepreneurial firms take advantage of opportunities that other businesses are not able to identify or exploit. Although the effect of EO on value creation is evident, some factors can reduce this effect, e.g. CEO entrenchment, due to (1) the corporate governance provisions that

protect managers from the majority will of shareholders; (2) substantial ownership that provides excessively strong decision-making power; and (3) substantial family-based holdings in the corporation (Keil et al., 2017).

An EO clearly encourages managers to develop value creation strategies through new product development and R&D innovativeness, which, in turn, allows firms to achieve long-term and sustainable advantages. However, the dimensions of EO themselves cannot fully explain how strategic decisions concerning value creation are made, but surely EO makes CEOs think strategically and act flexibly and openly (Wang et al., 2020). What is more, innovativeness, proactiveness, and the risk-taking dimensions of EO can increase managers' confidence in achieving desirable outcomes through

entrepreneurial activities (Wang et al., 2020). Therefore, senior managers need to develop the understanding of the potential value of entrepreneurial opportunities before investing crucial resources to create and capture value from them. When firms sense opportunities, they engage in entrepreneurial activities to create and capture more value despite varying degrees of uncertainty.

Organisations can create value through the use of Big Data by integrating resource orchestration and EO. The findings indicate the important role of EO, through which resource orchestration leads to value creation from Big Data. They identified EO as one of the key factors through which companies bundle and orchestrate resources arising from Big Data for value creation, concluding that EO moderates the relationship between resource coordination and value creation from Big Data (Zheng and Khan, 2019).

Furthermore, highly interesting research in that field was conducted by Li et al. (2017) in 197 Chinese firms. The authors analysed how the adoption of an EO by partner firms can affect alliance outcomes and confirmed that relational characteristics regarding cooperation and conflict moderate the relationship between EO and alliances' performance, based on the RV. One can therefore argue that EO plays an important role in achieving firm-level alliance success, and relational factors in the alliance context determine the relationship between EO and alliance success (Li et al., 2017). The findings show how the RV may be used to examine

relational strategies and forms in the context of alliances and relationships, e.g. cooperation or conflict as contingencies.

Additionally, research by Mu et al. (2017) suggested that the ability of firms to achieve higher levels of EO or market orientation may be increased by access to various streams of network resources empowered by the networking capability. It is evident that all of the three approaches to value creation (RBV, EO and RV) are complementary and additive to each other. To obtain a deeper understanding of value creation and capture processes, these three approaches need to be combined.

It has been posited that EO is the source of a firm's competitive advantage (Mishra, 2017) which is embedded in the business model mechanisms enhanced by management logics and continually updated and enriched by entrepreneurial incentives. Moreover, the business model itself sustains value creation only when supported by EO. In other words, the management logics, core resources, value opportunities, and value activities that generate the business model support value creation and appropriation. A sustainable competitive advantage can be obtained if the EO supports the strategic execution of business model mechanisms. Thus, entrepreneurial incentives lie at the core of VCVC, which leads to a firm's competitive advantage. The synthesis of recent research concerning the entrepreneurial perspective in value creation is presented in Table 2.

Table 2. Summary of the EO perspective in VCVC

Authors	Research topic	Objective	Scope of research	Conclusions
Keil et al., 2017	Effects of EO on value creation	To investigate how CEO EO affects firm value creation and how this relationship is moderated by three sources of CEO entrenchment.	Longitudinal analysis of S&P 500 firms between 1999 and 2007	CEO EO enhances firm value creation, but this positive effect is reduced when CEOs are entrenched.

Authors	Research topic	Objective	Scope of research	Conclusions
Li et al., 2017	EO and strategic alliance success	To extend entrepreneurship research into the domain of strategic alliances by hypothesising a positive relationship between EO and firm-level alliance success.	Data collected in a survey of 197 Chinese firms engaged in strategic alliances, on-site interviews from August 2010 to January 2011	The study provides novel insights into <i>whether</i> and <i>when</i> partner firms can translate an EO into final alliance outcomes.
Mu et al., 2017	Strategic orientation and new product development performance	To examine the effect of a firm's ability to connect with external network partners (networking capability) and the ability of new product development (NPD) project managers to network with stakeholders within the firm (networking ability).	Survey methodology for our data collection in China, across three high-tech industries, 650 firms with product innovation activities	Market orientation and EO are positively associated with NPD performance when the managers of NPD projects possess networking ability to successfully mobilise the support and advocacy of stakeholders within the firm.
Zheng and Khan, 2019	The role of resource orchestration and EO in value creation	To examine how managers orchestrate, bundle and leverage resources from Big Data for value creation in emerging economies.	The study utilises an inductive, multiple-case research design to understand the process of creating value from Big Data	EO is vital for companies in emerging economies that can create value through Big Data by bundling and orchestrating resources and in result improving performance.
Wang et al., 2020	Effects of EO on top management's strategic emphasis choices	To examine the relationship between management's EO and its relative strategic emphasis on value-creation versus value-appropriation.	Literature review and use of a multi-source dataset of 337 Standard & Poor (S&P) 500 companies from 2007-2015	Entrepreneurially oriented managers tend to focus more on value creation over value appropriation but this influence is contingent on at least three factors: (1) relative firm performance, (2) compensation strategy, and (3) capital market patience.

Source: own elaboration

2.3. Value creation and capture: The relational perspective

According to the RV, organisations are anchored in dyads and networks rather than being atomistic entities (Li et al., 2017). In the contemporary world, the ability to co-operate with other companies is crucial in order to obtain relational rents and achieve competitive advantage. Dyer et al. (2018) redefined the RV model by identifying determinants of value creation and value capture from the evolutionary perspective. The original model presents complementary resources, relation-specific assets, knowledge-sharing routines, and effective governance as sources of value creation. The authors posited that firms operating in alliances should start by assessing whether a potential partner has the complementary resources necessary to launch a new, resource-intensive technology (Dyer et al., 2018), as it becomes an incentive to invest in relation-specific assets, knowledge-sharing routines and effective governance as the source of value capture. It has been found that the greater the complementarity of resources, the more value is created and the longer the duration of the alliance (Dyer et al., 2018). Additionally, it has been argued that there are four factors that lead to the decrease in value creation in alliance relationships: (a) diminished complementary resources between partners due to resource convergence or divergence, (b) increased relational inertia which negatively influences alliance value creation activities, (c) replication or replacement of value creation resources by competitors, and (d) environmental dynamism that results in the obsolescence of value creation (Dyer et al., 2018).

Within the lens of strategic management theory, key strategic managerial choices to build up the content of the RV have been offered: (a) the process of creating and appropriating value, (b) selecting a partner

and their significance, (c) interorganisational dynamics, and (d) the way of forming interorganisational relationships (Zakrzewska-Bielawska, 2019). The number and variety of partners of the alliance as well as the expectations of partners are the two factors that should be considered in the firm's strategy and its relational orientation (Zakrzewska-Bielawska, 2019). Recently, the joint value creation drivers in independent venture capital and corporate venture capital investment syndicates have been analysed to seek an explanation of how independent venture capital and corporate venture capital creates value for firms. Shareholder relationships, the corporate setup, venture life cycle and deal structure have been identified as key factors driving joint value creation (Balz et al., 2022).

Based on the RV, Weber et al. (2017) analysed partnership dyads and identified the factors influencing successful joint value creation. It was also confirmed that the value created mutually differs for the two partners while it is relevant to both parties. Moreover, from the dyadic perspective, the relation-specific investment and complementarity of resources approach can be applied to the not-for-profit sector as well.

Mu et al. (2017) examined how resource-orchestrating capabilities facilitate strategic orientation on performance outcomes. It has been posited that to realise the performance advantages of the strategic orientation, companies need to depend on its networking capabilities. Companies with high market orientation or EO may also fail if they do not develop sufficient networking capability to be able to take advantage of network resources to develop appropriate products and seize market opportunities leading to value creation and appropriation (Mu et al., 2017). The recent research on the RV concerning value creation is presented in Table 3.

Table 3. Summary of RV on VCVC

Authors	Research topic	Objective	Scope of research	Conclusions
Li et al., 2017	EO and strategic alliance success	To extend entrepreneurship research into the domain of strategic alliances by hypothesising a positive relationship between EO and firm-level alliance success.	Data collected in a survey of 197 Chinese firms engaged in strategic alliances, on-site interviews from August 2010 to January 2011	Organisations are anchored in dyads and networks rather than being atomistic entities; they often enter alliances as a form of partnership. There is a positive relationship between EO and firm-level alliance success.
Weber et al., 2017	Social value creation in inter-organisational collaborations in the not-for-profit sector	To understand which factors, drive joint value creation and whether and how these factors and their effects differ for the two parties involved in the not-for-profit sector.	Analysis of 121 partnership dyads	Some factors governing the successful creation of joint value differ for the two partners while others are relevant to both parties. Those latter factors, in turn, differ in terms of their effects on the respective outcome.
Mu et al., 2017	Strategic orientation and new product development performance	To examine the effect of a firm's ability to connect with external network partners (networking capability) and the ability of new product development (NPD) project managers to network with stakeholders within the firm (networking ability).	Survey methodology for our data collection in China, across three high-tech industries, 650 firms with product innovation activities	Market orientation and EO are positively associated with NPD performance when a firm has sufficient networking capability to manage network dynamics.

Authors	Research topic	Objective	Scope of research	Conclusions
Dyer et al. 2018	The RV in value creation and capture	To extend the RV to offer a dynamic perspective on the factors that drive value creation and value capture over the alliance life cycle.	Literature review	There is interdependence between the complementary resources of partners as the critical factor determining the pattern of alliance value creation, depending on how quickly alliances generate value and how quickly they are likely to dissolve.
Zakrzewska-Bielawska, 2019	Recognition of relational strategy content	To recognise how managers perceive a firm's relational strategy content through the identification of strategic choices made therein.	Research conducted in 53 companies based in Poland using semi-structured interviews with executives	Choices regarding the process of creating and appropriating value, selecting a partner and their significance, and the associated interorganisational dynamics as well as ways of forming interorganisational relationships are the key strategic choices that make up the content of relational strategy.
Balz et al., 2022	Value creation for new venture firms	To show how Corporate Venture Capital (CVCs) leverage resources from their corporate sponsors to add value for New Venture Firms (NVF).	Cross-industry case study of 11 CVC units	CVCs contribute complementary assets beyond capital to their NVFs.

Source: own elaboration

3. Discussion

The conditions in which organisations operate change over time. By developing dynamic capabilities, the organisation is able to adapt to the environment and improve the value creation and value capture processes. Some changes are a slow process, and some can dramatically affect the shape of the environment in an immediate way. One such factor was undoubtedly the COVID-19 pandemic. Because of actions aimed at limiting the spread of the virus, organisations had to adapt to the new operating conditions in just a few weeks, with the simultaneous impact of other processes shaping the environment.

In this paper, we have demonstrated that three perspectives are crucial to the analysis of value creation and value capture in the changing world, namely resource orientation, EO, and RV. Research on the resource orchestration framework offers guidance on how the focal firm could gain a competitive advantage and capture value through resource configuration (Hitt et al., 2011; Sirmon and Hitt, 2009). The efficient reallocation of resources, as well as finding new solutions for existing ones, and thus VCVC, has allowed for links between RBV and dynamic capability to be drawn in the literature (Barney, 1991; Teece et al., 1997). Teece (2007) perceives the constant reconfiguration of the resource base to adapt to the dynamically changing environment as the main aspect of the dynamic capabilities theory, which is crucial to organisational development and achieving competitive advantage. Our literature review indicated that during the pandemic time, the pace of an organisation's adjustment processes led to the stimulation of creating and capturing value and, as a result, helping companies to go through rapid changes in the dynamic environment. Confirmation of this argument may be found in research by Dyduch et al. (2021) indicating that the value creation and

value capture processes that translate into overall performance are mostly shaped by a firm's dynamic capabilities during times of crisis. Hence, value creation and capture are an outcome of dynamic capabilities. This represents a significant argument for companies to shape and develop dynamic capabilities that can translate into value creation and capture.

Scholars argue that EO can be the principal mechanism of value creation and capture ensuring sustainable growth. According to Anderson et al. (2015), EO is the combination of innovative, proactive entrepreneurial activities and managerial readiness to sense and seize opportunities with an acceptance of the risk of failure. The growth of a company is followed up by introducing new resources and using opportunities to combine them with existing resources in novel ways that lead to value creation. The fundamental antecedent to the actual entrepreneurial activities carried out to capture opportunity value is greater understanding and the related exposure to new entrepreneurial opportunities (Hitt et al., 2001). EO is a resource-consuming strategic posture and when it is applied in a focused, disciplined manner as part of the intended strategy of the company, the level of EO increases (Anderson et al., 2009). The presented literature review on analysing EO as a perspective of VCVC development indicated that organisations focused on the desire to continue operating dynamically sought to find ways to do so (Zighan et al., 2022).

A different approach assumes that enterprises no longer operate as isolated organisations, but as organisation networks, supported by advanced solutions of Internet communication technologies that compete with other networks (Dyduch, 2022). Value creation stems from resources exchanged in relationships between a focal firm and its stakeholders. Stakeholders are actors who have control over the resources and capabilities that determine whether co-specific

investments will be made with the resources and capabilities owned by other actors. This study confirms that considering stakeholder expectations during the COVID-19 pandemic significantly translated into better VCVC.

It should be emphasised that some scholars demonstrate that RBV, EO and RV should not be analysed as three separate perspectives, since they are inextricably linked. For instance, Mesquita et al. (2008) argue that the RBV and the RV are distinct perspectives, albeit complementary, regarding VCVC. The combination of these two perspectives allows for a deeper understanding of competitive advantages. Similar conclusions were presented by Li et al. (2017), who found that the RV is helpful for analysing partner firms with high EO to understand how to manage valuable resources in alliances in order to achieve competitive advantage.

The three approaches to studying VCVC, e.g. the RBV, EO and the RV, are distinct yet complementary, which is evident in the presented publications. Combining these three approaches can deepen our understanding of value creation and value capture processes. It is worth emphasising that each of these perspectives can be analysed separately to understand the organisation's activities in each market segment and in specific conditions. Hence, it would be possible to isolate the effect of certain determinants on VCVC. It is particularly important to study specific cases, which will increase the state of management knowledge and contribute to improving the performance of organisations.

Conclusions

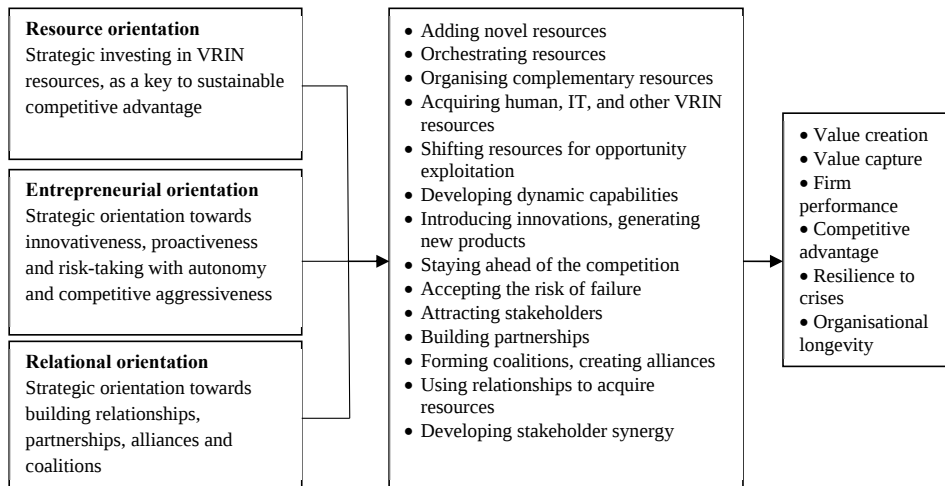
The activity of an organisation is conditioned by the environment in which it is located. The ability to adapt to changes in the business ecosystem is essential in times of gamechangers. New activities and novel mechanisms developed by organisations

to improve performance in the dynamic environment create an inspiring field of research seeking to understand how given ways contribute to optimising value creation and value capture. This paper presents a revision of the recent approaches used to study VCVC, e.g. the RBV, EO and the RV, which have gained scholarly attention.

The results of the literature review demonstrate that one of the most significant ways of stimulating value creation in recent times has been the adaptation to digitalisation, which has been strengthened by the COVID-19 pandemic. The effective use of information and communication technologies has allowed businesses to reach a wider group of customers than in the case of conducting business in the traditional on-site form. The pandemic not only increased the number of e-commerce customers, but also created new markets and effectively expanded the existing ones.

Furthermore, the actions undertaken by governments to reduce the spread of the virus have largely restricted in-store operations. Adapting to the lockdown conditions by digitalising operations was in many cases the only alternative to ceasing operations. Innovative solutions to unexpected problems, proactive actions, competitive aggressiveness, and risk-taking were visible among companies as the elements of EO.

In addition, due to the abovementioned restrictions, demand has moved online. People expected that the companies whose products and services they used would also move online or increase the scale of their e-commerce activities. Therefore, the digitalisation of activities was the fulfilment of their expectation. Moreover, the changes in supply chains, new ways of stakeholder communication, and redefined partnerships call for the justified application of the RV. Taking all three perspectives, we can offer a conceptual framework for studying value creation and value capture processes (Figure 1).

Figure 1. The conceptual model of value creation and value capture

Source: Own elaboration

The contribution of this study is three-fold. First, it adds to the theoretical literature on VCVC by demonstrating that RBV is still a viable viewpoint from which to analyse value creation and capture, while the EO and RV emerge as important perspectives for studying value creation in times of uncertainty.

Second, the search demonstrates that VCVC in contemporary organisations depend on digitalisation, adopting new technologies, attracting external partnerships, patenting, forming alliances, as well as using EO and dynamic capabilities to quickly shift the necessary resources in order to seize opportunities.

Third, with relatively little empirical research carried out into value creation after the COVID-19 pandemic, it can be expected that the economic impact of this crisis will require further research in this area. Nonetheless, this paper contributes to value creation and capture studies by identifying the most important strategic orientations that support value creation.

Several categories of practical implications are crucial with regard to managerial actions and strategic choices oriented

towards creating and capturing value. First, managers need to invest in digitalisation. Preparing efficient ICT tools, coupled with adopting new technologies and introducing innovations, can become the source of future value creation. Concentrating on increasing the in-use value for customers of existing products in traditional supply chains may only produce short-lived benefits. Second, it is important to identify activities in the value and supply chains that are sources of value and to invest in them strategically. Third, it is advisable to attract external stakeholders, enter coalitions or partnerships, organise complementary resources and develop resource-intensive technologies which are impossible to generate separately. Creating alliances, operating in closed ecosystems or partnerships that set the rules for the whole branch can lead to increased value creation, and thus greater value capture. Fourth, developing an EO, dynamic capabilities and flexibility allows one to react quickly in uncertain periods, where time is money. Spotting the opportunity before the competition and shifting the resources necessary to exploit it can be a source of creating value. Finally, patenting is needed to capture

the value created, as this limits the threat of imitation by competitors.

This paper is mostly conceptual; therefore, it presents some limitations. First, we decided to undertake a search on publications from the last five years, to identify which trends of this study constitute the subject of the literature review, second the length limitation of the article, as well as the method of collecting articles. Perhaps this could contribute to other studies which are relevant from the point of view of this study. On the other hand, the directions of future research on VCVC may focus on determining whether the VCVC methods used in the pandemic are continued, as well as assessing their effectiveness.

References

- Anderson, B.S., Covin, J.G., Slevin, D.P. (2009), Understanding the relationships between entrepreneurial orientation and strategic learning capability: An empirical investigation, *Strategic Entrepreneurship Journal*, 3, 218-240. DOI: 10.1002/sej.72.
- Anderson, B.S., Kreiser, P.M., Kuratko, D.F., Hornsby, J.S., Eshima Y. (2015), Reconceptualizing entrepreneurial orientation, *Strategic Management Journal* 36: p. 1579–1596. DOI: 10.1002/smj.2298.
- Balz F., Bugl B., Kanbach D. (2022), New venture Value Creation in Syndicates Between Independent and Corporate Investors, *International Journal of Innovation and Technology Management*, 19(06), 2250014. DOI: 10.1142/S0219877022500146.
- Barney, J. (1991), Firm resources and sustained competitive advantage, *Journal of Management*, 17, 99–120. DOI: 10.1177/014920639101700108.
- Blocker, C.P., Barrios, A. (2015), The transformative value of a service experience, *Journal of Service Research*, 18(3), 165-283. DOI: 10.1177/1094670515583064.
- Bowman, C., Ambrosini, V. (2000), Value creation versus value capture: towards a coherent definition of value in strategy, *British Journal of Management*, 11(1), 1-15. DOI: 10.1111/1467-8551.00147.
- Chatain, O. (2010), Value Creation, Competition, and Performance in Buyer-Supplier Relationships, *Strategic Management Journal*, 32(1), 76-102. DOI: 10.1002/smj.864.
- Davidow, M. (2018), Value Creation and Efficiency: Incompatible or Inseparable? *Journal of Creating Value*, 4(1), 123-131. DOI: 10.1177/2394964318768904.
- Dunn, S. (2022), Placing Value Creation at the Core of Strategy. *Academy of Management*, 1. DOI: 10.5465/ambpp.2022.17157abstract.
- Dyduch, W. (2016), Value Creation and Capture in Entrepreneurial Organizations, *Problemy Zarządzania*, 14(3/62), 11-23. DOI: 10.7172/1644-9584.62.1.
- Dyduch, W. (2022), *Strategic processes and mechanisms of value creation and value capture: Some insights from business organizations in Poland*, in: A. Zubac, S. Kirkpatrick, O. Zwikael, K. Hughes and D. Tucker (Eds.), *Effective Implementation of Transformation Strategies: How to Navigate the Strategy and Change Interface Successfully* (pp. 289-316). Palgrave/MacMillan. DOI: 10.1007/978-981-19-2336-4_12.
- Dyduch, W., Chudziński, P., Cyfert, S., Zastempowski, M. (2021), *Dynamic capabilities, value creation and value capture: Evidence from SMEs under Covid-19 lockdown in Poland*, *Plos One*, 16(6), e0252423. DOI: 10.1371/journal.pone.0252423.
- Dyer, J. H., Singh, H., Hesterly, W. S. (2018), The relational view revisited: A dynamic perspective on value creation and value capture, *Strategic Management Journal*, 39(12), 3140–3162. DOI: 10.1002/smj.2785.
- Gans, J., Ryall M.D. (2017), Value Capture Theory: A Strategic Management Review. *Strategic Management Journal*, 38, 17-41. DOI: 10.1002/smj.2592

- González-Padilla, P., Navalpotro, F. D., Saura, J. R. (2023), Managing entrepreneurs' behavior personalities in digital environments: A review, *International Entrepreneurship and Management Journal*, 1-25. DOI: 10.1007/s11365-022-00823-4.
- Hannah, D. P., Eisenhardt, K. M. (2018), How firms navigate cooperation and competition in nascent ecosystems, *Strategic Management Journal*, 39(12), 3163–3192. DOI: 10.1002/smj.2750.
- Hitt, M. A., Ireland, R. D., Camp, S. M., Sexton, D. L. (2001), Strategic entrepreneurship: entrepreneurial strategies for wealth creation, *Strategic Management Journal*, 22, 479–491. DOI: 10.1002/smj.196.
- Hitt, M. A., Ireland, R. D., Sirmon, D. G., Trahms, C. A. (2011), Strategic entrepreneurship: Creating value for individuals, organizations, and society, *Academy of Management Perspectives*, 25(2), 57–76. DOI: 10.2139/ssrn.1994491.
- Keil, T., Maula, M., Syrigos, E. (2017), CEO entrepreneurial orientation, entrenchment, and firm value creation, *Entrepreneurship Theory and Practice*, 41(4), 475–504. DOI: 10.1111/etp.12213.
- Li, L., Jiang, F., Pei, Y., Jiang, N. (2017), Entrepreneurial orientation and strategic alliance success: The contingency role of relational factors, *Journal of Business Research*, 72, 46–56. DOI: 10.1016/j.jbusres.2016.11.011.
- Mesquita, L. F., Anand, J., Brush, T. H. (2008), Comparing the resource-based and relational views: Knowledge transfer and spillover in vertical alliances, *Strategic Management Journal*, 29(9), 913–919. DOI: 10.1002/smj.699.
- Mishra, C. S. (2017), Entrepreneurial Orientation, *Entrepreneurship Research Journal*, 7(4) 20170112. DOI: 10.1515/erj-2017-0112.
- Mu, J., Thomas, E., Peng, G., Di Benedetto, A. (2017), Strategic orientation and new product development performance: The role of networking capability and networking ability, *Industrial Marketing Management*, 64, 187–201. DOI: 10.1016/j.indmarman.2016.09.007.
- Oghazi, P., Parida, V., Wincent, J., Mostaghel, R. (2022), Ecosystems transformation through disruptive innovation: A definition, framework and outline for future research, *Journal of Business Research*, 147, 16–26. DOI: 10.1016/j.jbusres.2022.03.073.
- Osterwalder, A., Pigneur, Y., Tucci, C. L. (2005), Clarifying business models: Origins, present, and future of the concept, *Communications of the Association for Information Systems*, 16(1), 1–25. DOI: 10.17705/1CAIS.01601.
- Panico, C. (2023), *Value Creation, Value Appropriation, and Cooperation in Team Production*. Academy of Management. DOI: 10.5465/amr.2021.0491.
- Rachinger, M., Rauter, R., Müller, C., Vorraber, W., Schirgi, E. (2018), Digitalization and its influence on business model innovation, *Journal of Manufacturing Technology Management*, 30(8), 1143–1160. DOI: 10.1108/JMTM-01-2018-0020.
- Reddy, S. Reinartz, W. (2017), Digital Transformation and Value Creation: Sea Change Ahead, *GfK Marketing Intelligence Review*, 9(1), 10–17. DOI: 10.1515/gfkmir-2017-0002.
- Schoenmaker, D., Schramade, W. (2023), *Integrated Value Creation*. In: *Corporate Finance for Long-Term Value* (pp. 33–63). Springer Texts in Business and Economics. Springer, Cham. DOI: 10.1007/978-3-031-35009-2_2.
- Schweikl, S., Obermaier, R. (2022), *Lost in translation: IT business value research and resource complementarity – an integrative framework, shortcomings and future research directions*, *Management Review Quarterly*. DOI: 10.1007/s11301-022-00284-7.
- Sirmon, D. G., Hitt, M. A. (2009), Contingencies within dynamic managerial capabilities: Interdependent effects of resource investment and deployment on firm performance, *Strategic Management Journal*, 30(13), 1375–1394. DOI: 10.1002/smj.791.
- Stratopoulos, T., Wang V. (2022), Estimating the duration of competitive advantage from emerging technology adoption, *International Journal of Accounting Information Systems*, 47, 100577. DOI: 10.1016/j.accinf.2022.100577.

- Teece, D. J., Pisano, G., Shuen, A. (1997), Dynamic capabilities and strategic management, *Strategic Management Journal*, 18(7), 509-533. DOI: 10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z.
- Tsiotsou, R.H. Diehl, S. (2022), Delineating transformative value creation through service communications: an integrative framework, *Journal of Service Management*, 33(4/5), 531-551. DOI: 10.1108/JOSM-11-2021-0420.
- Tsiotsou, R.H. (2021), Introducing relational dialectics on actor engagement in the social media ecosystem, *Journal of Services Marketing*, 35(3), 349-366. DOI: 10.1108/JSM-01-2020-0027.
- Wang, X., Dass, M., Arnett, D.B., Yu, X., (2020), Understanding firms' relative strategic emphases: An entrepreneurial orientation explanation, *Industrial Marketing Management*, 84, 151-164. DOI: 10.1016/j.indmarman.2019.06.009.
- Weber, C., Weidner, K., Kroeger, K., Wallace, A. (2017), Social value creation in inter-collaborations in the not-for-profit Sector – Give and take from a dyadic perspective, *Journal of Management Studies*, 54(6), 929-956. DOI: 10.1111/joms.12272.
- Zeng, J., Khan, Z. (2019), Value creation through big data in emerging economies: The role of resource orchestration and entrepreneurial orientation, *Management Decision*, 57(8), 1818-1838. DOI: 10.1108/MD-05-2018-0572.
- Zeng, J., Tavalaei, M. M., Khan, Z. (2021), Sharing economy platform firms and their resource orchestration approaches, *Journal of Business Research*, 136, 451-465. DOI: 10.1016/j.jbusres.2021.07.054.
- Zhang, Z., Zhu H., Zhou Z., Zou K., (2022), How does innovation matter for sustainable performance? Evidence from small and medium-sized enterprises, *Journal of Business Research*, 153, 251-265. DOI: 10.1016/j.jbusres.2022.08.034.
- Zighan, S., Abualqumboz, M., Dwaikat, N., Alkalha, Z. (2022), The role of entrepreneurial orientation in developing SMEs resilience capabilities throughout COVID-19, *International Journal of Entrepreneurship and Innovation*, 23(4), 227-239. DOI: 10.1177/14657503211046849.

Prof. Wojciech Dyduch, has more than 20 years of research experience in strategic management and corporate entrepreneurship involving the problems of intangible assets stimulating entrepreneurship, value creation and value capture in entrepreneurial organizations, creative strategy in organizations, organizational entrepreneurship measurement, as well as strategic responses to crises. He authors or co-authors over 150 publications. Based on research results Wojciech Dyduch has developed scales measuring social capital, assessing the level of corporate entrepreneurship, and diagnosing the strategic support for creativity in organizations. He has developed and empirically tested the model of entrepreneurship-based performance management, and the concept of creativity-based corporate strategy. Recently, he has identified specific dynamic capabilities that help companies survive difficult times. Wojciech Dyduch heads the Faculty of Management, and the Department of Entrepreneurship at the University of Economics in Katowice, Poland. He is a President of the Organization and Management Sciences Committee at the Polish Academy of Sciences, and a member of the Scientific Excellence Council. His passions include visual astronomy, microbiology, macrophotography, swimming and snowboarding. ORCID no. <https://orcid.org/0000-0003-1090-5690>

Magdalena Dominiczewska, is interested in strategic management issues, in particular the resource-based view as well as the dynamic capabilities of organizations and creating and capturing value mainly in the sector of micro, small and medium-sized enterprise. She presented her papers at Polish and international conferences as a part of

individual research projects. Professionally, she is a research and teaching employee of the Department of Entrepreneurship at the University of Economics in Katowice. She is also the supervisor of the Entrepreneurship Scientific Club, whose students successfully take part in international conferences. She constantly expands her research and teaching skills by participating in workshops, trainings and internships. ORCID no. <https://orcid.org/0000-0002-0240-1241>

Jakub Kubiczek, is a researcher and practitioner – a Ph.D. student and assistant at the Department of Economic and Financial Analysis University of Economics in Katowice. He works as a senior specialist at the Ministry of Finance. Jakub Kubiczek actively engages as a member and research team coordinator in prestigious scientific grants, including those from the National Science Center, Inter-University Research Grants SGH-UEW-UEK-UEP-UEKat, and the Metropolitan Fund for Support of Science of GZM. With over 50 publications, his research primarily explores the intricacies of multidimensional behavior – examining both determinants and the comprehensive process. ORCID no. <https://orcid.org/0000-0003-4599-4814>

Driving the Image of an Electricity Supplier through Marketing Activities

DARIUSZ DĄBROWSKI, JAKUB DĄBROWSKI, KRZYSZTOF ZAMASZ,
MARCIN LIS

Abstract

The liberalisation of the electricity market enables consumers to freely choose their electricity provider. Consequently, it is crucial for these providers to cultivate a positive image, as it can lead to customer loyalty and positive recommendations. However, to date, no research has been conducted to assess how the marketing activities of electricity providers within the marketing mix affect their image. Therefore, the aim of this study is to determine how marketing actions undertaken within the marketing mix by electricity providers influence their image. Referring to the Stimulus-Organism-Response (SOR) theory, research hypotheses were formulated, and a regression model was constructed, assuming the positive impacts of selected marketing actions of electricity providers on their image. A quantitative approach was employed to test the research hypotheses. Data were collected through a questionnaire survey of 503 randomly selected domestic electricity consumers, and statistical analysis was used for the purposes of data analysis. The research results indicate that the following marketing activities of electricity providers have a positive impact on their image: offering other products along with electricity, providing price discounts, providing physical customer service offices, and engagement in sponsorship. Several positive effects of marketing activities of electricity providers on their image were identified. Thus, the study theoretically contributes to the field of marketing management of energy companies. Based on the results obtained, the following practical implications for electricity providers can be proposed. It is recommended that these providers employ the following marketing activities to shape a positive image among consumers: offering other products along with electricity, providing price discounts, providing physical customer service offices, and engaging in sponsor-

DOI: 10.23762/FSO_VOL11_N04_4

Dariusz Dąbrowski

e-mail: dariusz.dabrowski@zie.pg.gda.pl
Gdansk University of Technology,
Faculty of Management and Economics,
Poland

Jakub Dąbrowski

e-mail: kuba_dabrowski@wp.pl
independent researcher,
Poland

Krzysztof Zamasz

e-mail: kzamasz@wsb.edu.pl
WSB University,
Institute of Energy Transformation,
Poland

Marcin Lis

e-mail: mlis@wsb.edu.pl
WSB University,
Regional Development Centre,
Poland

ship. In line with the literature, this positive image should foster desired consumer behaviour from the perspective of the electricity provider (e.g. customer loyalty, issuing positive recommendations).

Key words

marketing mix, marketing activities, image, electricity.

Introduction

In Poland, the process of creating an energy market dates back to 1997. On 10 April of that year, the Energy Law Act came into force. It was established in line with European Union (EU) Directive 96/92/EC and was a significant step towards the liberalisation of the energy market, demonstrating Poland's alignment with European standards. Actions regarding the liberalisation of this market accelerated significantly after the country's accession to the European Union (EU) in 2004. This was associated with the alignment of its internal regulations with the later Energy Package of 2007. The liberalisation of the domestic electricity market led to the introduction of competition in a previously monopolised market. As a result of this liberalisation, many new electricity providers emerged, leading to increased competition on the market (Wojtkowska-Łodej et al., 2014). From the customers' perspective, this competition means they have a wider choice of electricity suppliers, while from the suppliers' perspective, it implies the pursuit of a competitive advantage. These electricity suppliers can achieve this by shaping a higher economic value compared to their competitors, which means striving to provide the highest possible benefits to customers at the lowest possible costs (Barney and Hesterly, 2012; Grondys et al., 2020).

In a situation where the electricity market operates according to the principles of a free market, it is crucial for electricity providers to shape a positive image among electricity consumers. The company's image,

understood as the general perception of the company by consumers and other entities in the environment (Zawadzka 2010; Vaničková et al., 2020), is an important factor in its success. It can influence consumers' decisions to enter into, continue, or terminate an electricity supply agreement (Saługa et al., 2020). Additionally, the image impacts consumer recommendations, which are voluntary consumer behaviours that influence its operations. These recommendations can involve recommending or discouraging cooperation with a particular company to other consumers, as well as encouraging or discouraging the purchase of the company's products (Baehre et al., 2021).

The company's image is linked to its marketing activities, which are usually categorised in reference to the concept of the marketing mix, the classical 4P (product, price, place, promotion). These activities refer to all the various actions undertaken by a company in the field of marketing that are intended to achieve its marketing goals (Kotler and Keller, 2018), such as creating a positive company image or stimulating positive consumer recommendations (Penc, 2001). Relationships between the company's marketing actions and its image can be embedded within the framework of Mehrabian and Russell's (1974) "Stimulus-Organism-Response" (SOR) theory. According to this theory, the marketing actions of electricity providers (stimulus) induce a specific state in consumers' minds (state of the organism), such as the image of the electricity provider. This state, in turn, serves as a basis

for specific consumer behaviours. These behaviours can include continuing or terminating cooperation with the electricity provider, issuing positive or negative recommendations, or advocacy.

The substantive relationships between the marketing actions of electricity providers and their image, as well as the aforementioned importance of shaping a positive image, lead to the formulation of the following research problem: How do the marketing activities of electricity providers, carried out in the realm of the marketing mix, impact the image of these providers among consumers? The research literature indicates that to date, such a problem has not been the subject of research, and therefore represents a research gap.

According to the authors' best knowledge, previous research on the impact of marketing actions on company image has not been conducted in relation to electricity providers. Previous national studies have focused on specific components of the marketing mix, most often promotion, and its influence on the image of entities in the banking sector (Fałowski, 2010; Sobczyk-Kolbuch, 2000), the dairy industry (Parkita, 2017), hotels (Orfin-Tomaszewska and Sidorkiewicz, 2019), and commercial entities in the Fast Moving Consumer Goods (FMCG) sector (Wójcik, 2014; Oleś, 2017). Research conducted worldwide has primarily focused on issues related to advertising in terms of expenditures incurred, as well as sales promotion, distribution efficiency, core product, and price level in terms of their impact on a company's image. These studies encompassed entities from the food and beverage sectors (Sembiring, 2021), IT services (Kim and Hyun, 2011), retail in the food industry (Mukonza and Swarts, 2020), and the job market (Kim et al., 2011). However, research on the impact of marketing actions of electricity suppliers on their image is still lacking.

The contribution of this work to management science lies in understanding how selected marketing actions undertaken by

electricity providers within the marketing mix influence their image. The study focuses on the Polish electricity market, as after its liberalisation, the relationships between electricity providers have largely been shaped by the phenomenon of competition. Consequently, the importance of marketing activities by electricity providers and the shaping of their desirable image among consumers are amplified in this market.

1. Literature review

The concept of actions in management is defined as the execution of specific activities with the intention of achieving the goals of an organisation or as activities leading to an intended result (Kotarbiński, 1975; Mucha-Kuś et al., 2021; Hussain et al., 2021; Saługa, 2021). In this context, marketing activities can be understood as a set of controlled actions undertaken by a company to elicit a desired response among buyers. Concerning the shaping of a desirable image, marketing activities are defined as stimuli sent by the company to consumers to achieve a positive, trustworthy image (Penc, 2001). One way to classify marketing activities is to place them in the categories of the so-called marketing mix, also known as the "4Ps" of marketing. In line with this approach, the classical categories of the marketing mix are product, price, place, and promotion (McCarthy and Perreault, 2002).

The first conceptualisation of the term "image" in management science appeared in the 1950s (Martineau, 1958) and subsequently evolved, developing its essence, complexity, and role. As early as the 1990s, it was recognised that achieving success is not sufficient solely through a product supported by attractive prices, considering the broad-ranging promotional activities. It is essential to create a specific company image that supports buyers in making choices and purchase decisions (Bombiak, 2015) based on their own opinion or perception (Wereda

and Książek, 2012), despite the potential lack of complete information. It is believed that a negative attitude towards a company can lead to the abandonment of purchasing or owning its product, even if it satisfies a felt need. Similarly, a positive attitude towards a company can lead to the purchase of its products (Rudnicki, 2012), as well as to recommendations.

For the purposes of this article, the authors adopted the definition of the company's image as associations that arise in response to stimuli sent by the company to participants in its environment, where each of them assesses the organisation through the lens of their own experiences, values, or benefits (Zawadzka, 2010). The image is formed as a result of the company's interactions with its environment and is understood as an impression (Nguyen and Leblanc, 2001) or perceptions (Lemmink et al., 2003) and beliefs (Pomeroy and Johnson, 2009) about the organisation (Frąckiewicz, 2008). The company's image contributes to ensuring its success in the competitive market (Gray and Balmer, 1998) and creates its value (Spyropoulou et al., 2010). It is used to introduce new products (Dowling, 1986), leading to customer satisfaction (Hart and Rosenberger, 2004) and ensuring their loyalty (Nguyen and Leblanc, 2001). Consequently, companies strive to provide their recipients with a positive image (Gray and Balmer, 1998), whereby the latter believe they are receiving high value when they make a purchase (Nguyen and Leblanc, 2001). The issue of the company's image therefore lies in the question of how to use marketing activities to shape a positive company image in the minds of customers to achieve the intended goal.

The Stimulus-Organism-Response theory, also known as the Stimulus-State-Response (SSR) framework, provides a theoretical framework that explains how individuals' behaviours are shaped based on stimuli from their environment (Koch and Oulasvirta, 2018). In reference to this theory, a stimulus

is any factor from an individual's environment that influences that individual and leads to a specific state or behaviour. An organism, in this context, refers to an individual's internal state, including beliefs, attitude, emotions or image. Next, a response refers to a specific behaviour or action undertaken by an individual in response to a stimulus (Koch and Oulasvirta, 2018).

The work focuses on the first two components of the SOR model, namely external stimuli (stimulus) and the state of the organism. In the context of this work, external stimuli are perceived as the marketing activities of the electricity provider to which the electricity consumer is exposed. On the other hand, the internal state of the organism can be considered as the image of this provider that forms in the consumer's mind. This image represents the overall perception of the provider by the consumer, which is formed based on the provider's past and present actions. Furthermore, the consumer's response to the marketing activities of the electricity provider – which is not the subject of this work – is expressed through the behaviour of the consumer, which may involve continuing or terminating cooperation with the electricity provider, recommending or criticising it.

According to the authors' best knowledge, no empirical research has been conducted thus far to determine the impact of marketing activities undertaken within the marketing mix on the image of energy companies. Previous studies conducted in Poland have only examined the impact of selected marketing mix activities, often limited to promotions, on the image of cities, provinces, and Poland (Stanowicka-Traczyk, 2007; Ludew, 2016; Mazurkiewicz, 2011; Szarota, 2011; Ślusarz, 2015), banks (Fałowski, 2010; Sobczyk-Kolbuck, 2000), the dairy industry (Parkita, 2017), hotels (Orfin-Tomaszewska and Sidorkiewicz, 2019), and commercial entities in the FMCG industry (Wójcik, 2014; Oleś, 2017; Wróblewski, 2018). Research

conducted globally has primarily focused on issues related to advertising in terms of the expenditures incurred and sales promotion, distribution efficiency, core product, and price level in relation to their proposed relationship with the company's image. These studies encompassed sectors such as food and beverages (Sembiring, 2021), IT services (Kim and Hyun, 2011), retail in the food industry (Mukonza and Swarts, 2020), and the job market (Kim et al., 2011). They were conducted in companies (Cobb-Walgren et al., 1995; Kim and Hyun, 2011; Sembiring, 2021; Mukonza and Swarts, 2020; Konovalyuk et al., 2023), as well as among students, who were treated as potential "target customers" (Ebeid, 2014).

The results of empirical research on the impact of an electricity provider's marketing activities on its image will contribute to the field of management science, thereby enhancing the significance of the current state of the art. This is because such research pertains to a different environment than previously studied (it relates to the national energy sector) and considers the specific marketing activities undertaken by electricity providers within various categories of the marketing mix. Hence, the identified research gap arises from the previous lack of studies on the impact of marketing activities conducted by electricity suppliers within the marketing mix on their image.

In the following part of this chapter, research hypotheses related to each category of the marketing mix will be developed.

In the literature, it is indicated that marketing activities related to the product are significant in shaping how a company is perceived by its customers (Frąckiewicz, 2008). Characteristics of these activities include, among others, building product quality, service levels, warranties provided, and creating product lines in the company's offerings (Armstrong and Kotler, 2012; Rafiq and Ahmed, 1995). Customers' perceptions of a company arise from the accumulation

of information through which buyers evaluate the company's offerings (Nguyen and Leblanc, 2001). In light of the SOR theory, this information stems from the marketing activities of companies that showcase certain aspects, such as the promise of high quality through warranties or the creation of product packages tailored to customer needs. This is intended to influence the positive perception of the energy company by its customers. A study published in 2021 indicated that an ecological product line influences the perception of the company. This study focused on entities in the food industry in Indonesia and was conducted among firms (Sembiring, 2021). In another study conducted in the Korean market among firms in the IT industry, it was also shown that delivered quality, in this case through levels of service warranties, impacts the company's image (Kim and Hyun, 2011).

In the context of the activities carried out by energy companies in the product area, it can be observed that in addition to the core product, which is electricity, for which uninterrupted electricity supply is guaranteed by companies (a fundamental quality criterion at the core product level), additional products are also offered, such as eco-friendly options (indicating electricity sourced exclusively from renewable energy sources or photovoltaic installations for homes with contracts for the purchase/sale of electricity). Offers for other products are also created in conjunction with electricity, such as natural gas or home appliances, e.g. boilers or air purifiers, signalling the satisfaction of various customer needs. Considering the above, the following hypotheses have been formulated:

- H1:** The offering of additional products along with electricity by the provider positively influences its image.
- H2:** Ensuring the continuity of the electricity supply positively influences the image of the provider.

Marketing activities in the area of pricing can be utilised to shape a company's image. Price has been recognised as an initial attribute that influences the process of shaping a company's image (Dowling, 1986). The price can signal the quality of the purchased product (Milgrom Robert, 1986; Yoo et al., 2000). The level of the price can suggest the product quality and can thus be associated with how the company is perceived (Kim and Hyun, 2011). Too high a price for homogeneous products can have a negative impact on the company's image, as customers realise it is merely about paying more (Kim and Hyun, 2011). On the other hand, the use of discounts and rebates can suggest lower prices, contributing to a positive perception of the company (Herbig and Milewicz, 1998). Characteristics of marketing activities in the area of pricing have been attributed to, among other things, setting discounts for the purchase of additional products, applying moderate or the lowest prices in the area/region (Poh et al., 2011).

In the context of the actions carried out by energy companies in the area of pricing, it can be observed that psychological discounts are already widely applied in fixed fees, for example, a monthly subscription fee of PLN 9.90. Seasonal promotions and discounts are less common. In light of the above, the following hypothesis has been formulated:

H3: The provision of price discounts by the electricity provider positively influences its image.

Distribution channels owned by the company and its ability to create them in line with the expectations set by customers, as well as the standards offered in the market, can be used to shape the image of the provider (Dowling, 1986). By adjusting the intensity of the company's distribution channels, signals are sent to increase the level of convenience for customers, who engage less and sacrifice less in the purchase

of products, thereby increasing their satisfaction level (Yoo et al., 2000). It has been shown that the intensity of distribution channels has a positive impact on the company's image (Ebeid, 2014), as does the performance of the sales channel (Kim and Hyun, 2011). Characteristics of marketing activities in the area of distribution have been attributed to, among other things, the creation of channels expressed by the distribution range, sales area, location of sales points, and customer service (Rafiq and Ahmed, 1995), their attractiveness in terms of decor and convenience for customers, including convenient parking, short distance from the place of residence, or the possibility of reaching them by public transport (Poh et al., 2011). It is noted that customers prefer companies that have mastered online distribution channels to make them available to their buyers, thereby enhancing user convenience (Shpak et al., 2020).

In the context of activities carried out by energy companies, it can be observed that the largest ones operate physical customer service points, albeit in varying numbers and locations. The locations of these points also vary, with some companies having them exclusively in shopping centres, while others have them in county and provincial towns, often situated on main streets and city centres. Some electricity providers do not have physical service points at all. Additionally, the majority of energy companies, including smaller ones, provide alternative distribution channels in the form of websites and electronic platforms, thereby influencing the distribution reach and sales area. In this regard, the following hypotheses have been formulated:

H4: The provision of a physical customer service office by an electricity provider positively influences its image.

H5: The provision of a remote customer service office by an electricity provider positively influences its image.

The ability to undertake and create appropriate promotional activities, including communication and sponsorship, can be used in shaping image. Advertising is perceived as one of the most visible marketing activities (Buil, 2013). When consumers encounter a company's advertisement, they automatically form an image of it, albeit not necessarily positive. Corporate advertising objectives, in line with the theory of attitudes, would be actions aimed at creating awareness and knowledge of the company among consumers (Dowling, 1986). The amount spent on advertising indicates the company's investment in its brand (Yoo et al., 2000). Characteristics of promotional activities include not only advertising but also engaging in events and consciously, purposefully, and systematically influencing the environment through sponsoring entities and events (Rafiq and Ahmed, 1995).

In the context of activities carried out by energy companies, it is common to observe advertising on the Internet, the use of billboards in urban areas, displays at sales points, as well as promotion through sponsoring and supporting sporting, cultural, or other local community events. In light of the above, the following hypotheses have been formulated:

H6: Advertising by the electricity provider has a positive impact on its image.

H7: Engagement in sponsorship by the electricity provider has a positive impact on its image.

2. Methodology

In relation to the research hypotheses, the theoretical model considered in the study can be expressed using the following linear regression equation (based on Muthén, Muthén and Asparouhov, 2016):

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \beta_7 x_{7i} + \varepsilon_{yi}, \quad (1)$$

where:

y_i – the image of the electricity provider as perceived by individual i ,

x_{1i} – offering other products along with electricity as perceived by individual i ,

x_{2i} – ensuring the continuity of the electricity supply as perceived by individual i ,

x_{3i} – providing price discounts as perceived by individual i ,

x_{4i} – providing physical customer service offices as perceived by individual i ,

x_{5i} – providing a remote customer service office as perceived by individual i ,

x_{6i} – advertising of the supplier as perceived by individual i ,

x_{7i} – engagement in sponsorship as perceived by individual i ,

β_0 – intercept term,

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ – regression coefficients,

ε_{yi} – residual in equation for individual i .

The verification of research hypotheses and the achievement of the study's goal were facilitated by a quantitative study conducted based on primary sources. To gather empirical material, a survey was carried out among individuals responsible for cooperation with the electricity provider in households.

The units of the studied population were national households purchasing electricity for their own needs. The sample selection

utilised a natural list of population units, considering the geographical distribution of households resulting from their place of residence. The sample size was 503 units, and the "random-route" method was used for its selection. Face-to-face interviews, with the use of a standardised questionnaire, were conducted within households among individuals responsible for cooperation with the electricity supplier in a household.

In the random-route method, 80 randomly selected starting points were used. Firstly, the map of Poland was divided into territorial units according to the Nomenclature of Territorial Units for Statistics (NTUS). Sixteen voivodeships were assigned to six regions, and then – based on the analysis from 16 provincial offices of the Central Statistical Office in Poland – specific towns for the survey were identified, meeting the criterion of the size of the place of residence (local NTUS level). The selected towns were assigned a street name randomly chosen from the publicly available Google Maps service. Next, the first housing unit (i.e. an apartment or a single-family house) was located as the starting point. Subsequently, the interviewer moved to the next apartment or house, interviewing residents, while interviews were not conducted at the starting points. Buildings were counted by moving to the right from the selected house, on the same side of the street.

With regard to the questionnaire, the Likert scale was used to measure the independent variables describing the marketing activities of the electricity supplier. For each of these variables, a positive statement was constructed, and respondents were asked to indicate the extent to which they agreed or disagreed with the statement. The degree of agreement was assessed on a five-point scale, with points defined verbally from “strongly disagree” to “strongly agree”. On the other hand, the measurement of the dependent variable, expressing the image of the electricity provider,

involved evaluating this image based on a five-point scale, with points described verbally from “decidedly negative” to “decidedly positive”. The questionnaire was tested in a pilot study before conducting the main survey.

Multiple linear regression was used for data analysis, with the evaluation of the image of the household’s electricity provider as the dependent variable, and the evaluations of the marketing activities of the provider captured in the study as the independent variables. The statistical software Mplus v. 7.11 was used to estimate the regression coefficients and their statistical significance, using the Maximum Likelihood and Mean-adjusted (MLM) estimator. This estimator is robust to deviations of data from the normal distribution (Muthén and Muthén, 2012).

As presented in Table 1, the participants in our sample were classified based on their gender, age, and the size of their place of residence. Regarding gender, there were slightly more women (52.0%) than men (48.0%) in the sample. The majority of the participants resided in rural areas (33.4%), followed by cities with a population of over 200,000 (28.6%), then cities with a population ranging from 20,000 to 200,000 (24.9%), and the fewest resided in cities with less than 20,000 inhabitants. The majority of the respondents were in the age range of 30 to 49 years (50.9%), followed by the age group of 50 to 59 years (31.8%), then those above 60 years (14.7%), with the fewest participants in the age group of 18 to 29 years (2.6%).

Table 1. Structure of the research sample

Feature	Sample size	Percentage	Feature	Sample size	Percentage
Age			Residence size		
18-29 years	13	2.6%	village	168	33.4%
30-49 years	256	50.9%	town up to 20,000	66	13.1%
50-59 years	160	31.8%	town from 20,000 to 200,000	125	24.9%
60 years and over	74	14.7%	city over 200,000	144	28.6%
Gender					
women	263	52.0%			
men	240	48.0%			

Source: own elaboration

3. Research results

In the multiple regression model, the independent variables were as follows: offering other products along with electricity, ensuring the continuity of the electricity supply, providing price discounts, providing

a physical customer service office, providing a remote customer service office, advertising by the provider, and engagement in sponsorship by the electricity provider. The dependent variable was the image of the electricity provider. Table 2 presents the standardised estimates of the regression coefficients.

Table 2. The effects of independent variables on the image of the electricity provider

Variable	Estimate (standardised)	P-value
offering other products along with electricity	0.201	0.000
ensuring the continuity of the electricity supply	0.082 ns	0.067
providing price discounts	0.211	0.000
providing physical customer service offices	0.144	0.001
providing a remote customer service office	-0.065 ns	0.155
advertising by the supplier	0.045 ns	0.290
engagement in sponsorship	0.159	0.000

Source: own work

The results presented in Table 2 indicate that the following factors positively affect the image of the electricity provider: offering other products along with electricity ($\beta = 0.201$, $p < 0.001$), providing price discounts ($\beta = 0.211$, $p < 0.001$), providing physical customer service offices ($\beta = 0.144$, $p < 0.01$), providing a remote customer

service office, advertising, and engagement in sponsorship ($\beta = 0.159$, $p < 0.001$). Therefore, the following research hypotheses were accepted: H1, H3, H4, and H7. However, no statistically significant impact on the electricity provider's image was observed for the following variables: ensuring the continuity of the electricity supply

($\beta = 0.082$, $p > 0.05$), providing a remote customer service office ($\beta = -0.065$, $p > 0.05$), and advertising ($\beta = 0.045$, $p > 0.05$). As a result, the following research hypotheses were rejected: H2, H5, and H6. The coefficient of determination (R^2) in the regression model was 0.239, indicating that the adopted model explained approximately 24% of the variability of the dependent variable.

4. Discussion

The results of the analysis allowed for the verification of the research hypotheses. Regarding the results obtained in relation to hypotheses H1 and H2, formulated within the product category, it appears that offering other products along with electricity positively influences the image of the energy company. However, contrary to our expectations, the same cannot be said for ensuring the continuity of the electricity supply to households. This latter result is somewhat surprising. A previous study conducted in the Information Technology (IT) industry demonstrated that delivered quality, including service guarantee levels, influences the company's image (Kim et al., 2011). The result obtained in our work can be explained by the fact that the reliability of the electricity supply is currently a sort of expected norm or standard; thus, ensuring a continuous power supply does not affect the image of companies in the energy industry.

In relation to the price category, within which hypothesis H3 was formulated, it was found that offering price discounts positively impacts the image of the electricity provider. This is likely due to the specific benefit that consumers obtain as a result of such actions, in the form of lower electricity fees. Previous research findings support this positive influence of pricing activities on the company's image (Herbig and Milewicz, 1998; Ling et al., 2012).

In reference to the results concerning the distribution category, it was found that

providing physical customer service offices positively influences the image of energy companies, as indicated by the adopted hypothesis H4. This result is consistent with the findings of other studies that have demonstrated the positive impact of the performance of the sales channel on a company's image (Kim and Hyun, 2011) and the possession of proprietary distribution channels (Ebeid, 2014).

Regarding the next hypothesis within the distribution category (H5), our results indicate that providing a remote customer service office has no impact on the image of the electricity provider. This result is inconsistent with earlier research findings (Shpak et al., 2020), which suggested that customers prefer companies that have mastered online distribution channels, thereby enhancing usability. It can be presumed that the provision of remote customer service offices by electricity providers is currently a certain norm; therefore, such an action may not influence the image of the electricity provider. Currently, not all electricity providers offer physical customer service offices, likely due to the high costs associated with their maintenance, despite the fact that, as previously mentioned, this is positively associated with the image of the electricity provider.

In the context of the promotion category, where hypotheses H6 and H7 were posited, the results might appear surprising due to the rejection of the sixth hypothesis (H6). Some previous studies have demonstrated a positive relationship between advertising expenditures and company image. However, these studies highlighting the influence of advertising intensity on company image were focused on product categories other than electricity, such as FMCG products (Wójcik, 2014; Oleś, 2017) and food products (Mukonza and Swarts, 2020; Sembiring, 2021). Businesses operating in these latter product groups often utilise expensive television advertisements due to their wide reach (Szymański, 2021), which is not common

in the case of electricity. These differences may account for the varying results when examining the impact of advertising on the company's image. However, concerning the seventh hypothesis (H7), it is evident that engagement in sponsorship positively influences the image of energy companies, which is in line with our expectations and the findings of previous research (Ahmed, 1995).

Conclusions

The study addressed the issue of the impact of selected marketing activities on the image of electricity providers in households. Seven different marketing activities of domestic electricity suppliers were considered, encompassing various categories of the marketing mix. Based on the SOR theory, a positive influence of each investigated activity on the image of the electricity provider was assumed, as expressed in the formulated research hypotheses. These hypotheses were tested based on data collected during a survey conducted among households using electricity.

The adopted research model, expressed in the form of multiple regression, assumed the influence of the analysed marketing activities on the image of electricity providers. The results of the empirical study demonstrated that out of the seven examined marketing activities, four had a positive impact on the image of electricity providers. These activities spanned the following marketing mix categories: offering other products along with electricity in the product context, providing discounts in the price domain, offering physical customer service offices in the distribution realm, and sponsorship in the promotion domain. The results of the analysis indicate that these marketing activities, encompassing different elements of the marketing mix, have a favourable impact on the image of electricity suppliers. This is a significant theoretical insight from our study and contributes to the field of

marketing management for electricity supply companies.

Based on the results obtained, the following practical recommendations are suggested for electricity suppliers. It is recommended that such providers implement the following marketing activities, integrating them within the marketing mix, to build a positive image among households: offering additional products along with electricity (such as private medical care, access to technicians for minor home repairs), providing discounts (e.g. reducing the energy price for extending electricity supply agreements), ensuring access to physical customer service offices (e.g. establishing service points in easily accessible shopping centres), and engaging in sponsorship (e.g. sponsoring local sporting events). According to the available literature, such a favourable image should foster favourable consumer behaviours towards the electricity supplier, such as loyalty and positive recommendations.

This study is not without limitations. One of the limitations pertains to the focus on specific determinants of the image of electricity providers in the form of selected marketing activities. It is conceivable that there are other factors not considered in the empirical study that also influence the image of the electricity provider. These might include marketing activities specific to a particular provider or factors that fall outside the scope of the marketing mix of the companies. Another limitation is the adoption of the consumer perspective in our study, which seems appropriate for evaluating a company's image. However, when it comes to assessing marketing activities, there are certain limitations that result from the level of perception of these actions by consumers. Furthermore, the empirical study was conducted on a specific group of companies, namely domestic electricity providers. Therefore, the direct transfer of the results to companies in other industries or countries should be approached with

caution. Another limitation is the cross-sectional nature of the empirical study, which limits the ability to establish causal relationships. Nevertheless, the relationships examined in the empirical study were based on substantive grounds derived from the SOR theory, justifying their potential existence.

The limitations listed indicate potential directions for future research related to the theme of the work to a certain extent. Future research could consider other potential determinants of company image, such as those extending beyond the scope of activities included in the marketing mix (e.g. environmental responsibility, transparency in operations). Another possible research perspective could involve conducting a long-term study in which marketing activities would be evaluated at the company level, while the image of these companies would be analysed at the consumer level. Another research task could be to test our research model in the context of industries other than the electricity provider sector or on an international scale. However, concerning the issue of applying the proposed research approach to the energy sectors of other countries, the proposed model can be applied, but after taking into account the specific conditions present in the given country. It is particularly important to recognise and incorporate the specific marketing actions undertaken by energy providers in the given country into the model. The next potential research direction could focus on the consequences of a specific image, such as customer advocacy or their engagement in the actions of suppliers.

References

- Armstrong G., Kotler P., (2012), *Marketing. Wprowadzenie*, Wolters Kluwer, Warszawa.
- Baehre S., O'Dwyer M., O'Malley L., Lee N., (2021), The use of Net Promoter Score (NPS) to predict sales growth: insights from an empirical investigation, *Journal of the Academy of Marketing Science*, pp. 67–84, <https://doi.org/10.1007/s11747-021-00790-2>.
- Barney J.B., Hesterly W.S., (2012), *Strategic management and competitive advantage: concepts and cases*. International edition. 4th ed. Pearson, Edinburgh.
- Bombiak E., (2015), *Wizerunek – kluczowy element postrzegania przedsiębiorstwa, Współczesny marketing i logistyka – innowacyjne rozwiązania*, Siedlce, pp. 93–103.
- Buil I., Chernatony L., Martínez E., (2013), Examining the role of advertising and sales promotions in brand equity creation, *Journal of Business Research*, Vol. 66, pp. 115–122, <https://doi.org/10.1016/j.jbusres.2011.07.030>
- Dowling G., (1986), Managing Your Corporate Images, *Industrial Marketing Management*, 15, pp. 109–115.
- Dyrektywa 96/92/WE Parlamentu Europejskiego i Rady z dnia 19 grudnia 1996r. dotycząca wspólnych zasad rynku wewnętrznego energii elektrycznej.
- Fałowski D., (2010), *Kształtowanie wizerunku banku na przykładzie PKO BP – praca dyplomowa*, Wyższa Szkoła Biznesu – National Louis University.
- Frąckiewicz E., (2004), *Zarządzanie marketingowe*, PWE, Warszawa.
- Gray E., Balmer J., (1998), Managing Corporate Image and Corporate Reputation, *Long Range Planning*, Vol. 31, Issue 5, pp. 695–702, [https://doi.org/10.1016/S0024-6301\(98\)00074-0](https://doi.org/10.1016/S0024-6301(98)00074-0)
- Grondys, K., Androniceanu, A., Dacko-Pikiewicz, Z. (2020), Energy Management in the Operation of Enterprises in the Light of the Applicable Provisions of the Energy Efficiency Directive (2012/27/EU). *Energies*, 13, 4338. <https://doi.org/10.3390/en13174338>

- Hart A., Rosenberger P., (2004), The Effect of Corporate Image in the Formation of Customer Loyalty: An Australian Replication, *Australasian Marketing Journal*, Vol. 12, Issue 3, 88-96, [https://doi.org/10.1016/S1441-3582\(04\)70109-3](https://doi.org/10.1016/S1441-3582(04)70109-3)
- Herbig P., Milewicz J., (1994), Marketing Signals in Service Industries: Implications for Strategic Decision Making and Profitability, *Journal of Services Marketing*, Vol. 8, Issue 2, pp. 19-35.
- Hussain, H.I., Haseeb, M., Kamarudin, F., Dacko-Pikiewicz, Z., Szczepańska-Woszczyna, K. (2021), The Role of Globalization, Economic Growth and Natural Resources on the Ecological Footprint in Thailand: Evidence from Nonlinear Causal Estimations. *Processes*, 9, 1103. <https://doi.org/10.3390/pr9071103>
- Kim J., Hyun Y., (2011), A model to investigate the influence of marketing-mix efforts and corporate image on brand equity in the IT software sector, *Industrial Marketing Management*, (40), pp. 424-438, DOI:10.1016/j.indmarman.2010.06.024
- Koch J., Oulasvirta A., (2018), *Group Cognition and Collaborative AI*, in: J. Zhou and F. Chen (Eds.), *Human and Machine Learning*, (pp. 293-312), Springer.
- Konovalyuk, I., Brych, V., Borysiak, O., Mucha-Kuś, K., Pavlenchuk, N., Pavlenchuk, A., Moskvayak, Y., & Kinelski, G. (2023). Monitoring the integration of environmentally friendly technologies in business structures in the context of climate security. *Forum Scientiae Oeconomia*, 11(2). https://doi.org/10.23762/FSO_VOL11_NO2_8
- Kotarbiński T., (1975), *Traktat o dobrej robocie*, Ossolineum, Wrocław.
- Kotler Ph., (1994), *Marketing – analiza, planowanie, wdrażanie, kontrola*, Gebethner i Ska, Warszawa.
- Kotler Ph., Keller K.L., (2018), *Marketing*, Rebis, Poznań.
- Lemmink J., Schuijf A., Streukens S., (2003), The role of corporate image and company employment image in explaining application intentions, *Journal of Economic Psychology*, Vol. 24, Issue 1, pp. 1-15.
- Ling A., Saludin M., Mukaidono M., (2012), Deriving consensus rankings via multicriteria decision making methodology, *Business Strategy Series*, Vol. 13 Iss: 1, pp. 3-12, <https://doi.org/10.1108/17515631211194571>
- Ludew A., (2016), *Znaczenie promocji w kształtowaniu wizerunku miejsca na przykładzie Krakowa* – praca dyplomowa, Wydział Zarządzania i Komunikacji Społ., UJ.
- Maison D., Noga-Bogomilski A., (2007), *Badania marketingowe. Od teorii do praktyki*, Gdańskie Wydawnictwo Psychologiczne, Gdańsk.
- Martineau P., (1958), *The Personality of the Retail Store*, Harvard Business Review, Vol. 36, pp. 47-55.
- Mazurkiewicz K., (2011), *Wpływ promocji na wizerunek województwa śląskiego jako regionu turystycznego* – praca dyplomowa, Wydział Zarządzania i Komunikacji Społ., UJ.
- McCarthy J., Perreault W., (2002), *Basic Marketing: A Global Managerial Approach*, wyd. 14, McGraw-Hill Irwin.
- Mehrabian, A. and Russell, J.A., (1974), *An Approach to Environmental Psychology*, MIT Press, Cambridge.
- Milgrom P., Robert J., (1986), Price and advertising signals of product quality, *Journal of Political Economy*, Vol. 94, No. 4, pp. 796-821.
- Mucha-Kuś K., Sołtysik M., Zamasz, K., Szczepańska-Woszczyna, K. (2021). Coopetitive Nature of Energy Communities-The Energy Transition Context. *Energies*. 931. DOI:10.3390/en14040931.
- Mukonza C., Swarts I., (2020), The influence of green marketing strategies on business performance and corporate image in the retail sector, *Business Strategy and the Environment*, Vol. 29, Issue 3, 838-845, DOI:10.1002/bse.2401
- Muth'en B., Asparouhov T., (2016), *Multi-Dimensional, Multi-Level, and Multi-Timepoint Item Response Modeling*, in: van der Linden, W. J., *Handbook of Item Response Theory*. Volume One. Models, (pp. 527-539), Boca Raton: CRC Press.

- Nguyen N., Leblanc G., (2001) Corporate Image and Corporate Reputation in Customers' Retention Decisions in Services, *Journal of Retailing and Consumer Services*, Vol. 8(4), 227-236, DOI:10.1016/S0969-6989(00)00029-1
- Oleś J., (2017), *Kreowanie wizerunku marki – praca dyplomowa*, Wydział Zarządzania i Komunikacji Społ., UJ.
- Orfin-Tomaszewska K., Sidorkiewicz M., (2019), Marketing-Mix Instruments in Shaping the Hotel's Image. *Theoretical and Analytical Approach, Entrepreneurship and Management*, no. 20, pp. 263-275.
- Parkita M., (2017), *Kształtowanie wizerunku firmy OSM Włoszczowa – praca dyplomowa*, Wydział Zarządzania i Komunikacji Społ., UJ.
- Penc J., (2001), *Strategiczny system zarządzania*, Agencja Wydawnicza PLACET, Warszawa.
- Poh A., Ling A., Saludin M., Mukaidono M., (2011), Deriving consensus rankings via multicriteria decision making methodology, *Business Strategy Series No. 13*, pp. 3-12, DOI:10.1108/17515631211194571
- Pomeroy A., Johnson L., (2009), Constructing a corporate social responsibility reputation using corporate image advertising, *Australasian Marketing Journal*, Vol. 17(2), pp. 106-114, DOI:10.1016/j.ausmj.2009.05.006
- Rafiq M., Ahmed P., (1995), Using the 7Ps as a Generic Marketing Mix: an Exploratory Survey of UK, *Marketing Intelligence & Planning*, 13(9), pp. 4-15 DOI:10.1108/02634509510097793
- Rudnicki L., (2012), *Zachowania konsumentów na rynku*, PWE, Warszawa.
- Saługa, P.W., Szczepańska-Woszczyna, K., Miśkiewicz, R., Chłód, M. (2020), Cost of Equity of Coal-Fired Power Generation Projects in Poland: Its Importance for the Management of Decision-Making Process. *Energies*, 13, 4833. <https://doi.org/10.3390/en13184833>.
- Saługa, P.W., Zamasz, K., Dacko-Pikiewicz, Z., Szczepańska-Woszczyna, K., Malec, M. (2021), Risk-Adjusted Discount Rate and Its Components for Onshore Wind Farms at the Feasibility Stage. *Energies*, 14, 6840. <https://doi.org/10.3390/en14206840>
- Sembiring R., (2021), The Effect Green Marketing Mix on Corporate Image as Well as Implication for Purchase Intention of Food and Beverages Companies In Indonesia, *Journal of Social Science*, 210-222, DOI:10.46799/jsss.v2i2.112
- Shpak N., Kuzmin O., Dvulit Z., Onysenko T., Sroka W., (2020), *Digitalization of the Marketing Activities of Enterprises: Case Study, Information. Knowledge Management, Trust and Communication in the Era of Social Media*, pp. 109-120, DOI:10.3390/info11020109
- Sobczyk-Kolbuck A., (2000), Promocja jako element marketingu kształtujący wizerunek banku, *Zeszyt Naukowy Katedry Zarządzania i Marketingu Górnośląskiej Wyższej Szkoły Handlowej w Katowicach*, no 5, pp. 153-180.
- Spyropoulou S., Skarmas D., Katsikeas C., (2010) The role of corporate image in business-to-business export ventures: A resource-based approach, *Industrial Marketing Management*, 39(5), 752-760, DOI:10.1016/j.indmarman.2010.02.014
- Stanowicka-Traczyk A., (2007), Rola marketingu mix w budowaniu tożsamości miasta, *Samorząd Terytorialny*, no 9, pp. 17-33, YADDA.element.ekon-element-000150041139
- Szarota K., (2011), *Promocja jako narzędzie kształtowania wizerunku jednostki samorządu terytorialnego na przykładzie miasta Sanok – praca dyplomowa*, WSB – NLU.
- Szymański G., (2021), Marketing Activities of Local Food Producers in E-Commerce, *Sustainability*, Vol. 13 (9406), <https://doi.org/10.3390/su13169406>
- Ślusarz D., (2015), *Wykorzystanie narzędzi promocji w budowie wizerunku Polski – praca dyplomowa*, Wydział Zarządzania i Komunikacji Społ., UJ.
- Vaníčková, R., Szczepańska-Woszczyna, K. (2020), Innovation of business and marketing plan of growth strategy and competitive advantage in exhibition industry. *Polish Journal of Management Studies*. 21(2):425-445. <https://doi.org/10.17512/pjms.2020.21.2.30>.
- Wereda W., Książek E., (2012), *Rola obsługi klienta w kreowaniu wizerunku gminy inteligentnej*, *Współczesne Zarządzanie*, nr 4, pp. 160-168.

- Wojtkowska-Łodej G., Michalski D., Hawranek P. (2014), *Zmiany uwarunkowań funkcjonowania przedsiębiorstw na rynku energii elektrycznej w Unii Europejskiej*, Oficyna Wydawnicza Szkoły Głównej Handlowej, Warszawa.
- Wróblewski, Ł., Mokrysz, S. (2018). Consumer preferences for coffee brands available on the Polish market. *Forum Scientiae Oeconomia*, 6(2), 75–90. https://doi.org/10.23762/FSO_VOL6NO2_18_6
- Wójcik J., (2014), *Tworzenie i budowanie wizerunku przedsiębiorstwa handlowego na przykładzie Biedronki BP* – praca dyplomowa, WSB – NLU.
- Yoo B., Lee S., Donthu N., (2000), An Examination of Selected Marketing Mix Elements and Brand Equity, *Journal of the Academy of Marketing Science*, Vol. 28(2), pp. 195–211, DOI:10.1177/0092070300282002
- Zawadzka A., (2010), *Psychologia zarządzania w organizacji*, PWN, Warszawa.

Dariusz Dąbrowski is an Associate Professor at the Gdańsk University of Technology. His scientific interests have focused on problems related to the management of product innovation, as well as the market orientation of organisations. His recent research concerns issues related to the creativity and application of market knowledge in new product development within high technology companies, shaping the image of market entities, the implementation of market orientation and marketing programmes in organisations, and achieving a competitive advantage based on new products. He has participated in numerous research projects implemented at academic centres and in projects requested by industry. Currently, he serves as the head of the Marketing Department at the Faculty of Management and Economics at the Gdańsk University of Technology. ORCID no. <https://orcid.org/0000-0002-2045-2683>

Jakub Dąbrowski, PhD, is a member of the Polish Scientific Marketing Society. He is the author of publications in the field of project management, organisational management, and marketing. Certified as a project manager and methodologist, he places a strong emphasis on effectiveness, efficiency, and innovation in his professional work. He has authored development strategies for companies in the energy sector, developing and implementing new products. He leads complex research projects and market analyses, taking responsibility for the execution of marketing strategies. Currently, he serves as the Chief Marketing Officer (CMO) at one of the major energy groups in Poland. ORCID no. <https://orcid.org/0009-0002-9912-8241>

Krzysztof Zamasz is a Polish manager and economist, and an Associate Professor at WSB University in Dąbrowa Górnicza and the Silesian University of Technology. He is the author of a number of publications devoted to the management of energy companies and scientific expertise in the field of energy economics, the energy market, mergers and acquisitions, innovation and logistics process management. He is a recognised authority and expert who for many years had merged the theory of economy and management with practice as a member of the management boards of the biggest Polish and international energy groups. During the 25 years of his professional life, he pursued his career in the energy sector, where he implemented projects related to the transformation of the sector. He currently serves on the boards of companies in the energy sector and he is also the Director of the Institute of Energy Transformation at WSB University. ORCID no. <https://orcid.org/0000-0003-4090-8737>

Marcin Lis is an Associate Professor and Vice-Rector for Student Affairs and Cooperation with the Environment at WSB University. He is an advocate for initiatives aimed at the development of higher education, entrepreneurship, knowledge transfer from science to the economy, and the development of a knowledge-based economy. He serves as the President of the Delegation (Dąbrowa Górnicza) of the Regional Chamber of Commerce in Katowice, a member of the international association The European Academy of Management (EURAM

c/o EIASM – European Institute for Advanced Studies in Management), Vice-President of the Board of the Scientific Society of Organisation and Management's branch in Dąbrowa Górnicza, Vice-President of the Board of the Polish Economic Society in Katowice, Vice-President of the Board of the Silesian Employers' Association Lewiatan, and a member of the Programme Board of the National Cluster "Silesia Automotive & Advanced Manufacturing" of the Katowice Special Economic Zone. He has extensive corporate experience gained in international service companies, having held key managerial positions related to the creation of customer relationship management systems, quality and process management, and project management. He served as an executive-level manager at Orange S.A. and is an MBA graduate. In recognition of his activity in shaping relations between science and business, he was honoured with the Silver and Golden Cross of Merit, the Medal of the National Education Commission, and the Golden Honorary Badge for Merit to the Silesian Voivodeship. ORCID no. <https://orcid.org/0000-0001-7046-591X>

Religious Values and Food Waste: A Comparative Study of Roman Catholic Believers and Non-Religious Individuals

JINDŘICH ŠPIČKA

Abstract

DOI: 10.23762/FSO_VOL11_N04_5

Food waste is a global problem with significant implications for the environment and social justice alike. Despite the importance of religion and faith as social phenomena, their relationship to food waste remains relatively under-researched. This study focuses on Roman Catholicism as one of the most widely practiced religions in the world. The research is based on the analysis of data from the Czech Social Science Data Archive from 2022, which includes responses from 579 respondents aged 15+. The results of research conducted using the CHAID method show that younger and older Roman Catholics have different motivations to reduce food waste. Younger believers focus more on moral issues and feel guilty about wasting food, while older believers prioritise economic considerations and worry about the amount of food wasted. In addition, the study shows that Roman Catholic households with lower monthly food expenditures show more compassion for those in need and feel guilty about food waste, while non-religious individuals in households with higher expenditures are more likely to waste food. These conclusions suggest the influence of Catholics' moral and economic values on consumers' food waste attitudes and behaviour. The study adds a new piece to the mosaic of factors that influence food waste and people's attitudes toward it.

Key words

circular model of food waste; consumption model; ecological behaviour of consumers; environmental responsibility; food waste management; economic considerations; moral values; religious affiliation; Roman Catholicism; sustainable development goals.

Jindřich Špička

e-mail: spickaj@pef.czu.cz

Czech University of Life
Sciences Prague, Faculty of
Economics and Management,
Department of Statistics,
Czech Republic

Introduction

Food waste is a long-term negative trend that threatens the sustainable development of society. Food waste is addressed by the United Nations Sustainable Development Goal 12. The European Union supports initiatives according to which countries should implement the circular economy in order to move towards greater sustainability (Aleksnevičienė and Bendoraitytė, 2023; Herrero-Luna et al., 2022; Mikhno et al., 2021). Circular economy principles emphasise the reduction of waste at every stage of the product lifecycle.

According to the Food and Agriculture Organisation (FAO), approximately one-third of edible food is wasted each year, and households are responsible for nearly two-thirds of the world's total food waste (Aloysius et al., 2023). There are a number of definitions of food waste, some overlapping and some complementary. According to the FAO, ERS (the U.S. Department of Agriculture's Economic Research Service), and FUSIONS (a European Union project) definitions, food waste consists of the sum of food "landfilled" and food "used for non-food purposes" (FAO, 2023).

However, this is not a correct definition of food waste, because if recovered food is used as an input, for example as animal feed, fertiliser, or biomass to make products, then by definition it is not waste (Bellemare et al., 2017). According to the same critical study, another inconsistency between these definitions is that the FAO and ERS definitions apply only to edible, safe and nutritious foods, while the FUSIONS and EPA (Computer-Assisted Personal Interviewing) definitions apply to both edible and inedible parts of food. In addition, the ERS and EPA definitions exclude food that is not harvested at the farm level from food waste (Bellemare et al., 2017).

Food waste occurs throughout the food distribution chain, from agricultural production to final consumption in households.

Food losses occur in the early stages, while food waste occurs in the later stages at the consumption level (sales, households). When it comes to food waste, most of it is produced by individuals in households, approximately 61% according to the UNEP (United Nations Environment Programme) Food Waste Index 2021 (Forbes et al., 2021). Individuals are therefore key players in the fight against food waste, because by changing individual behaviour, everyone can help to combat it. This study, therefore, looks at food waste through the lens of households. Food waste is the difference between purchased and consumed food raw materials and processed food that is disposed of in municipal waste without further use.

Previous research has examined the demographic, socioeconomic, and motivational determinants of household food consumption (Čvirik, 2023; Kita et al., 2021). Empirical studies have shown a relationship between food waste and gender, age (Ellison and Lusk, 2018; Flanagan and Priyadarshini, 2021), education (Heidari et al., 2020), household income (Aschemann-Witzel et al., 2019; Liu and McCarthy, 2023; Szabó-Bódi et al., 2018), household size (Edjabou et al., 2016), and type of housing (Nguyen et al., 2022; Rispo et al., 2015).

Internal motives of individuals leading to less food waste were identified as financial and environmental motives (dos Santos et al., 2022; Graham-Rowe et al., 2014; Neff et al., 2015; Galant and Cvek, 2021; Ribbers et al., 2023), moral motives (Bretter et al., 2023; Ribbers et al., 2023; Richter and Bokelmann, 2018), and social motives (Kharazishvili et al., 2020; Celestino et al., 2022; Principato et al., 2021; Ribbers et al., 2023).

The relationship between faith and food waste has received relatively little attention in empirical studies, even though faith is an important social phenomenon worldwide

that shapes human values and moral principles. Religions around the world are diverse and varied, but they also share some commonalities while differing in their beliefs, practices, and cultural expressions. For example, most religions have moral and ethical rules that guide the behaviour and actions of their followers and emphasise virtues such as compassion, honesty, and kindness.

This article focuses on Roman Catholicism as one of the most widely represented religions in the world and the most important branch of Christianity. There are approximately 1.3 billion Catholics throughout the world (Oakley et al., 2023). The connection between food waste and Roman Catholicism can be understood in the context of broader Catholic social teaching and the principles of stewardship, care for creation, and solidarity with the poor. In his 2015 encyclical “*Laudato si*”, Pope Francis emphasised the importance of environmental protection, sustainable development, and the moral imperative to address issues such as food waste and its impact on the environment and vulnerable communities (Bergoglio, 2015).

One of the main principles of Catholic social teaching is the idea of stewardship (Ambalu et al., 2013), which emphasises that people have a duty to care for and protect the environment and its resources, recognising them as a gift from God. Food waste contributes to environmental degradation, including increased greenhouse gas emissions, water waste, and inefficient land use. By wasting food, individuals are not fulfilling their role as stewards of creation.

Another central theme of Catholic social teaching is the call to solidarity with the marginalised and less fortunate, including the poor and hungry (Ambalu et al., 2013). Food waste is particularly problematic because it occurs in a world where millions of people suffer from hunger and malnutrition. Reducing food waste can help address the problem of food insecurity and show compassion for those in need.

Both cases involve moral and social motivations. Moral motivations have to do with conscience, fear, and guilt toward people who do not have adequate access to food. Moral motivations to prevent food waste in the home relate to promoting food safety, treating animals ethically, addressing social justice issues, caring for the environment, promoting responsible behaviour, and respecting the value of food and the efforts of those involved in food production (Richter and Bokelmann, 2018). Social motivation to avoid food waste involves a person’s self-representation of how they are perceived by others according to social norms (Principato et al., 2021). Particularly important in the context of food waste are the injunctive norms that result from the expectations of others, regardless of whether they behave according to those norms themselves (Ribbers et al., 2023).

This research offers a closer look at faith as the determinant of household food waste. Religiosity has been shown to promote food waste reduction. Specifically, religiosity is positively related to consumers’ attitudes, activism, and personal and subjective norms for reducing food waste (Elhoushy and Jang, 2021). When consumers are aware of the harmfulness of food waste, subjective moral norms (Bretter et al., 2023) and perceived control contribute positively to the intention to reduce food waste (Wang et al., 2023). This study does not address specific expressions of religiosity or different religions, as previous research has done. Instead, it focuses on the declared religious beliefs of Roman Catholics and the associated individual beliefs and public attitudes toward food waste. The goal of the study is to determine the differences in public views on food waste that depend on stated affiliation with the Roman Catholic religion compared to a group of non-religious people.

The study used data from the Czech Social Science Data Archive from 2022. A total of 821 people were interviewed,

representing the population of the Czech Republic aged 15 years and older. The sample is representative in terms of regions of the Czech Republic, size of residence, gender, age, and education. The Czech Republic was selected as an EU (European Union) member state that is experiencing an increase in consumption and food waste as the economy grows.

In the Czech Republic, households discard approximately 2.6 kg of food waste each week on average, which equates to about 1.1 kg per capita. Annually, this extrapolates to about 135.7 kg of food waste per household, or 57.1 kg per capita. Notably, half of this waste was disposed of in municipal bins for mixed waste, indicating a need for improvement in disposal methods to meet sustainability criteria. “Regarding international comparison, the total food waste per person per year of 57 kg is slightly lower than in the other new EU member states with similar socioeconomic and political characteristics (Hungary has 68 kg of the total food waste per person a year) also applying the kitchen diary approach. The avoidable part of Hungarian food waste is quite similar to the Czech part (Czechia 33 kg, Hungary 35 kg)” (Nováková et al., 2021). Vegetables, fruit, and bakery products were identified as the largest categories of food waste, often due to spoilage or overpurchasing (Nováková et al., 2021).

The Czech Republic has many factors in common with other EU member states, such as similar lifestyles, consumption habits, and distribution systems. On the other hand, the Czech Republic leads a secularised, Christian world with the highest percentage (over 70%) of religiously unaffiliated people in the world (Furstova et al., 2021). Historically, the Czech Republic has a complex religious past, marked in modern history by secularisation during the pre-1989 communist era. On the other hand, fewer than 30% of people in Czech society openly profess faith in the Roman Catholic religion,

which has a significant presence in Europe, where it has historically played a central role in shaping the cultural, social, and political landscape of the continent. Examining views associated with food waste can help identify potential links between religiosity and pro-environmental behaviour. This analysis can contribute to broader discussions about the relationship between religion and sustainable development practices around the world.

The following literature review examines the relationship between religion and food waste. Key empirical studies from recent years are cited. The purpose of the literature review is to provide arguments for formulating the hypotheses that will be tested in this study. Data and Methods describe the research design, sample structure and size, and quantitative research methods used to test the hypotheses. The results of the study are then discussed. The conclusions of the study include a summary of the main findings, their practical implications, and suggestions for further research.

1. Literature review

Religion is a multidimensional spiritual concept that includes beliefs, rituals, values, and community (Mathras et al., 2016). All four dimensions influence the behaviour of individuals. Of particular importance to this research are moral, social, and ethical values that influence consumer behaviour (Vitell et al., 2018).

The theory of planned behaviour views religion as a background variable that indirectly influences behaviour through a chain of relationships. Religiosity plays an important role in reducing food waste. This proposition is supported by the idea that a person's belief system is the basis for their behaviour and that religious belief is more general compared to attitude (Minton et al., 2015). Since reducing food waste can be considered a divine commandment, people who believe

in God might be familiar with and accept such restrictions.

Another theoretical framework for the study is the hierarchy of values, attitudes, and behaviour, which assumes that personal values influence consumer behaviour. Religious values, which are deeply rooted and have a wide reach, can significantly influence consumption and non-consumption behaviour. Religious texts and teachings often include guidelines and restrictions regarding food that can both contribute to and discourage food waste, depending on the specific practices (Minton et al., 2020).

Recent empirical studies have shown a positive relationship between food waste aversion and the personality traits of conscientiousness, frugality, and religiosity (Abdelradi, 2018; Elhoushy and Jang, 2021; Kutlu, 2022). Conscientiousness is a personality trait associated with self-discipline, organisation, and responsibility. Individuals with a high degree of conscientiousness are more aware of their actions and consider the consequences of waste. They plan their food purchases and consumption more carefully, avoiding excessive shopping and waste. In addition, conscientious people tend to be more environmentally conscious, which may also have implications for reducing food waste as part of their overall pro-social behaviour. Frugality is the tendency to be thrifty and avoid waste. People with frugal tendencies are more likely to be resourceful, creatively reuse leftovers, and find ways to minimise food waste. Their tendency to conserve resources coincides with reducing food waste, seeing it as an unnecessary waste of money and food.

Consumer activism and personal norms are important mediators of the effect of religiosity on intention to reduce food waste (Elhoushy and Jang, 2021). Those who make a special effort to reduce environmental problems, actively try to convince others to reduce food waste (including family) and recognise the importance of small

individual steps to large collective change were classified as activist consumers. As part of the personal norms assessment, individuals were asked if they felt bad about throwing away food, if they felt obligated not to waste food, and if it was against their principles to have to throw away food. On the other hand, the study (Elhoushy and Jang, 2021) did not demonstrate the influence of consumers' attitudes, injunctive norms (derived from family, neighbours, colleagues, and community), and descriptive norms (sharing the same norms with important people in a person's life) on their intentions to reduce food waste.

Not all religious movements have the same influence on pro-environmental behaviour. Some religions, such as Christianity, Judaism and Buddhism, have a positive influence on the adoption of pro-environmental practices. Islam, Hinduism, and folk religions, on the other hand, show an inverse relationship (Rodríguez-Domínguez and Gallego-Alvarez, 2021). Restrictive religious norms (e.g. food consumption rules, fasting) lead to increased food waste, while supportive religious norms (e.g. sharing food) lead to decreased food waste. At the same time, the likelihood that a religious person will reduce food waste is influenced by a marketing message that is associated with an environmental argument or support for human society (Minton et al., 2020).

Because the literature on the relationship between religiosity and pro-environmental behaviours that reduce food waste is sparse, this study extends existing research by specifically examining the value dimension of the Roman Catholic religion as reflected in views on food waste in the home. Moral, environmental, economic, and health-related views of food waste are examined.

In terms of moral norms, religious adherents have different moral values than secular people (Brown et al., 2023). Roman Catholics, as followers of a particular faith, are influenced by religious teachings that

emphasise dominion theory (according to which nature exists to serve human needs (Konisky, 2018)), stewardship theory (according to which religious beliefs lead people to care for and protect nature (Clements et al., 2014)), compassion, and care for God's creation. According to stewardship theory, religious people believe that they are morally obligated to care for nature and therefore should care more about the environment. Stewardship theory supports Christians' increased concern for immediate environmental problems rather than long-term environmental threats in the future (E. K. Smith et al., 2018). Christian teaching often promotes the responsible use of resources, including minimising waste and sharing with those in need. On the other hand, non-believers may not have specific religious teachings that inform their views regarding food waste, and their moral values may be shaped by other philosophical or ethical perspectives.

The attitude toward environmental protection is related to the role of Roman Catholics as stewards of God's creation, who have the duty to protect and preserve the environment, which is a gift from God. This view may lead to a greater emphasis on sustainable practices and food waste reduction as part of their commitment to protecting the earth (Filimonau et al., 2022). Christianity, as an important social actor, coexists with and can reinforce concern for and respect for nature (Petrescu-Mag et al., 2020). Regarding expressions of religiosity, it was found that among Roman Catholics, participation in sociocultural religious activities and self-assessed spirituality were positively and significantly associated with different dimensions of environmental engagement, but church attendance as an expression of belonging to a particular religion was not (Briguglio et al., 2020). It has been empirically demonstrated that religious values and family upbringing reinforce personal moral motives, beliefs, attitudes,

and norms to reduce food waste in heavily Catholic Poland (Filimonau et al., 2022). In contrast, a previous study found that among Christians, religiosity was positively related to pro-environmental behaviour, but not to pro-environmental attitudes or beliefs (Clements et al., 2014).

According to recent research, however, religion does not have a unidirectional influence on people's attitudes toward the environment, and neither the dominion theory nor the stewardship theory can be fully supported. Religious people do not need to worry about environmental threats because their faith helps them cope with immediate concerns about those threats (in the sense of "God has everything under control" or "God will not subject me to any test I am not prepared for"). On the one hand, people who are more religious experience a lower sense of threat from environmental threats, but show increased general concern about the environment because this concern is focused on more than just environmental threats (Michaels et al., 2021; Peifer et al., 2016; N. Smith and Leiserowitz, 2013).

While previous research has shown a link between religiosity and attitudes toward food waste, it has not addressed which specific moral, environmental, economic, and health beliefs related to food waste are typical of religious people and which are typical of non-religious people. Only this deeper analysis will make it possible to distinguish the views of people of Roman Catholic faith from those of people without religious faith, and thus explain the specific values associated with the Roman Catholic faith that relate to food waste.

H1: Moral views related to food waste differ between Roman Catholics and non-religious people.

H2: Environmental views related to food waste differ between Roman Catholics and non-religious people.

H3: Economic views related to food waste differ between Roman Catholics and non-religious people.

H4: Health beliefs related to food waste differ between Roman Catholics and non-religious people.

2. Methodology

2.1. Data and sample

The main data source for the study is secondary data from the Food 2022 survey, obtained from the Czech Social Science Data Archive (CSDA), a national data service centre for the social sciences that acquires, processes, documents, and stores digital data files from scientific projects and makes them available for further analytical use in scientific research and teaching at universities. CSDA is part of the Institute of Sociology of the Academy of Sciences of the Czech Republic and is the Czech national node of the pan-European research infrastructure CESSDA ERIC (Consortium of European Social Science Data Archives) and its service provider in the Czech Republic (Czech Social Science Data Archive, 2022).

A total of 821 respondents representing the population of the Czech Republic aged 15 years and older were interviewed. Not all respondents completed the questionnaire; 579 respondents comprised the final sample. Respondents were selected by quota sampling. The quota characteristics were region (NUTS 3, Nomenclature of Territorial Units for Statistics), size of residence, sex, age, and education. Data were collected by means of a standardised interview using the CAPI method (Computer-Assisted Personal Interviewing). Data collection was conducted by trained interviewers from the Centre for Opinion

Research of the Institute of Sociology of the Czech Academy of Sciences from 14 July 2022 to 4 September 2022.

The study focused on food waste, shopping and consumption behaviour of Czech households, the discarding of visually unsound fruit and vegetables, the Czech public's awareness of the Czech Association of Food Banks, the type of eating, shopping and environmental behaviour of Czech society, and the opinions and attitudes of the Czech public toward food waste.

The dataset was weighted after stratification to achieve structural representativeness for the population in the Czech Republic. The weights were created using an iterative proportional weighting method. The weighting variables are education (four categories) $\times$ NUTS 2, age (four categories) $\times$ NUTS 2, sex $\times$ region, size of residence (eight categories) $\times$ age (four categories), and education (four categories) $\times$ age (four categories). The data source for the weights is the Czech Statistical Office. The size of the weights is restricted to the range 0.333 to 3.

2.2. Variables

Belonging to the Roman Catholic Church was determined by the question "To which religion or religious community do you belong?" According to the weighted data, 24.3% of people in the Czech Republic belong to the Roman Catholic religion, 67.3% of people are non-denominational, and 8.4% of people belong to another religion. Other denominations were not considered in this study, meaning that only the Roman Catholic denomination and the population of no faith were included. Table 1 examines the relationship between religious affiliation and subjective food waste compared to a household of the same size.

Table 1. Relationship between the Roman Catholic religion and relative food waste rates relative to the same household size

Religion	Unit	I waste more	I waste the same	I waste less	Total
No religion	Number	56	183	206	445
	%	12.6%	41.1%	46.3%	100.0%
	Adj. Residual	2.1	3.5	-4.7	
Roman Catholic	Number	8	33	93	134
	%	6.0%	24.6%	69.4%	100.0%
	Adj. Residual	-2.1	-3.5	4.7	
Total	Number	64	216	299	579
	%	11.1%	37.3%	51.6%	100.0%

Note: Pearson Chi-square = 22.241 ($p < 0.001$), Phi = 0.196 ($p < 0.001$), Cramer’s V = 0.196 ($p < 0.001$)

Source: own elaboration

Pearson’s Chi-square test shows a statistically significant relationship between Roman Catholic religious affiliation and the relative rate of food waste compared to households of similar size. People of the Roman Catholic religion waste less than people with no religion. The Roman Catholic religion is thus related to food waste, and is, therefore, a relevant variable in food waste research.

General opinion on food waste (PL_7) was rated on a scale of 1 = food waste is not a societal problem (9.3%), 2 = food waste is not right, but there are more pressing problems (44.1%), 3 = food waste is a big problem (46.6%).

Sub-opinions about food waste were rated on a Likert scale in the following questions (question codes from the original data set). Respondents indicated their agreement with the statements on a scale of 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), 5 (strongly agree). The frequencies of responses to the questions are shown in Appendix A. The questions were divided into four groups according to whether they were related to moral, environmental, economic, or health views.

A. *Moral views* (related to remorse associated with food waste)

- PL_126c Agree with the statement – I try not to waste food but I do so.
 - PL_126a Agree with the statement – I have a guilty conscience when I waste food.
 - PL_126b Agree with the statement – I feel guilty when I waste food because other people have nothing to eat.
 - PL_126d Agree with the statement – frequent food waste could be prevented.
- B. *Environmental views* (related to the perceived environmental impact of food waste)
- PL_126f Agree with the statement – food waste is a problem for the environment due to biodegradability.
 - PL_126g Agree with the statements – food packaging is worse for the environment than food waste.
 - PL_126e Agree with the statement – when wasting food, I think about its impact on the environment.
- C. *Economic views* (related to efforts to plan purchases and consumption, to optimise spending on food purchases and to make efficient use of food supplies)

- PL_126i Agree with the statement – I only buy products from the shopping list.
 - PL_126j Agree with the statement – I plan meals ahead for more efficient shopping.
 - PL_126k Agree with the statement – I buy more than intended at a discount.
 - PL_126h Agree with the statement – I am concerned about the amount of food wasted.
 - PL_126m Agree with the statement – I am concerned about the cost of wasted food.
 - PL_126n Agree with the statement – I try to use everything I can when preparing food.
 - PL_126o Agree with the statement – I freeze leftover food for later.
 - PL_126p Agree with the statement – leftovers are eaten by the next day.
 - PL_126q Agree with the statement – I always prepare more food than needed.
 - PL_126l Agree with the statement – I never buy food that I already have at home.
- D. *Health views* (related to the visual attributes of food and perceptions of the past use-by date and its health consequences)
- PL_126r Agree with the statement – I decide what to throw away based on appearance/smell.
 - PL_126s Agreeing with the statement – I take care not to consume food after the expiry date.
 - PL_126t Agree with the statement – it is better to throw food away than risk it being unhealthy.
 - PL_126u Agree with the statement – I forget to eat food before it spoils.
 - PL_126v Agree with the statement – it is nice to empty the fridge and get rid of old food.
- Among the demographic and socioeconomic variables, the following variables were tested, which are those most commonly tested in empirical studies:
- Gender: 1 = male, 2 = female. The sample is 49.1% male and 50.9% female, which is consistent with the population structure.
 - Age of the respondent in 2022. Age was transformed into categories as suggested by the CSDA: 15 to 19 years (5.7%), 20 to 29 years (12.2%), 30 to 39 years (16.8%), 40 to 54 years (28.4%), 55 to 64 years (14.8%), 65 years and over (22.1%). Age is related to the economic activity of the respondent and therefore the economic activity of the respondent was not considered separately.
 - Education according to the International Standard Classification of Education (ISCED): Level 1 (44.7%) = 3C (General Certificate of Secondary Education, International Baccalaureate); Level 2 (33.8%) = 3A/4A (college with A level); Level 3 (21.5%) = 5A (university degree: bachelor's, master's, doctorate).
 - Municipality size by population. 1 = up to 1,999 inhabitants (26.2%); 2 = 2,000 – 4,999 inhabitants (12.7%), 3 = 5,000 – 19,999 inhabitants (16.6%); 4 = 20,000 – 49,999 inhabitants (12.7%); 5 = 50,000 – 199,999 inhabitants (12.1%); 6 = 200,000 or more (19.6%).
 - Household size is assessed by two questions.
 - Living with a partner: 1 = yes (58.5%), 2 = no (41.5%).
 - Number of dependent children: 1 = one (15.1%), 2 = two (13.0%), 3 = three (2.5%), 4 = four or more (0.5%), 5 = none (68.9%).
 - The household's standard of living is rated by the respondent's subjective standard of living: 1 = good (58.2%),

2 = neither good nor bad (34.2%),
3 = bad (7.6%).

- Level of household expenditure on food per month. Eight levels of expenditure were monitored: 1 = up to 80 EUR (4.4%); 2 = 80 – 160 EUR (17.0%); 3 = 160 – 240 EUR (21.2%); 4 = 240 – 320 EUR (21.6%); 5 = 320 – 400 EUR (17.0%); 6 = 400 – 480 EUR (12.1%); 7 = 480 – 560 EUR (3.3%); 8 = more than 560 EUR (3.3%).

2.3. Method (CHAID)

A non-parametric classification tree method was used to determine opinions about food waste because all variables are categorical. The tree-like sequential partitioning of data into homogeneous subsets is a technique that lends itself to the study of relationships, which is the purpose of this research. At the same time, the analysis is more descriptive in nature, as it aims to identify variables that distinguish the group of people who are Roman Catholics from those who are not religious.

The advantage of classification trees is their ability to visually represent relationships in a clear and transparent manner. Classification tables also allow for the evaluation of results and model fit. The model developed in this study does not have predictive ambitions, as a number of other variables unrelated to food waste views have an impact on Roman Catholic religious denomination. A visual analysis of the tree branches will find specific subgroups and relationships that are not obvious at first glance or that traditional statistics would find difficult and laborious to uncover. The classification procedures, and thus the rules, are represented as branches, and the nodes represent subgroups. In this way, a classification rule gradually leads to a more precise determination of the target variables and the final classification classes.

In practice, one of the four most common classification algorithms can be chosen – CHAID (Chi-Square Automatic

Interaction Detection), Exhaustive CHAID, CRT (Classification and Regression Trees) and QUEST (Quick Unbiased Efficient Statistical Tree). CHAID is a fast statistical algorithm based on the optimal value of the Chi-square or F-test. It examines the data quickly and efficiently, forming segments and profiles in a sequence of optimal steps, each time dividing the groups into an appropriate number of statistically homogeneous subgroups. CHAID is based on statistical hypothesis testing at each step, with the optimal step usually given by maximum significance (Kass, 1980). Exhaustive CHAID is a modification of the CHAID algorithm that examines all possible splits for each predictor (Biggs et al., 1991). The CRT algorithm generates binary trees (a group is always divided into two parts) and maximally homogeneous groups according to statistical criteria (Gordon et al., 1984). QUEST is a statistical algorithm that selects variables without bias and generates accurate binary trees quickly and efficiently (Loh and Shih, 1997).

Considering that not only binary tree splitting is required, but also optimising the number of statistically homogeneous subgroups, the CHAID algorithm is used. According to the results of the comparison of CHAID algorithms, it generates the most classification rules and has the highest error prediction accuracy (Lin and Fan, 2019).

The CHAID algorithm is a statistical method for building classification trees. It was originally developed for categorical variables only. It is a non-parametric technique that recursively divides the data into mutually exclusive subsets and creates a tree structure. The main goal of CHAID is to identify the key predictors and their interactions that best explain the variability in the target variable (in this case, Roman Catholics compared to non-religious individuals). The algorithm works with the following sequential steps:

1. Distribution of data: The CHAID algorithm starts with the entire data set and the search for a predictor (independent

variable) that best divides the data into two or more homogeneous groups based on the target variable (dependent

variable). Pearson's Chi-square test was used to determine the statistical significance of these distributions.

$$\chi^2 = \sum \frac{(o_i - e_i)^2}{e_i} \quad (1)$$

where o_i denotes the observed frequencies of occurrence of the variation and e_i denotes the expected frequencies of occurrence of the variation. The significance value for the distribution of nodes and merging categories can be influenced. For both criteria, the default significance level is 0.05. For multiple comparisons, the significance values for the merge and split criteria are adjusted using the Bonferroni method to reduce the probability of a Type I error.

Within the algorithm, the categories are merged. In the case of ordinal variables, adjacent categories are merged.

2. Node creation: once the best predictor and its value for the data distribution are found, the algorithm creates a tree node for that combination. A node represents a rule that decides the next routing in the data analysis.
3. Recursive partitioning (node partitioning): The algorithm repeats the splitting of the data and the creation of the nodes for each newly created group (node). For each node, the best predictor and its value are searched again to create more nodes in the tree structure. The procedure is repeated until a certain termination criterion is met (e.g., the minimum number of samples in a node). For each predictor and its pooled categories, a chi-square test and an F-test are performed to test for dependence on the target variable. The merged categories form child nodes (sub-nodes) if $p < \alpha_{\text{split}}$. Otherwise, splitting is terminated, and the node is terminal.
4. Stopping criteria: To avoid overlearning the model, the algorithm uses stopping criteria to limit further splitting of the data or creation of new nodes:

- the number of instances in the node is less than the specified limit (parent node size), in this case 100;
 - the number of instances in the node that would result from the most appropriate split is less than the specified limit for the child node (child node size), in this case 50;
 - the depth of the tree would exceed the specified limit (depth), in this case three levels;
 - no chi-square test or F-test is more significant than the specified limit (significance), in this case 0.05;
 - all observations in the node have the same target category value;
 - all observations in the node have the same values in all predictors.
5. Node adjustment: after the tree is created, the algorithm can perform node adjustment to remove branches that do not contribute significantly to the predictive ability of the model. This step helps to obtain a simpler and more efficient classification tree.
 6. Terminal tree: the result of the CHAID algorithm is a classification tree with a root node (first node) and leaf nodes (terminal nodes). Each terminal node contains a predicted category or value of the target variable for the new data based on the rules in the tree.

Although in the case of descriptive analysis the evaluation of the predictive ability of the model is not relevant, a classification table of sensitivity and specificity values is shown for completeness. Sensitivity is the probability that the model predicts a positive outcome for a positive subject (i.e. the correct classification of a case into the Roman Catholic group). Specificity is the

probability that the model predicts a negative outcome for a negative subject (i.e. the correct classification of a case into the group with no religious affiliation). The overall accuracy of the model is then the relative classification success of all evaluated cases. The default cutpoint is 0.5.

The Received Operation Characteristic (ROC) curve shows the sensitivity versus specificity for each cutpoint. The area under the ROC curve (AUC) is the most common quantitative index describing the ROC curve and also expressing the accuracy of the test. The following cut-off values are used to rate the test: 0.9–1 excellent, 0.8–0.9 very good, 0.7–0.8 good, 0.6–0.7 fair, 0.5–0.6 poor (Pampel, 2000).

The performance of the nodes in the classification tables is evaluated using three key metrics: gain, index and response.

Gain is the most basic metric in SPSS classification tables. It indicates how well the table classifies observations compared to the original distribution of categories. It is expressed as the ratio of classified observations to the total number of observations in a given node. Gain increases from zero to one, with a value of one (100%) indicating perfect classification. Higher gain values mean better model performance.

The index is another useful metric for evaluating node performance in classification tables. It considers not only the quality of classification, but also the composition of categories in a node. It expresses how well the observations in a given node are classified into different categories. The index ranges from 0 to 1, with a value of 1 (100%) indicating the ideal distribution of observations among categories. Higher index values mean that the node is well distributed and has high homogeneity within a category.

Response in classification tables indicates how quickly nodes adapt to changes in input data. A node with a high response will have abrupt changes in classification as the values of the input variables change. Conversely, a node with a low response will be less affected by changes in the input data and its classification will remain more stable. The optimal response value depends on the specific requirements and goals of the model.

3. Results

3.1. Classification Table

The results are presented in the form of a classification table showing statistically significant variables at the 0.05 significance level.

Table 2. Classification table

Node	No religion (0)		Roman Catholic (1)		Total		Pred. Cat.	Parent Node	Primary Independent Variable				
	N	%	N	%	N	%			Variable	Sig. ^a	Chi-Square	df	Split Values
0	496	73.6%	178	26.4%	674	100.0%	0						
1	201	86.6%	31	13.4%	232	34.4%	0	0	Age	0.000	47.648	2	<= 30-39
2	198	73.6%	71	26.4%	269	39.9%	0	0	Age	0.000	47.648	2	[30-39,55-64]
3	97	56.1%	76	43.9%	173	25.7%	0	0	Age	0.000	47.648	2	> 55-64
4	90	95.7%	4	4.3%	94	13.9%	0	1	EN_126a	0.007	11.321	1	<= 3

Node	No religion (0)		Roman Catholic (1)		Total		Pred. Cat.	Parent Node	Primary Independent Variable				
	N	%	N	%	N	%			Variable	Sig. ^a	Chi-Square	df	Split Values
5	111	80.4%	27	19.6%	138	20.5%	0	1	EN_126a	0.007	11.321	1	> 3
6	87	61.3%	55	38.7%	142	21.1%	0	2	Food expend.	0.000	23.568	1	<= 240–320 EUR
7	111	87.4%	16	12.6%	127	18.8%	0	2	Food expend.	0.000	23.568	1	> 240–320 EUR
8	48	72.7%	18	27.3%	66	9.8%	0	3	PL_126h	0.005	12.021	1	<= 3
9	49	45.8%	58	54.2%	107	15.9%	1	3	PL_126h	0.005	12.021	1	> 3
10	48	81.4%	11	18.6%	59	8.8%	0	6	PL_126b	0.000	17.165	1	<= 2
11	39	47.0%	44	53.0%	83	12.3%	1	6	PL_126b	0.000	17.165	1	> 2
12	44	78.6%	12	21.4%	56	8.3%	0	7	PL_126q	0.031	7.093	1	<= 2
13	67	94.4%	4	5.6%	71	10.5%	0	7	PL_126q	0.031	7.093	1	> 2

Notes: Opinions on food waste were rated on a Likert scale. Respondents expressed agreement with the statements on a scale of 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), 5 (strongly agree). a. Bonferroni adjusted

Source: own elaboration

Age has the greatest influence on religious denomination. The proportion of Roman Catholics is higher for older people (55–64 years, 43.9%, Node 3) than for younger people (30–39 years, 13.4%, Node 1). For younger people, moral motives to reduce food waste are particularly important. The group of young people who did not indicate a guilty conscience about food waste is dominated by non-religious people (95.7%, Node 4). In comparison, the group of young people who have a guilty conscience about food waste contains a smaller proportion of young people with no religion (80.4%, Node 5) and a larger proportion of Roman Catholics (19.6%, Node 5) compared to Node 4.

In contrast, economic motives to reduce food waste are important among older people (55–64 years) because they are concerned about the amount of food wasted. A higher proportion of elderly Roman Catholic

people are concerned about the amount of food wasted (54.2%, Node 9) compared to people with no religion (45.8%, Node 9). The group of elderly people who did not report being concerned about the amount of wasted food is dominated by people with no religion (72.7%, Node 8).

For both age groups (30–39, 55–64), the amount of monthly food expenditures is important. Both younger and older people need to consider this purely economic factor. The amount of monthly food expenditure is divided by an interval from 240 to 320 EUR. Households with higher food expenditure than 240 to 320 EUR are characterised by a higher proportion of people with no religion (87.4%, Node 7) than households with lower food expenditure (61.3%, Node 6). In other words, households with lower food expenditures have a higher proportion of people of Roman Catholic faith (38.7%, Node 6) than households with higher food

expenditures (12.6%, Node 7). However, each of these segments is characterised by different motivations for reducing food waste.

Roman Catholic households with lower food expenditures tend to feel guilty about wasting food because other people have food constraints (53.0% vs. 47% of non-religious households with feelings of guilt; Node 11). Conversely, the group of households that do not feel guilty is dominated by non-religious households (81.4% compared to 18.6% of Roman Catholic households that do not feel guilty; Node 10). It is clear, then, that moral motives and consideration for others in need are typical of Roman Catholic households.

The second group of households spends more on food than 240 – 320 EUR. For these households, the economic motive is important because they are aware that they waste food mainly because they always prepare more food than they need. This behaviour is predominantly admitted to by non-religious individuals (94.4% versus 5.6% of Roman

Catholics, who also give the same reason for wasting; Node 13). In contrast, Roman Catholic households with higher food expenditures are more likely to disagree with this statement (21.4% compared to those who admit to this reason for waste; Node 12). Thus, Roman Catholic households generally optimise their purchases and consumption of raw materials, groceries, and prepared foods so that they do not waste food unnecessarily by making excessive purchases that they cannot use.

3.2. Post hoc tests

The resulting model is able to predict Roman Catholic religion at 57.3% (sensitivity) and non-religious at 82.3% (specificity). The overall accuracy of the model is 75.7%. The area under the ROC curve is 0.697 with a 95% confidence interval (0.653; 0.740) and standard error of the estimate of 0.022 ($p < 0.001$), indicating the fair predictive ability of the model. Table 3 contains the performance data of the Gains for Nodes.

Table 3. Gains for Nodes

Node	Node		Gain		Response	Index
	N	Percent	N	Percent		
9	107	15.9%	58	32.6%	54.2%	205.3%
11	83	12.3%	44	24.7%	53.0%	200.7%
8	66	9.8%	18	10.1%	27.3%	103.3%
12	56	8.3%	12	6.7%	21.4%	81.1%
5	138	20.5%	27	15.2%	19.6%	74.1%
10	59	8.8%	11	6.2%	18.6%	70.6%
13	71	10.5%	4	2.2%	5.6%	21.3%
4	94	13.9%	4	2.2%	4.3%	16.1%

Note: The node numbers correspond to the node numbers in the rows of Table 2.

Source: own elaboration

The most profitable nodes are Nodes 9 and 11. Node 9 contains the proportion of people with no religion and Roman

Catholics in the 55–64 age group who are more concerned about the amount of food wasted. Dissatisfaction predominates

among Roman Catholics (54.2%). Node 11 contains the proportion of people with no religion and Roman Catholics in households with lower monthly food expenditures who feel guilty about wasting food because other people have food constraints. This moral factor is predominant among those of Roman Catholic faith (53.0%).

4. Discussion

The study revealed a number of interesting findings. First, younger and older people alike were found to have different motives for reducing food waste. A lower percentage of younger people (aged 30–39) profess Roman Catholic beliefs than older people (aged 55–64). Younger Roman Catholics are more likely to give preference to moral motives and feel guilty about wasting food. Conversely, older Roman Catholics prefer economic motives and are more concerned about the amount of food wasted than non-religious individuals. Regarding the formulated hypotheses, we can tend to accept the veracity of hypothesis H1 for younger individuals (moral beliefs related to food waste are different between Roman Catholics and non-religious individuals) and hypothesis H3 for older individuals (economic beliefs related to food waste are different between Roman Catholics and non-religious individuals).

For younger Roman Catholics, the moral aspects of their religion may play an important role in shaping their attitudes toward food waste. Religious teachings that emphasise responsibility for others and care for the poor may lead to feelings of guilt or blame for behaving irresponsibly and wasting food. The theoretical justification for this conclusion regarding the tenets of the Roman Catholic faith may be related to moral responsibility. Roman Catholic religious teaching emphasises the moral responsibility of individuals toward others and toward God's creation. Younger Roman Catholics who prefer moral

motives may be influenced by these teachings and perceive food waste as an immoral act. This may lead to feelings of guilt and reproach if they engage in such irresponsible behaviour (Elhoushy and Jang, 2021).

Conversely, older people may be more sensitive to the economics of food waste because they are likely to have experienced different economic situations in their lifetimes. They may remember times of scarcity, which in the Czech context was the period of central planning during socialism from 1949 to 1989, and therefore value food and see waste as an unwise and irresponsible practice (Večerník, 2008). The theoretical justification for this conclusion in relation to Roman Catholic principles can be related to traditional economic principles. Older Roman Catholics who prefer an economic motive may be influenced by traditional economic principles that are part of religious education and preaching. These may be principles of thrift, economy, and the responsible use of resources, which may have the side effect of making them concerned about food waste because it is seen as inefficient and uneconomical in the context of societal norms (De Groot et al., 2021).

The way society perceives food waste may also influence individuals' lifestyles (Tahal and Formánek, 2022). The younger generation may be more exposed to information and discussions about environmental issues, sustainability, and responsible consumer behaviour, which could lead to an emphasis on the moral aspects of waste. Conversely, the older generation may have less exposure to such information and focus more on the economic consequences of waste (Ioniță, 2017).

Regardless of age, the amount of monthly spending on food purchases is critical for households. The amount spent may be related to both household size and the household's overall standard of living. Roman Catholic households with lower monthly expenditures on food tend to be

compassionate toward others and feel guilty about wasting food because other people have food constraints. Roman Catholic religious teaching emphasises compassion for others, especially those in need. This moral value can be rooted in faith and promoted in the religious community. Roman Catholic households with lower food expenditures may be influenced by these religious teachings and feel guilty if they waste food inefficiently, consuming resources that could be used for those in need (Wang et al., 2021). In addition, households with fewer financial resources may be more sensitive to the needs of others and more aware that some do not have enough food to meet their basic needs. This may lead to a sense of compassion and responsibility to manage food efficiently and minimise waste (Filimonau et al., 2022).

Conversely, non-religious individuals in households with higher expenditures on food create significant amounts of food waste, as they always prepare more food than they need. Households with higher spending on food may have greater financial capacity and flexibility to shop for and prepare meals. This may lead them to purchase more ingredients and food than necessary, and then waste may occur if not all food is consumed in a timely manner (Aschemann-Witzel et al., 2019). Relatedly, other authors have found that strategies designed to save money – such as buying food in bulk, shopping monthly, favouring supermarkets, and cooking with meat – actually lead to more food waste (Porpino et al., 2015).

Roman Catholic households that optimise their purchases and consumption may be influenced by a desire to minimise waste and avoid irresponsible consumption. In Roman Catholic households, perceptions of food may be based on faith and religious teachings, which may lead to a greater awareness of the value of food and responsibility for its efficient use (Elhoushy and Jang, 2021; Hinčica et al., 2022). Conversely,

individuals without religious beliefs may not have the same motivations for thinking about the importance of food and its use.

Regarding the hypotheses, the associations between Roman Catholic religion and environmental attitudes (H2) and health beliefs related to food waste (H4) could not be demonstrated. This is consistent with recent findings that religion does not have a unidirectional influence on people's environmental attitudes and cannot be fully supported by either dominance theory or stewardship theory (Michaels et al., 2021).

Conclusions

This study addressed the relationship between Roman Catholic religious affiliation and food waste in Czech households. The literature review revealed that there are relatively few empirical studies on this topic, despite the fact that faith and piety influence human values and moral principles worldwide.

Theoretical implications

With particular attention to the Roman Catholic denomination, younger and older individuals were found to have different motivations for reducing food waste. Younger Roman Catholics tend to prefer moral motivations and feel guilty about wasting food, whereas older Roman Catholics prefer economic motivations and are concerned about the amount of food wasted. These differences may be related to different aspects of Roman Catholic religious teachings, which emphasise caring for the poor, frugality, and the responsible use of resources.

Environmental and health beliefs regarding food waste have been shown to be unrelated to Roman Catholic beliefs, which is consistent with the results of recent research that has shown no unidirectional effect on the environmental attitudes of religious people. Moral and economic

beliefs related to food waste appear to be more important in the context of reported Roman Catholic denomination. It is possible that the relationship between Roman Catholicism and environmental attitudes toward food waste is mediated by moral values and views, which needs to be tested in follow-up studies.

The study also confirmed that Roman Catholicism was positively related to consumer attitudes, activism, and personal and subjective norms for reducing food waste. Individuals with no religious affiliation in households with higher food expenditures were found to typically waste food and always prepare more food than they need. In contrast, Roman Catholic households show a stronger tendency to optimise their purchases and consumption of raw materials, groceries, and prepared foods and to feel a sense of belonging to those in need.

Practical implications

This study provides a deeper insight into the relationship between religion and food waste. The findings may contribute to a better understanding of these relationships and open discussions on how food waste can be reduced by emphasising Christian values. The research findings can be relevant to countries with a higher proportion of the population with Roman Catholic religious affiliation (e.g. Poland, Spain and Italy in Europe).

Religion and religious teachings have the potential to influence individuals' attitudes and behaviour toward issues such as food waste. Since the study showed that religious beliefs have an impact on reducing food waste, this could encourage activists and organisations working on environmental issues to reach out to different religious communities and engage them in sustainable initiatives. People who profess Roman Catholic faith typically find support and meaning in their religious

community. Through social interactions and the sharing of common values, they can reduce food waste. Non-religious people can also be influenced and inspired by the study's findings to reduce food waste and become more responsible food stewards. Ethical and moral principles that are often part of religious beliefs do not have to be exclusive to believers and can serve as inspiration to non-believers as well.

In this study, we have explored the intricate relationship between household food waste management, religious affiliations, and ecological behaviour. Our findings illuminate the potential of integrating these aspects into a circular model for sustainable development. To this end, we propose practical recommendations for policymakers and stakeholders.

Practical recommendations for sustainable development focus on the following topics: 1) Incorporating religious values: recognise and integrate the diverse religious beliefs of households in developing waste management policies. This approach can enhance community engagement and compliance with sustainable practices. 2) Behavioural economics in waste management: utilise principles of behavioural economics to design incentives and programmes that encourage households to reduce food waste and participate in recycling and composting initiatives. 3) Education and awareness: implement educational campaigns that focus on the ecological impacts of food waste and the benefits of sustainable practices, tailored to respect and incorporate various religious perspectives.

Moving forward, a strategic approach is necessary for managing food waste within the frameworks of a circular and behavioural economy. This strategy should prioritise the optimisation of resource use, promote the recycling and repurposing of food waste, and foster a culture of sustainability at the household level.

The study is also a plea for support for policy initiatives aimed at reducing food waste and improving the sustainability of the food system. Policy organisations and government institutions can use the research findings as a basis for policy decisions that could promote responsible food use.

Limits of research

The research has its limitations. First, the study relies on a specific sample from one country and focuses on one religious denomination, which limits the generalisability of the findings to a broader international population. Second, the study relies on subjective statements from the respondents themselves, which may be biased or inaccurate. Participants may tend to provide socially desirable responses, leading to under- or overestimation of views on food waste. This bias could affect the accuracy of the data and potentially skew the results. Future studies might consider the use of objective measures or observational data to validate the self-reported information provided by respondents. More objective measurement of food waste can be undertaken through a combination of household records of food purchases and consumption and inspection of municipal waste.

Directions for further research

Given the interesting results and possible social implications of this study, here are some suggestions for further research. In addition to the aforementioned direction of testing the mediating effect of moral motives on the relationship between environmental views on food waste and Roman Catholic religious beliefs, other research challenges suggest themselves. This study focused only on the Roman Catholic denomination. For further research, it would be interesting to include other religious

groups in the study to compare the views and attitudes of different religious communities on food waste and sustainability. This could help identify specific characteristics and differences in behaviour and views between different religious groups. For further research, it would be useful to monitor people's behaviour and attitudes toward food waste over the long term. This would make it possible to observe long-term changes and trends in perceptions and attitudes about the issue, for example in the form of a longitudinal study.

Overall, the directions for future research should focus on international comparative studies, policy impact analysis and technological innovations. International comparative studies should investigate how religious beliefs influence consumer behaviour and attitudes towards food waste management across different European countries. They could provide a broader understanding of the cultural dynamics in sustainable practices. Policy impact analysis would assess the effectiveness of policies that integrate religious and ecological considerations in food waste management. Finally, studies on technological innovations should explore the role of technology in enhancing food waste management, particularly in segregating and recycling processes, and how it aligns with various cultural and religious practices.

In conclusion, the interplay of religious affiliations, ecological behaviour, and food waste management presents a unique opportunity to drive sustainable development. By embracing a holistic approach that considers these factors, we can develop more effective strategies for resource conservation and environmental protection. The proposed future research areas will not only deepen our understanding but also guide us in creating more inclusive and effective sustainability policies.

List of abbreviations

- CAPI: Computer-Assisted Personal Interviewing. Refers to a survey data collection method where an interviewer uses a computer or electronic device to assist in conducting face-to-face interviews, typically in surveys and research studies.
- CHAID: Chi-Square Automatic Interaction Detection. A statistical technique used for data mining and decision tree analysis. CHAID is used to uncover relationships within categorical variables in a dataset, aiming to find patterns and interactions between variables.
- CSDA: the Czech Social Science Data Archive. An organisation in the Czech Republic that collects, preserves, and provides access to social science data for research purposes.
- CRT: Classification & Regression Trees. A type of decision tree algorithm used for classification and regression tasks in machine learning and data analysis. It recursively splits the dataset based on the most significant variables to create a tree-like model.
- CESSDA ERIC: Consortium of European Social Science Data Archives European Research Infrastructure Consortium. A collaborative network of social science data archives across Europe, aiming to provide researchers with access to a wide range of social science data for cross-national and comparative research.
- EPA: the Environmental Protection Agency. A United States government agency responsible for regulating and enforcing environmental laws and policies to protect human health and the environment.
- ERS: the U.S. Department of Agriculture's Economic Research Service. The research arm of the U.S. Department of Agriculture, providing economic and statistical information related to agriculture, food, natural resources, and rural development.
- EU: the European Union.
- FAO: the Food and Agriculture Organisation. A specialised agency of the United Nations focused on addressing issues related to food and agriculture to ensure global food security, eliminate hunger, improve nutrition, and enhance rural development.
- FUSIONS was a European Union-funded project aimed at addressing food waste and its environmental impact. It worked to develop strategies to reduce food waste throughout the food supply chain, from production to consumption.
- NUTS: Nomenclature of Territorial Units for Statistics. A hierarchical system used by the European Union for dividing regions into statistical units for various data reporting and analysis purposes.
- QUEST: Quick Unbiased Efficient Statistical Tree. A decision tree algorithm used for classification and regression tasks, designed to create a decision tree by recursively splitting data based on statistical tests.
- UNEP: the United Nations Environment Programme. A UN agency that coordinates environmental activities, assists countries in implementing sustainable development practices, and addresses global environmental challenges.

Annexes

Appendix A: Relative frequencies of responses to questions on food waste (%)

Variable	Valid N	1 (strongly disagree)	2	3	4	5 (strongly agree)
EN_126a	802	5.4	14.0	18.4	38.5	23.6
PL_126b	786	5.9	23.8	24.2	33.9	12.1
EN_126c	807	9.2	33.6	23.8	29.4	4.1
EN_126d	819	23.7	41.8	18.1	14.0	2.4
PL_126e	791	6.4	32.9	24.7	27.0	8.9
EN_126f	787	13.7	40.5	20.1	20.2	5.5
EN_126g	768	1.1	9.4	22.1	42.0	25.5
PL_126h	784	2.0	12.7	24.6	38.9	21.8
PL_126i	811	9.4	35.5	23.4	24.7	7.0
EN_126j	804	6.5	21.5	19.6	38.9	13.5
PL_126k	813	8.4	28.7	22.5	32.3	8.1
EN_126l	808	2.9	30.1	24.5	32.9	9.6
EN_126m	798	6.3	18.2	15.6	34.5	25.4
EN_126n	803	0.4	3.7	12.5	52.2	31.2
PL_126o	810	6.3	16.9	14.6	40.9	21.2
EN_126p	806	1.2	11.1	19.0	51.4	17.4
PL_126q	815	8.8	44.5	23.7	18.7	4.3
EN_126r	798	4.3	14.0	12.8	50.2	18.6
PL_126s	809	4.7	19.2	24.1	36.6	15.4
PL_126t	810	1.4	10.4	14.3	45.6	28.4
EN_126u	818	13.7	43.2	21.9	18.5	2.7
PL_126v	762	3.0	16.9	25.5	38.0	16.6

Source: own elaboration

References

- Abdelradi, F. (2018). Food waste behaviour at the household level: A conceptual framework. *Waste Management*, 71, 485–493. <https://doi.org/10.1016/j.wasman.2017.10.001>
- Aleknevičiene, V., & Bendoraityte, A. (2023). Role of Green Finance in Greening the Economy: Conceptual Approach. *Central European Business Review*, 12(2), 105–130. <https://doi.org/10.18267/j.cebr.317>
- Aloysius, N., Ananda, J., Mitsis, A., & Pearson, D. (2023). Why people are bad at leftover food management? A systematic literature review and a framework to analyze household leftover food waste generation behavior. *Appetite*, 186, 106577. <https://doi.org/10.1016/j.appet.2023.106577>
- Ambalu, S., Coogan, M. D., Feinstein, E. L., Freedman, P., Philip, N., Stobart, A., Thompson, M., Tieszen, C. L., & Weeks, M. (2013). *The Religions Book*. DK, Dorling Kindersley Limited.
- Aschemann-Witzel, J., Giménez, A., & Ares, G. (2019). Household food waste in an emerging country and the reasons why: Consumer's own accounts and how it differs for target groups. *Resources, Conservation and Recycling*, 145, 332–338. <https://doi.org/10.1016/j.resconrec.2019.03.001>
- Bellemare, M. F., Çakir, M., Peterson, H. H., Novak, L., & Rudi, J. (2017). On the Measurement of Food Waste. *American Journal of Agricultural Economics*, 99(5), 1148–1158. <https://doi.org/10.1093/ajae/aax034>
- Bergoglio, J. M. (2015). *Encyclical Letter Laudato Si' of the Holy Father Francis On Care for Our Common Home*. Libreria Editrice Vaticana. https://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_encyclica-laudato-si.html
- Biggs, D., De Ville, B., & Suen, E. (1991). A method of choosing multiway partitions for classification and decision trees. *Journal of Applied Statistics*, 18(1), 49–62. <https://doi.org/10.1080/026647691000000005>
- Bretter, C., Unsworth, K. L., Kaptan, G., & Russell, S. V. (2023). It is just wrong: Moral foundations and food waste. *Journal of Environmental Psychology*, 88, 102021. <https://doi.org/10.1016/j.jenvp.2023.102021>
- Briguglio, M., Garcia-Muñoz, T., & Neuman, S. (2020). Environmental engagement, religion and spirituality in the context of secularization. *Environmental Research Letters*, 15(10), 104098. <https://doi.org/10.1088/1748-9326/abb6a0>
- Brown, J. E., Van Mulukom, V., Charles, S. J., & Farias, M. (2023). Do you need religion to enjoy the benefits of Church services? Social bonding, morality and quality of life among religious and secular congregations. *Psychology of Religion and Spirituality*, 15(2), 308–318. <https://doi.org/10.1037/rel0000447>
- Celestino, É., Carvalho, A., & Palma-Oliveira, J. M. (2022). Household organic waste: Integrate psychosocial factors to define strategies toward a circular economy. *Journal of Cleaner Production*, 378, 134446. <https://doi.org/10.1016/j.jclepro.2022.134446>
- Clements, J. M., McCright, A. M., & Xiao, C. (2014). Green Christians? An Empirical Examination of Environmental Concern Within the U.S. General Public. *Organization & Environment*, 27(1), 85–102. <https://doi.org/10.1177/1086026613495475>
- Čvirik, M. (2023). Perceived Price and Quality of Food of European Union Countries of Origin by Slovaks: The Influence of Ethnocentric Tendencies. *Central European Business Review*, 12(1), 97–114. <https://doi.org/10.18267/j.cebr.314>
- Czech Social Science Data Archive. (2022). *Food 2022* [dataset]. <https://archiv.soc.cas.cz/en/o-archivu-2/kdo-jsme>
- De Groot, J. I. M., Bondy, K., & Schuitema, G. (2021). Listen to others or yourself? The role of personal norms on the effectiveness of social norm interventions to change pro-environmental behavior. *Journal of Environmental Psychology*, 78, 101688. <https://doi.org/10.1016/j.jenvp.2021.101688>
- dos Santos, J., da Silveira, D., da Costa, M., & Duarte, R. (2022). Consumer behaviour in relation to food waste: A systematic literature review. *British Food Journal*, 124(12), 4420–4439. <https://doi.org/10.1108/BFJ-09-2021-1075>

- Edjabou, M. E., Petersen, C., Scheutz, C., & Astrup, T. F. (2016). Food waste from Danish households: Generation and composition. *Waste Management*, 52, 256–268. <https://doi.org/10.1016/j.wasman.2016.03.032>
- Elhoushy, S., & Jang, S. (Shawn). (2021). Religiosity and food waste reduction intentions: A conceptual model. *International Journal of Consumer Studies*, 45(2), 287–302. <https://doi.org/10.1111/ijcs.12624>
- Ellison, B., & Lusk, J. L. (2018). Examining Household Food Waste Decisions: A Vignette Approach. *Applied Economic Perspectives and Policy*, 40(4), 613–631. <https://doi.org/10.1093/aep/pxp059>
- FAO. (2023). *Technical Platform on the Measurement and Reduction of Food Loss and Waste*. Food and Agriculture Organization of the United Nations. <https://www.fao.org/platform-food-loss-waste/food-waste/introduction/en>
- Filimonau, V., Mika, M., Kubal-Czerwińska, M., Zajadacz, A., & Durydiwka, M. (2022). Religious values and family upbringing as antecedents of food waste avoidance. *Global Environmental Change*, 75, 102547. <https://doi.org/10.1016/j.gloenvcha.2022.102547>
- Flanagan, A., & Priyadarshini, A. (2021). A study of consumer behaviour towards food-waste in Ireland: Attitudes, quantities and global warming potentials. *Journal of Environmental Management*, 284, 112046. <https://doi.org/10.1016/j.jenvman.2021.112046>
- Forbes, H., Quested, T., & O'Connor, C. (2021). *UNEP Food Waste Index 2021*. United Nations Environment Programme. <https://www.unep.org/resources/report/unep-food-waste-index-report-2021>
- Furstova, J., Malinakova, K., Sigmundova, D., & Tavel, P. (2021). Czech Out the Atheists: A Representative Study of Religiosity in the Czech Republic. *The International Journal for the Psychology of Religion*, 31(4), 288–306. <https://doi.org/10.1080/10508619.2020.1844967>
- Galant, A., & Cvek, D. (2021). The Effect of Environmental Performance Investments on Financial Performance: Analysis of Croatian Companies. *Central European Business Review*, 10(5), 37–51. <https://doi.org/10.18267/j.cebr.271>
- Gordon, A. D., Breiman, L., Friedman, J. H., Olshen, R. A., & Stone, C. J. (1984). Classification and Regression Trees. *Biometrics*, 40(3), 874. <https://doi.org/10.2307/2530946>
- Graham-Rowe, E., Jessop, D. C., & Sparks, P. (2014). Identifying motivations and barriers to minimising household food waste. *Resources, Conservation and Recycling*, 84, 15–23. <https://doi.org/10.1016/j.resconrec.2013.12.005>
- Heidari, A., Mirzaii, F., Rahnama, M., & Alidoost, F. (2020). A theoretical framework for explaining the determinants of food waste reduction in residential households: A case study of Mashhad, Iran. *Environmental Science and Pollution Research*, 27(7), 6774–6784. <https://doi.org/10.1007/s11356-019-06518-8>
- Herrero-Luna, S., Ferrer-Serrano, M., & Pilar Latorre-Martínez, M. (2022). Circular Economy and Innovation: A Systematic Literature Review. *Central European Business Review*, 11(1), 65–84. <https://doi.org/10.18267/j.cebr.275>
- Hinčica, V., Svobodová, A., & Řezanková, H. (2022). Consumer Perception of Quality of Clothing Products: A Lesson for the Business Sector Arising from Czech Evidence. *Central European Business Review*, 11(2), 101–121. <https://doi.org/10.18267/j.cebr.292>
- Ioniță, I. (2017). No crumb shall be left behind. Perceptions of food waste across generations. *Journal of Comparative Research in Anthropology and Sociology*, 8(2), 17–42.
- Kass, G. V. (1980). An Exploratory Technique for Investigating Large Quantities of Categorical Data. *Applied Statistics*, 29(2), 119. <https://doi.org/10.2307/2986296>
- Kharazishvili, Y., Kwilinski, A., Grishnova, O., & Dzwigol, H. (2020). Social Safety of Society for Developing Countries to meet sustainable development standards: Indicators, level, strategic benchmarks (with calculations based on the case study of Ukraine). *Sustainability*, 12(21), 8953. <https://doi.org/10.3390/su12218953>
- Kita, P., Žambochová, M., Strelinger, J., & Kitová Mazalánová, V. (2021). Consumer Behaviour of Slovak Households in the Sphere of Organic Food in the Context of Sustainable Consumption. *Central European Business Review*, 10(1), 1–17. <https://doi.org/10.18267/j.cebr.256>

- Konisky, D. M. (2018). The greening of Christianity? A study of environmental attitudes over time. *Environmental Politics*, 27(2), 267–291. <https://doi.org/10.1080/09644016.2017.1416903>
- Kutlu, M. B. (2022). A Trait-Based Consumer Segmentation for Food Waste Reduction Campaigns. *Social Marketing Quarterly*, 28(2), 130–146. <https://doi.org/10.1177/15245004221097752>
- Lin, C.-L., & Fan, C.-L. (2019). Evaluation of CART, CHAID, and QUEST algorithms: A case study of construction defects in Taiwan. *Journal of Asian Architecture and Building Engineering*, 18(6), 539–553. <https://doi.org/10.1080/13467581.2019.1696203>
- Liu, H., & McCarthy, B. (2023). Sustainable lifestyles, eating out habits and the green gap: A study of food waste segments. *Asia Pacific Journal of Marketing and Logistics*, 35(4), 920–943. <https://doi.org/10.1108/APJML-07-2021-0538>
- Loh, W.-Y., & Shih, Y.-S. (1997). Split Selection Methods for Classification Trees. *Statistica Sinica*, 1997(7), 815–840.
- Mathras, D., Cohen, A. B., Mandel, N., & Mick, D. G. (2016). The effects of religion on consumer behavior: A conceptual framework and research agenda. *Journal of Consumer Psychology*, 26(2), 298–311. <https://doi.org/10.1016/j.jcps.2015.08.001>
- Michaels, J. L., Hao, F., Smirnov, J., & Kulkarni, I. (2021). Beyond stewardship and dominion? Towards a social psychological explanation of the relationship between religious attitudes and environmental concern. *Environmental Politics*, 30(4), 622–643. <https://doi.org/10.1080/09644016.2020.1787777>
- Mikhno, I., Koval, V., Shvets, G., Garmatiuk, O., & Tamošiūnienė, R. (2021). Green Economy in Sustainable Development and Improvement of Resource Efficiency. *Central European Business Review*, 10(1), 99–113. <https://doi.org/10.18267/j.cebr.252>
- Minton, E. A., Johnson, K. A., Vizcaino, M., & Wharton, C. (2020). Is it godly to waste food? How understanding consumers' religion can help reduce consumer food waste. *Journal of Consumer Affairs*, 54(4), 1246–1269. <https://doi.org/10.1111/joca.12328>
- Minton, E. A., Kahle, L. R., & Kim, C.-H. (2015). Religion and motives for sustainable behaviors: A cross-cultural comparison and contrast. *Journal of Business Research*, 68(9), 1937–1944. <https://doi.org/10.1016/j.jbusres.2015.01.003>
- Neff, R. A., Spiker, M. L., & Truant, P. L. (2015). Wasted Food: U.S. Consumers' Reported Awareness, Attitudes, and Behaviors. *PLOS ONE*, 10(6), e0127881. <https://doi.org/10.1371/journal.pone.0127881>
- Nguyen, T. T. T., Malek, L., Umberger, W. J., & O'Connor, P. J. (2022). Household food waste disposal behaviour is driven by perceived personal benefits, recycling habits and ability to compost. *Journal of Cleaner Production*, 379, 134636. <https://doi.org/10.1016/j.jclepro.2022.134636>
- Nováková, P., Hák, T., & Janoušková, S. (2021). An Analysis of Food Waste in Czech Households – A Contribution to the International Reporting Effort. *Foods*, 10(4), 875. <https://doi.org/10.3390/foods10040875>
- Oakley, F. C., Cunningham, L., Knowles, M. D., Marty, M., Frassetto, M., Pelikan, J. J., & McKenzie, J. L. (2023). Roman Catholicism. In *Britannica Online* (p. <https://www.britannica.com/topic/Roman-Catholicism>).
- Pampel, F. (2000). *Logistic Regression*. SAGE Publications, Inc. <https://doi.org/10.4135/9781412984805>
- Peifer, J. L., Khalsa, S., & Howard Ecklund, E. (2016). Political conservatism, religion, and environmental consumption in the United States. *Environmental Politics*, 25(4), 661–689. <https://doi.org/10.1080/09644016.2016.1159604>
- Petrescu-Mag, R. M., Ana, A., Vermeir, I., & Petrescu, D. C. (2020). Beliefs and Actions Towards an Environmental Ethical Life: The Christianity-Environment Nexus Reflected in a Cross-National Analysis. *Journal of Agricultural and Environmental Ethics*, 33(3–6), 421–446. <https://doi.org/10.1007/s10806-020-09832-1>
- Porpino, G., Parente, J., & Wansink, B. (2015). Food waste paradox: Antecedents of food disposal in low income households: Food waste paradox. *International Journal of Consumer Studies*, 39(6), 619–629. <https://doi.org/10.1111/ijcs.12207>

- Principato, L., Mattia, G., Di Leo, A., & Pratesi, C. A. (2021). The household wasteful behaviour framework: A systematic review of consumer food waste. *Industrial Marketing Management*, 93, 641–649. <https://doi.org/10.1016/j.indmarman.2020.07.010>
- Ribbers, D., Geuens, M., Pandelaere, M., & Van Herpen, E. (2023). Development and validation of the motivation to avoid food waste scale. *Global Environmental Change*, 78, 102626. <https://doi.org/10.1016/j.gloenvcha.2022.102626>
- Richter, B., & Bokelmann, W. (2018). The significance of avoiding household food waste – A means-end-chain approach. *Waste Management*, 74, 34–42. <https://doi.org/10.1016/j.wasman.2017.12.012>
- Rispo, A., Williams, I. D., & Shaw, P. J. (2015). Source segregation and food waste prevention activities in high-density households in a deprived urban area. *Waste Management*, 44, 15–27. <https://doi.org/10.1016/j.wasman.2015.04.010>
- Rodríguez-Domínguez, L., & Gallego-Alvarez, I. (2021). Investigating the Impact of Different Religions on Corporate Social Responsibility Practices: A Cross-National Evidence. *Cross-Cultural Research*, 55(5), 497–524. <https://doi.org/10.1177/10693971211034446>
- Smith, E. K., Hempel, L. M., & MacIlroy, K. (2018). What's 'evangelical' got to do with it? Disentangling the impact of evangelical Protestantism on environmental outcomes. *Environmental Politics*, 27(2), 292–319. <https://doi.org/10.1080/09644016.2017.1384185>
- Smith, N., & Leiserowitz, A. (2013). American evangelicals and global warming. *Global Environmental Change*, 23(5), 1009–1017. <https://doi.org/10.1016/j.gloenvcha.2013.04.001>
- Szabó-Bódi, B., Kasza, G., & Szakos, D. (2018). Assessment of household food waste in Hungary. *British Food Journal*, 120(3), 625–638. <https://doi.org/10.1108/BFJ-04-2017-0255>
- Tahal, R., & Formánek, T. (2022). Environmental Stances and Lifestyle Preferences in Czechia: Generational Aspects and Socio-Demographic Implications. *Central European Business Review*, 11(5), 1–21. <https://doi.org/10.18267/j.cebr.305>
- Večerník, J. (2008). Household Consumption in the Czech Republic: From Shopping Queues to Consumer Society. *Polish Sociological Review*, 162(2), 153–173.
- Vitell, S., Ramos-Hidalgo, E., & Rodríguez-Rad, C. (2018). A Spanish perspective on the impact on religiosity and spirituality on consumer ethics. *International Journal of Consumer Studies*, 42(6), 675–686. <https://doi.org/10.1111/ijcs.12438>
- Wang, H., Ma, B., Cudjoe, D., Farrukh, M., & Bai, R. (2023). What influences students' food waste behaviour in campus canteens? *British Food Journal*, 125(2), 381–395. <https://doi.org/10.1108/BFJ-10-2021-1103>
- Wang, P., McCarthy, B., & Kapetanaki, A. B. (2021). To be ethical or to be good? The impact of 'Good Provider' and moral norms on food waste decisions in two countries. *Global Environmental Change*, 69, 102300. <https://doi.org/10.1016/j.gloenvcha.2021.102300>

Jindřich Špička, professor, Ph.D. in Business Economics and Management, researcher, editor. He is a Professor-Researcher at the Czech University of Life Sciences, Prague, Faculty of Economics and Management, Department of Statistics. He is a member of the Czech Academy of Agricultural Sciences and research teams for scientific projects. It coordinates and participates mainly in applied research projects and contract research with commercial partners. Scientific interests: agricultural economics, applied statistics, business economics & strategy, policy-impact evaluation, risk analysis & management, sustainability. ORCID no. <https://orcid.org/0000-0001-5699-9544>.

The Recent Development of High-Efficiency Cogeneration Units in Poland

ARTUR LEŚNIAK, TOMASZ SURMA, KATARZYNA SZCZEPAŃSKA-WOSZCZYNA,
KRZYSZTOF ZAMASZ

Abstract

DOI: 10.23762/FSO_VOL11_N04_6

Combined heat and power generation is a tool for achieving energy policy goals – improving energy efficiency, improving energy security, diversifying the structure of energy generation, the wider use of renewable resources, developing competitive markets and reducing the environmental impact of the energy sector. The broader use of combined heat and power, including high-efficiency cogeneration in particular, contributes to saving the primary energy contained in fuel and reducing the carbon footprint calculated in terms of the combined electricity and heat produced. Electricity generation in high-efficiency cogeneration units has found recognition in many European Union countries. These countries have introduced support systems to stimulate the development of these sources. Poland also has significant potential for the development of high-efficiency cogeneration. In Poland, a dedicated law promoting electricity from high-efficiency cogeneration was adopted in 2018. The law was implemented in the second half of 2019. Other schemes were also implemented in Poland, in which high-efficiency cogeneration units may participate for development purposes. The purpose of the all-new regulations is to further develop high-efficiency cogeneration, guaranteeing the possibility of building new sources or activities related to the modernisation or operation of existing sources. The article presents support systems for high-efficiency cogeneration, together with an assessment of their implementation and the impact on the development of these sources.

Key words

energy management, energy efficiency, cogeneration, Renewable Energy Sources.

Artur Lesniak

e-mail: artur.lesniak@veolia.com
Veolia Energia Polska S.A.

Tomasz Surma

e-mail: tomasz.surma@veolia.com
Veolia Energia Polska S.A.

Katarzyna Szczepanska-Woszczyna

e-mail: kszczepanska@wsb.edu.pl
WSB University, Dąbrowa Górnicza,
Poland

Krzysztof Zamasz

e-mail: kzamasz@wsb.edu.pl
WSB University, Dąbrowa Górnicza,
Poland

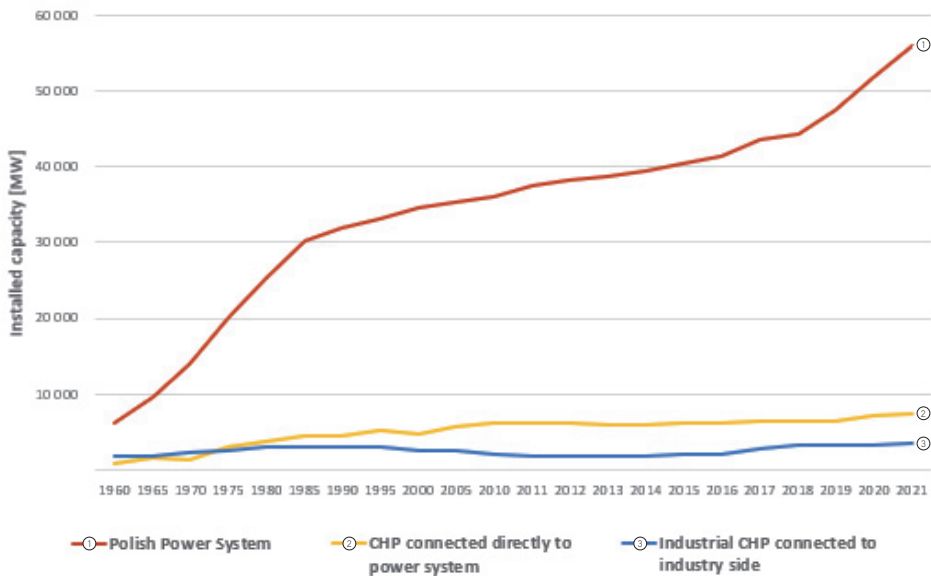
Introduction

Cogeneration, also known as Combined Heat and Power (CHP), is a process in which electricity and heat are generated together in one process or using one energy source. Compared to traditional methods of electricity generation, the cogeneration of electricity and heat is more efficient in converting the primary energy of fuel into useful energy and produces less emissions per unit of energy generated (i.e. electricity and heat in total).

The Polish heating sector makes significant use of cogeneration, mainly in units

fired with hard coal, biomass and natural gas. The share of cogeneration in heat production (calculated by volume) amounted to 62.1% in 2022, and 131 out of 355 heating professional utilities produced heat in cogeneration [15]. The share of electricity produced in CHP units has remained stable at approximately 12% for many years [12]. Figure 1 shows the installed capacity of the Polish Power System and the capacity of cogeneration units in 1960–2021.

Graph 1. Installed capacity of the Polish Power System, including cogeneration units – based on Energy Market Agency (EMA) statistical data



Source: own elaboration

An analysis of the statistical data on the installed capacity of the Polish Power System shows that new investments in cogeneration units are stagnant or growing only slightly. Thus, the purpose of this publication is to analyse the existing support mechanisms for high-efficiency cogeneration and assess how effective they are in

spreading this technology in the Polish power and heating systems.

1. Cogeneration in Poland

The Polish Power System presently contains 1.5 GW of cogeneration capacity fired with natural gas and 5 GW of coal-fired

cogeneration capacity. Industrial CHP plants have 1.8 GW of gas-fired capacity and 1.2 GW of coal-fired capacity [13]. Industrial CHPs generate electricity and especially heat for industrial processes and are usually located on industrial sites; they are sometimes able to deliver surplus electricity and heat to the household sector.

Cogeneration plays an important role in producing heat for district heating systems

that supply energy to approximately 16 million customers in Poland. The main fuel used for heat production in cogeneration is hard coal, accounting for around 59.21% of all fuel consumed to produce heat in CHP, followed by biomass at 15.18%, slightly ahead of natural gas at 8.76%. Table 1 shows the consumption of fuels for heat production in 2022 according to figures from the Energy Regulatory Office (URE) [15].

Table 1: Fuel consumption for heat generation in 2022
– compiled based on URE data [15]

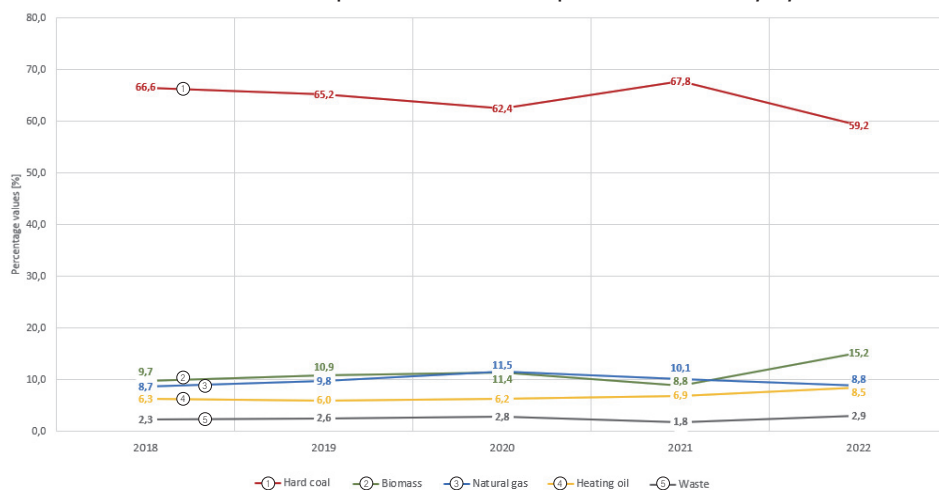
Fuel consumption for heat production				
Fuel type	Total [GJ]	Cogeneration [GJ]	Total [%]	Cogeneration [%]
Hard coal	291,644,203.64	186,548,701.00	65.19	59.21
Lignite	4,601,984.61	4,047,859.81	1.03	1.28
Heating oil	29,204,065.13	26,811,878.32	6.53	8.52
Natural gas	41,398,026.71	27,600,420.39	9.25	8.76
Biomass	54,869,015.75	47,837,882.39	12.26	15.18
Biogas	275,772.09	246,825.09	0.06	0.08
Other RES	1,203,504.64	29,234.81	0.27	0.01
Waste	9,251,847.67	9,251,098.23	2.07	2.93
Other fuel	14,918,198.42	12,675,628.01	3.33	4.02

Source: own elaboration

It is worth pointing out the change in the fuel structure for cogeneration units in terms of the previous years. Dating back to 2018, it is possible to observe a steady share of hard coal, which only fell below 60% in 2022. There is also a noticeable increase in the importance of biomass and heating oil. It is worth mentioning that the war in Ukraine and sanctions on fuel imports from Russia led to an increase in hard coal and natural gas prices in Europe.

The market situation justified the search for alternative energy sources, which turned out to be biomass and heating oil. It is worth noting that biomass, biogas and other RES technologies accounted for more than 15% of the heat generated in CHP in 2022, which constitutes an upward trend compared to previous years. Graph 2 shows fuel consumption for heat generation in cogeneration for the period of 2018–2022.

Graph 2. Fuel consumption for heat generation in cogeneration for the period of 2018–2022 – compiled based on data published annually by URE



Source: own elaboration

The profile of electricity production in cogeneration depends on the seasonality of heat production: heat is mainly consumed in autumn and winter, from September to May. Conversely, electricity demand is constant throughout the year. For cogeneration units that are producing steam for industry, the constant heat consumption throughout the year allows the primary energy of the fuel to be saved to the greatest extent. Today, when an increase in renewable energy sources is observed in Poland, especially wind and PV units, flexible cogeneration units can play a significant role in satisfying the projected generation balance in the power system [13].

The development of CHP units is also linked to urban development. In Poland, almost every major city is supplied with heat from a district heating network. Currently, there is a trend of population movement from the countryside to the cities, followed by the development of urban centres. This involves the construction of new buildings which are connected to district heating networks. Along with this, the demand for heat and electricity, and therefore for more generation from CHP units, is growing.

Connections of new consumers to district heating networks in large cities with over 500,000 inhabitants amount to approximately 20–40 MW/year, except for the Warsaw district heating system, to which over 100 MW of new customers have been connected annually in recent years. This enlargement of district heating systems requires the modernisation, reconstruction and construction of new high-efficiency cogeneration units. However, the development of cogeneration units will be reconsidered due to regulatory conditions, in particular the availability of support systems [14].

New cogeneration units have significant development potential in Poland, primarily due to the conditions on the heating market, the projected growth in demand for capacity in the power system and the need to phase out older, obsolete units. The share of cogeneration in the production of heat and electricity is projected to rise gradually, with increasing emphasis on the development of units using renewable energy sources (approximately 20% of the installed cogeneration capacity will come from renewable energy sources in 2030) [8]. According to the Polish Energy Policy until 2040, the majority

of new CHP units will be powered by natural gas. Approximately 2.5 GW of new units of this type may be built by 2030, and then another 3.5 GW by 2040 [11].

To achieve this potential, dedicated operational support mechanisms have been implemented, namely a support system for high-efficiency cogeneration and a support system for renewable energy sources. High-efficiency cogeneration units can also participate in the capacity market [22, 26, 27].

2. Cogeneration in the European Union Policy and Regulations

EU climate policy promotes the use of cogeneration, inter alia, by gradually raising energy efficiency ambitions. The *Fit for 55* package of regulations calls for the reduction of greenhouse gas emissions in Europe by 55% by 2030 (compared to the 1990 level) and the achievement of climate neutrality by 2050. The analysis of EU regulations comprising the *Fit for 55* package suggests that high-efficiency cogeneration can be used to achieve the fundamental goals of the EU climate and energy policy: reducing greenhouse gas emissions, improving energy efficiency and expanding the use of renewable energy resources.

2.1. Emission trading system

The revision of the Directive establishing a system for trading greenhouse gas emission allowances in the European Union [1] included in the *Fit for 55* package calls for the faster withdrawal of CO₂ emission allowances. The directive establishes a separate emissions trading system for the construction and transport sectors and for fuels for additional sectors. The new system will apply to heat suppliers (including in-house energy producing installations with a total nominal thermal capacity below 20 MWth) if the installations are not subject to the existing emission trading system. This system will oblige these undertakings to submit

emission allowances from 2027, with the maximum price of emission allowances set to 45 EUR/tCO₂. The amount of 45 EUR is based on 2020 prices and will be indexed based on the consumer price index. The regulatory environment thus created is to encourage undertakings to seek further opportunities to reduce CO₂ emissions and thus cut the operating expenses of utilities, which can be done, among others, by investing in high-efficiency cogeneration. All of the directive regulations stimulate market players to undertake activities related to decreasing CO₂ emissions. Cogeneration may play a vital role in this area.

An important element of the revision of the ETS Directive is the free allocation of an additional 30% of allowances for the district heating sector in certain member states. The main condition for receiving an additional allocation is the presentation of a climate neutrality plan by an installation operator specifying investments that are to be made, such that by the end of 2030 there will be a significant reduction in CO₂ emissions. The value of the additional allocation of free emission allowances must reflect the investment costs incurred in accordance with the climate neutrality plans. Therefore, for the heating sector in Poland, this is an opportunity to obtain additional funds for investment.

2.2. Energy efficiency

The tightening of the European Union's climate policy has led to a new definition of the energy efficiency improvement target: reducing final energy consumption in 2030 by at least 11.7% compared to 2030 energy consumption projections made in 2020. Energy Efficiency First is a core principle that is reflected in legislation and actions undertaken by national and EU institutions. Poland has set the following national contribution to the 2030 EU target: primary energy consumption of 91.3 Mtoe in 2030 and final energy consumption of 67.1 Mtoe in 2030.

These values, however, need to be adjusted to reflect the more ambitious approach presented in the *Fit for 55* package.

In the period of 2011–2021, Poland undertook significant improvements in the field of energy efficiency. Total primary energy consumption increased in the period of 2011–2021 from 96.6 Mtoe to 104 Mtoe (a cumulative annual growth rate of 0.74%). Final energy consumption increased in the same period from 64.7 Mtoe to 75.2 Mtoe, which means that the cumulative annual growth rate was 1.5%. The fastest rate of energy efficiency improvement between 2011 and 2021 was recorded in the industrial sector (1.3% per year) followed by households (1.1% per year) and transport (0.9% per year) [25]. Increased energy efficiency can occur, among other things, by transforming existing power plants and heating plants into combined heat and power plants, as well as building new high-efficiency cogeneration units which maximise the use of primary energy.

High-efficiency cogeneration represents one of the components of efficient district heating systems as defined by the Energy Efficiency Directive [3]. Maintaining the status of an efficient district heating system is a condition for receiving financial support for investment projects in the DH system. At the same time, EU regulations rule out financing cogeneration that emits more than 270 gCO₂/kWh of electricity and heat generated and therefore cannot be defined as being high-efficiency. High-efficiency gas-fired cogeneration will maintain the status of effective district heating systems at least until the end of 2034; from then on until 2045, the share of renewable energy sources and waste heat will have to be gradually raised in order to maintain such status.

2.3. Energy efficiency of buildings

A change in the definition of zero-emission buildings was proposed during work on the Energy Performance of Buildings

Directive [2]. From 2030, all new and thoroughly modernised buildings should comply with the definition of zero-emission buildings. Such buildings are to be supplied with energy only from renewable sources via an efficient district heating system. The proposed regulations rule out the use of heat from high-efficiency cogeneration for zero-emission buildings. EU regulations view high-efficiency cogeneration fired with biogas, biomass or waste most favourably, and high-efficiency cogeneration fired with natural gas less favourably.

Currently, more than half of the energy demand for heating residential buildings in Poland is satisfied by coal, mostly by means of indirect use in district heating systems. However, residential buildings remain largely energy-inefficient. Only about 20% of Polish district heating systems qualify as energy-efficient in line with the existing definition of efficient district heating systems. Moreover, 76% of district heating systems in Poland are based on coal, and most of those systems are based on cogeneration.

2.4. Renewable energy sources

The share of energy from renewable energy resources as a percentage of the total energy consumed in the EU is targeted to reach 42.5% by 2030 (the previous target was 32% by 2030 and has been tightened by revision of the Directive). Based on the current Directive, the goal may be additionally raised by 2.5 percentage points, which would raise the 2030 target to 45%. Cogeneration is a technology that uses renewable fuel efficiently. The revisions introduced by the new Directive on the promotion of the use of energy from renewable sources will impact the wider use of biomass [4]. The Directive limits the use of biomass by power plants due to the low efficiency of fuel conversion, and designates this fuel stream for CHP units which, by generating two energy streams – electricity and heat – can use this fuel much more efficiently. The lack of

access to certified biomass may impact the ability of Polish district heating systems to maintain their efficient system status. As of 2022, biomass was the second most popular fuel for cogeneration units in Poland after coal.

The *Fit for 55* package continues the climate and energy policy followed so far. The new regulations, as with previous legislative packages, will affect energy undertakings, including heating ones, and will drive their strategy and investment projects [10]. EU regulations play an important role in determining the form of member states' support systems. This is because state aid to economic operators that affects the internal market of the European Union is prohibited in principle. EU law permits the use of state aid only if it is justified by material reasons (e.g. aid for environmental activities). However, every aid case is treated as an exception to the rule and, in principle, requires justifications and approval by the European Commission. It is important to adjust the implemented support instruments to the *Fit for 55* package without delay so that cogeneration becomes a real tool for implementing Polish policies and achieving the intended goals.

3. Cogeneration in Polish Regulations

3.1. High-efficiency CHP support scheme

The Act of 14 December 2018 on promoting electricity from high-efficiency cogeneration (hereinafter: the “CHP Act”) [19] entered into force on 25 January 2019 and specifies the operating principles of the support system dedicated to high-efficiency cogeneration. The purpose of the CHP Act is to develop high-efficiency cogeneration by supporting the construction of new sources and promoting activities related to the modernisation or operation of existing sources.

The CHP Act divides cogeneration units into existing, modernised, significantly modernised and new – planned to commissioning. The CHP Act defines modernisation as an investment process aimed at restoring the original condition or changing the operating or technical parameters of a cogeneration unit. The Act also regulates the quality of materials and components used for the construction and modernisation of CHP units – they cannot be manufactured more than 60 months prior to the date of the initial generation of electricity from a particular unit. Additionally for modernisation, the capital expenditure during this investment must be within the range of 25% to 50% of that for a comparable new cogeneration unit. A significant modernisation is one where the capital expenditure exceeds 50% of that for a comparable new cogeneration unit.

Another important criterion for CHP units is the installed capacity [9]. Cogeneration units are split into the following installed capacity ranges:

- up to 1 MW (small CHP plants);
- from 1 to 50 MW;
- more than 50 MW;
- more than 300 MW.

The regulations apply an emission benchmark of 450 gCO₂/kWh. The emission benchmark laid down in the CHP Act may be revised when the *Fit for 55* package is transposed into the national legal system. The maximum duration of support for new units is 15 years from the date of commissioning – supplying electricity to the grid and selling it from this unit. Support for new cogeneration units may be provided in the following forms:

- guaranteed premium – below 1 MW (small CHP plants);
- cogeneration premium – from 1 to 50 MW;
- individual cogeneration premium – above 50 MW.

Table 2: Support parameters under the high-efficiency cogeneration support system in 2024 compared to 2023 (values in brackets)

Installation type	Gas fuels [PLN/MWh]	Solid fuels [PLN/MWh]	Biomass [PLN/MWh]	Others [PLN/MWh]
Guaranteed bonus – new or modernised small CHP unit	161.24 (181.53)	0 (0)	0 (0)	119.95 (106.52)
Guaranteed bonus – substantially modernised small CHP unit	109.64 – 161.24 (123.44 – 181.53)	0 (0)	0 (0)	71.97 – 119.95 (64.03 – 106.72)
Individual co-generation bonus Guaranteed bonus – modernised; Cogeneration unit with an installed capacity between 1 and 50 MW; Reference values for a new cogeneration unit	324.42 (390.83)	0 (458.44)	418.38 (415.35)	278.06 (301.45)
Reference values for a significantly modernized cogeneration unit	220.61 – 324.42 (265.76 – 390.83)	0 (183.38 – 458.44)	167.35 – 418.38 (166.14 – 415.35)	166.84 – 278.06 (180.87 – 301.45)
Guaranteed bonus – existing cogeneration unit with an installed capacity between 1 and 50 MW	168.97 (435.01)	0 (0)	0 (0)	36.13 (69.32)
Guaranteed bonus – existing small CHP unit	91.86 (374.52)	0 (0)	0 (0)	0 (0)

Source: own elaboration

Guaranteed premium

The guaranteed premium is paid for each MWh of electricity generated from a new cogeneration unit with less than 1 MW of installed capacity. Electricity does not have to be supplied to the power grid for support to be received. It may be delivered on the industry side or delivered directly to the customer. Existing or modernised units with a capacity from 1 MW to 50 MW can be supported with the guaranteed bonus, but support for these units is conditional on supplying power to the grid. The subsidy amount under the guaranteed premium scheme is determined annually by the Minister of Climate and Environment. A generator intending to receive the guaranteed premium must file an application for a license, build a cogeneration plant, and then apply to the President of the Energy Regulatory Office for admission to the

guaranteed premium system and for premium payment.

Cogeneration premium

Generators using new cogeneration units with an installed electrical capacity from 1 MW to less than 50 MW may apply for the cogeneration premium. Generators operating significantly modernised units are also entitled to the cogeneration premium. Support for the cogeneration premium is granted through cogeneration premium auctions announced at least every quarter. The maximum amount of the cogeneration premium is determined annually by the Minister of Climate and Environment.

Individual cogeneration premium

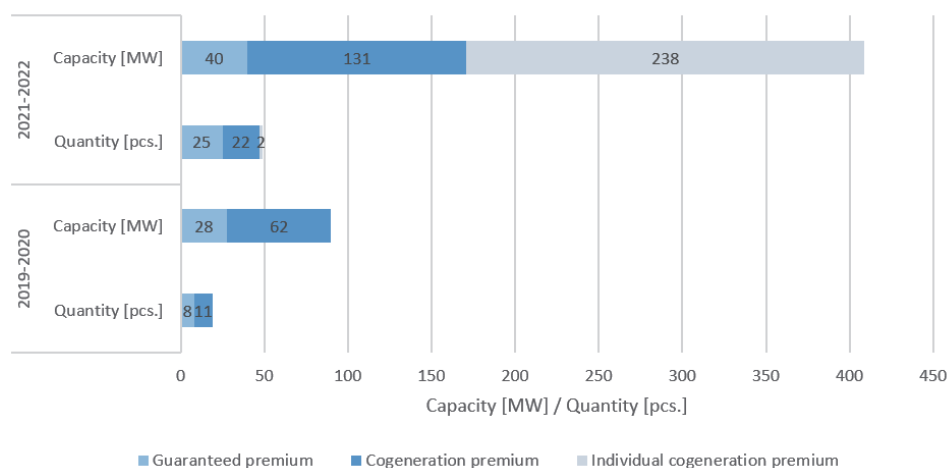
Generators operating new or significantly modernised cogeneration units with an

installed electrical capacity of 50 MW or more are entitled to the individual cogeneration premium dedicated to individual CHP units. Support in the form of the individual cogeneration premium is granted through calls published at least once or twice a year. The maximum amount of the individual cogeneration premium is determined annually by the Minister of Climate and Environment. Generators using units with more than 300 MW of capacity are a special case and may receive support only after individual approval is granted by the European Commission.

Summary

According to information published by the President of the Energy Regulatory Office (ERO) in regular reports on the conditions for undertaking and conducting business in the generation, transmission or distribution of electricity and gas fuels in 2019–2022, support under the CHP Act was granted to approximately 500 MW of installed electrical capacity in 68 new cogeneration units. Graph 3 presents the capacity and number of new cogeneration units contracted under the high-efficient cogeneration support scheme [16].

Graph 3. New cogeneration units contracted under the high-efficiency cogeneration support system in 2019–2022, compiled based on Energy Regulatory Office (ERO) data



Source: own elaboration

A comparison of the above values compiled based on Energy Regulatory Office (ERO) data with Energy Market Agency (EMA) data brings to light discrepancies in how these two authorities collect and present data. EMA data are based on information from power system operators pertaining to the connection of new electricity-generating units. According to EMA data, 617 MW of installed capacity in 40 cogeneration units was commissioned in

2021–2022. Data from the President of the ERO indicate that 409 MW of installed capacity was built in 49 cogeneration units, which were built with state aid. However, assuming that the difference between these two values provides an estimate of the number of units built outside the support scheme is not correct. For example, ERO data excludes the Żerań CCGT unit, which received support as part of the capacity market. EMA data, on the other hand,

excludes cogeneration units that were supported with guaranteed premiums, because this support is not conditional on supplying energy to the grid.

The growth of new capacity in cogeneration units is not impressive, and the support system for high-efficiency cogeneration is failing to achieve the desired results. The operation of the high-efficiency cogeneration support mechanism also significantly

deviates from the projections made in the impact assessment of the CHP Act. When drafting the Act, legislators planned for new installed capacity to grow by 2,900 MW in 2019–2022 under the high-efficiency cogeneration support system. Instead, only 17.2% of the planned capacity was contracted by the end of 2022. Table 3 shows the increased capacity from cogeneration units expected during regulation drafting.

Table 3: Installed electrical capacity volume of cogeneration units planned to be supported in 2019–2023 –compiled based on the CHP Act impact assessment

Installed electrical capacity (MW)	2019	2020	2021	2022	2023
Auctions	100	400	300	300	300
– solid fuel	20	75	75	75	75
– gas fuel	80	300	200	200	200
– other fuel	0	15	15	15	15
– biomass	0	10	10	10	10
Small cogeneration units	50	50	50	50	50
Call	600	600	250	150	100
TOTAL	750	1050	600	500	450

Source: own elaboration

The high-efficiency cogeneration support system for 2023–2024 will require adaptation to new EU regulations. This includes, among others, a new definition of high-efficiency cogeneration, hence lowering the emission benchmark to 270 gCO₂/kWh. The Fit for 55 transposition period may also offer an opportunity to introduce broader changes to improve the operation of the CHP Act.

3.2. Capacity market

High-efficiency cogeneration units may be supported as part of the capacity market introduced in Poland. This mechanism is governed by the Act of 8 December 2017 on the capacity market (hereinafter: the “**Capacity**

Market Act”) [18]. As part of the capacity market, generating units can bid capacity obligations or demand side response at capacity market auctions [5]. The maximum amount of capacity obligation that may be bid at a capacity auction is calculated based on the installed capacity of a given generating unit and the capacity utilisation factor determined individually for each technology by way of a Regulation [6, 21].

The capacity market in Poland was established as a response to the need to ensure available capacity in the power system to guarantee the security of power supply to consumers [20]. Under this mechanism, energy generators, operators of energy storage and DSR offer their generation capacities

at dedicated capacity auctions, and receive payment for this available capacity determined by the results of this auction. Then, the transmission system operator verifies whether the obligatory capacity supply was delivered; if the capacity obligation has not been fulfilled, the generator may be charged a financial penalty. Cogeneration units are entitled to take part in capacity market mechanisms.

The capacity market includes main auctions and additional auctions. Main capacity market auctions are held annually for the delivery year five years thereafter. In principle, both new and existing units can bid in main capacity market auctions, but for existing units, support is provided for no more than one year. Cogeneration units generating more than 30% of electricity in high-efficiency cogeneration annually can bid at both the main auction and the additional auction for the same delivery year. It is worth noting that the Capacity Market Act refers directly to the notion of high-efficiency cogeneration, which in the coming years will mean cogeneration with emission lower than 270 gCO₂/kWh of energy produced by combined heat and electricity generation.

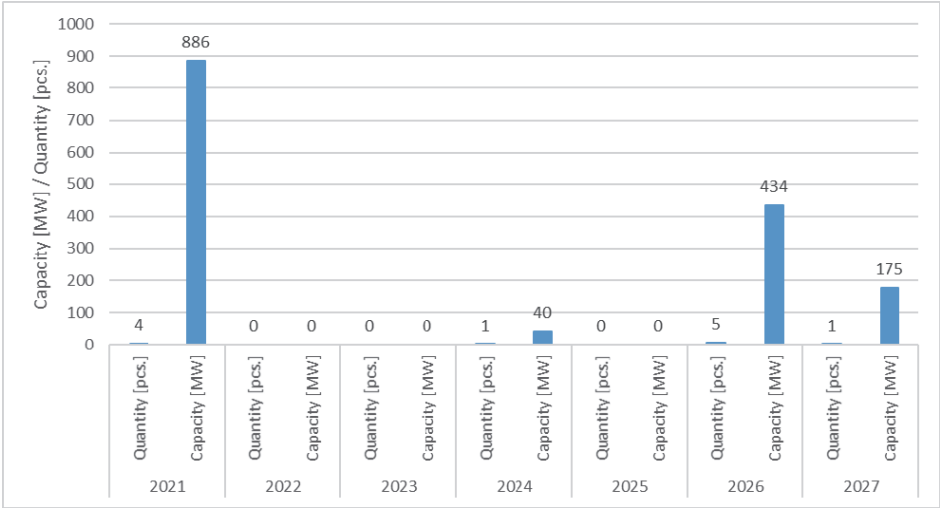
The maximum period of support for new units as part of main capacity market auctions is 15 years and may be extended by two years if the unit carbon dioxide emission rate is lower than 450 gCO₂/MWh of electricity and heat in total. This solution is dedicated primarily to cogeneration units, which can thus benefit from the capacity market for 17 years. The emissivity criterion of the capacity market is yet another criterion that will have to be changed once the

negotiations of the *Fit for 55* package are finalised, because some units, in order to be recognised as high-efficiency cogeneration, will have to demonstrate emissions of less than 270 gCO₂/kWh.

In addition, cogeneration units must supply at least half of the generated heat to a district heating system in which hot water is the heating medium. The capacity market also offers additional auctions held in the first quarter of the year for the next year of delivery. Additional auctions are, firstly, to “top up” the capacity in the system purchased at the main auctions, and secondly, to account for the seasonality of electricity production at some generating units, in particular CHPs. At additional auctions, support is granted for a specific quarter of the next delivery year.

Determining which cogeneration units bid at capacity auctions requires reviewing information about investment projects selected at capacity auctions that is reported publicly. The officially published results of capacity auctions do not identify the technology or fuel used. It should be emphasised that the capacity reported by the media and in the results of capacity market auctions concerns the capacity contract, so it is not the same value as the installed electrical capacity of the generating unit. A detailed analysis of the final results of capacity auctions suggests that approximately 1,535 MW of capacity was contracted from 12 new cogeneration units at all previous main auctions (delivery years 2021–2027). The results of capacity market auctions for cogeneration units are presented in Graph 4.

Graph 4. New cogeneration units contracted on the capacity market for the 2021–2027 delivery years – compilation based on capacity auction results



Source: own elaboration

To date, seven main auctions have been held for the 2021–2027 delivery years. At those auctions, at least 1.5 GW of installed electrical capacity of new cogeneration units was contracted. Neither PSE (the Polish TSO) nor the Energy Regulatory Office distinguishes cogeneration units in the published capacity auction results. Detailed data on this subject should be presented by the Cabinet in the assessment of the capacity market operation by the end of 2024. The capacity market supports and can continue to support the development of high-efficiency cogeneration units in Poland in the future. A comparison of the results of the main capacity market auctions to the support system for high-efficiency cogeneration shows greater investor interest (by volume) in the capacity market. The capacity market is dominated by investments in large cogeneration units.

The future of the capacity market in Poland is determined by EU regulations concerning the internal electricity market. Currently, a reform of the energy market proposed by the European Commission is in

the process of legislative work (New Market Design). During the negotiations, Poland ensured the extension of the derogation for the capacity market emission performance standard. The applicable EU regulations exclude any financial aid for generating units with emissions exceeding 550 kg CO₂/MWh, but for Poland, a derogation until June 2025 was already provided during the work on the *Winter Package*. New Market Design may extend the derogation until the end of 2028, which will allow Poland to carry out the necessary investments while maintaining energy security. At the same time, New Market Design clearly indicates that from a long-term perspective, the capacity markets across the EU should become a tool supporting investments in DSR and energy storage solutions.

3.3. RES support scheme

Cogeneration units using renewable energy resources may be supported through the mechanisms established in the Act of 20 February 2015 on renewable energy sources (hereinafter: the “RES Act”) [17]. The

support systems provided for in the RES Act include an auction support system, a feed-in tariff system (“FIT”) and a feed-in-premium system (“FIP”). Renewable energy support systems are to provide support for 15 years. The FIT and FIP systems are addressed to smaller units and specific technologies. The technology list is common and includes biogas (all types), hydropower and biomass. It is worth noting that, unlike the auction support system, the FIT and FIP systems do not obligate generators to produce a specific amount of energy.

Feed-in tariff system (FIT)

The FIT system guarantees the sale of electricity supplied to the network at a fixed price equal to 95% of the reference price. Reference prices are published for a calendar year by way of a regulation of the minister responsible for energy and determine the maximum amount of support that can be received by a given technology using renewable energy resources. Renewable energy installations eligible for the FIT must have less than 500 kW of total installed electrical capacity and be fitted with a separate set of equipment for power output. The purchasing entity is the so-called obligated seller appointed by the President of the Energy Regulatory Office.

Feed-in premium system (FIP)

The FIP system is designed for generators with installations from 500 kW to 2.5 MW of installed capacity (except for biomass, for which the installed capacity cannot exceed 1 MW) who sell electricity to a selected entity other than an obligated seller. The FIP system entitles the generator to have their negative balance covered (by a premium) up to the difference between the reference price and the average market price of electricity. The generator is authorised to apply for negative balance coverage, and the entity competent to settle it is the Settlement Administrator.

Renewable energy auctions

The RES Act governs the so-called auction support system, as part of which the President of the Energy Regulatory Office announces, organises and conducts auctions divided into specific technology baskets every year. The subject of the auction is the sale of electricity generated by a renewable energy installation and fed into the grid. The President of the Energy Regulatory Office regularly publishes the schedule of auctions to be held in a given year with the division into technology baskets. Auctions may be organised annually for CHP units within the following technology baskets:

- for agricultural biogas – in cogeneration or in simple cycle, above 1 MW;
- for agricultural biogas – in cogeneration or in simple cycle, up to 1 MW;
- for biogas from landfills, from sewage treatment plants, other biogas, waste to energy, biomass or hybrid systems – in cogeneration or simple cycle, above 1 MW;
- for biogas from landfills, from sewage treatment plants, other biogas, waste to energy, biomass or hybrid systems – in cogeneration or simple cycle, up to 1 MW.

Separate reference prices (maximum auction prices) were introduced for some technologies, including cogeneration, from 25 January 2019. Table 4 shows reference prices for individual technologies, both with and without (values in parentheses) cogeneration in 2019–2022.

The published reference prices increase year by year, with reference prices for cogeneration growing faster. Unfortunately, the increase in new cogeneration capacities supported by renewable energy auctions does not go hand-in-hand with an increase in reference prices, which determine the maximum amount of support. Table 4 and Graph 5 below present the reference prices of selected renewable energy technologies from 2019.

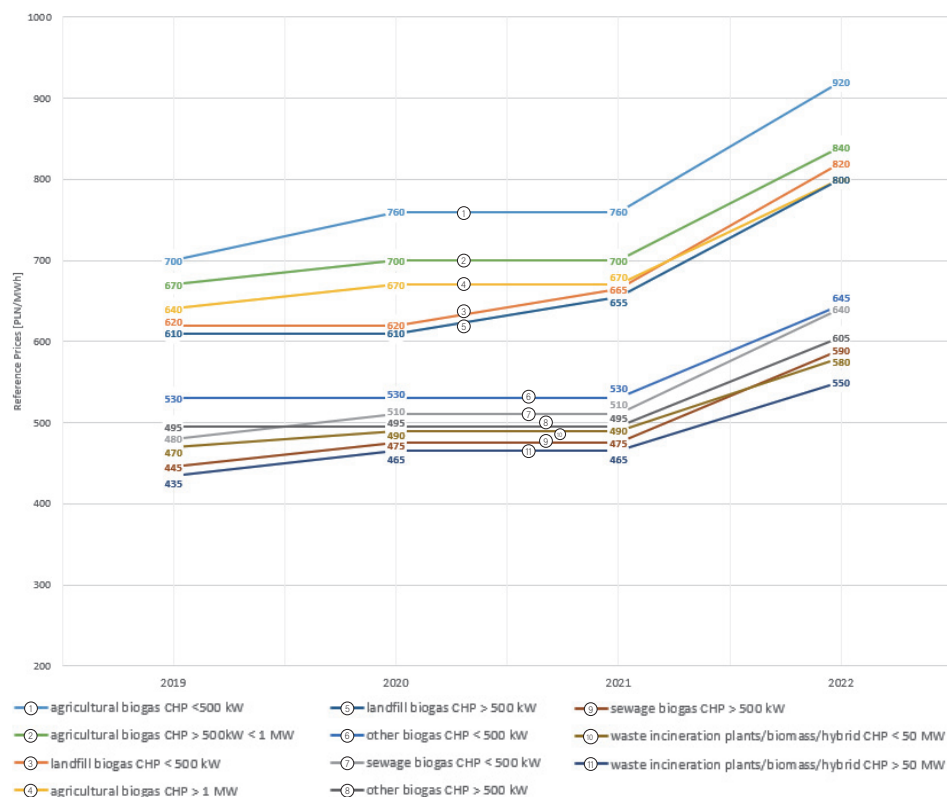
Table 4: Reference prices for renewable energy installations with and without cogeneration – own elaboration

Installation type	Reference price of selected technologies with cogeneration (reference price without cogeneration) [PLN/MWh]			
	2019	2020	2021	2022
Agricultural biogas < 500 kW	700 (650)	760 (650)	760 (650)	920 (785)
Landfill biogas < 500 kW	620 (560)	620 (560)	665 (605)	820 (730)
Sewage treatment biogas < 500 kW	480 (420)	510 (420)	510 (420)	640 (515)
Other biogas < 500 kW	530 (500)	530 (470)	530 (470)	645 (570)
Agricultural biogas 500 kW–1 MW	670 (590)	700 (590)	700 (590)	840 (715)
Agricultural biogas > 1 MW	640 (570)	670 (570)	670 (570)	800 (700)
Landfill biogas ≥ 500kW	610 (550)	610 (550)	655 (590)	800 (705)
Sewage treatment biogas ≥ 500kW	445 (385)	475 (385)	475 (385)	590 (470)
Other biogas ≥ 500kW	495 (435)	495 (435)	495 (435)	605 (525)
Waste to energy, biomass or hybrid system ≤ 50 MW	470 (435, 350)	490 (465, 350)	490 (465, 350)	580 (525, 420)
Waste to energy, biomass or hybrid system > 50 MW	435 (435, 350*)	465 (465, 350*)	465 (465, 350*)	550 (525, 420*)

Explanation: * – a separate reference price applies to waste to energy plants.

Source: own elaboration

Graph 5. Reference prices for renewable energy installations with cogeneration – own elaboration



Source: own elaboration

Summary

According to information published by the President of the Energy Regulatory Office in regular reports on the conditions for undertaking and conducting business in the generation, transmission or distribution of electricity and gas fuels in 2018–2022, 121 certificates allowing the sale of unused electricity at a fixed price were issued for cogeneration plants. The total installed electrical capacity of such units approximated 77 MW. It should be emphasised that this

number includes both existing and new installations – the figures published by the Energy Regulatory Office do not divide the plant capacity into existing and new sources. Therefore, it can be assumed that no more than 77 MW of installed power was contracted from 121 new cogeneration units using agricultural or landfill biogas in 2018–2022. Table 5 lists certificates issued by the President of the Energy Regulatory Office for the sale of electricity from cogeneration units.

Table 5: List of certificates issued in 2018–2022 allowing the sale of unused electricity at a fixed purchase price, categorised by installation type – compiled based on ERO data [16]

Type of cogeneration plant	Number of certificates issued [pcs.]	Installed electrical capacity (MW)
Agricultural biogas	112	69.394
Landfill biogas	9	7.631
Sewage treatment biogas	0	0

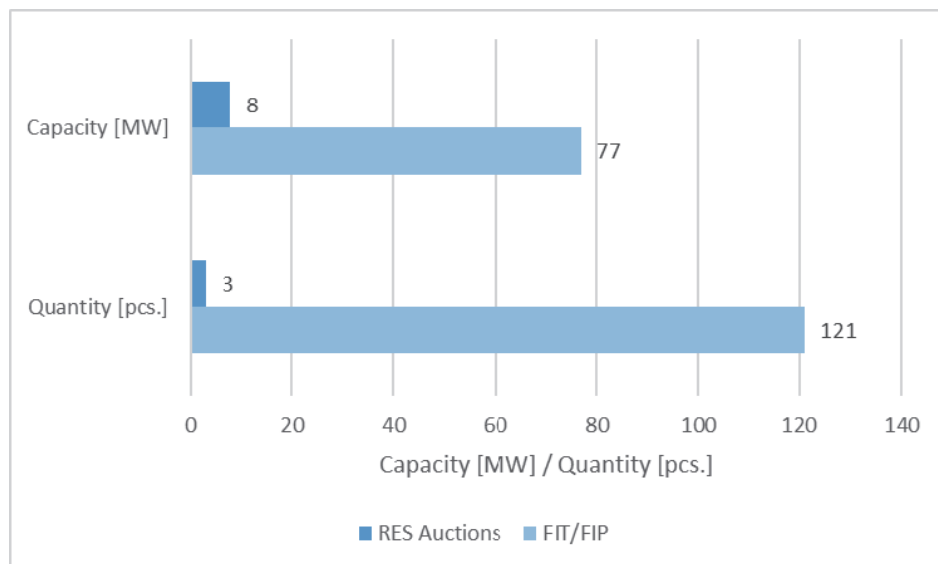
Source: own elaboration

The capacity of new high-efficiency cogeneration units supported through renewable energy auctions can be estimated by analysing auction results from 2019–2022. 2019 saw a number of renewable energy auctions, as existing and new installations were allowed to bid at auctions: twelve auctions were held altogether, with cogeneration units allowed to bid at seven of those. With regard to new installations for which auctions were held in 2019, it is worth noting the auction for biogas from landfills and from sewage treatment plants, other biogas, waste-to-energy, biomass or hybrid systems above 1 MW, where one winning bid was selected out of four placed by the same undertaking. No bids were accepted in auctions for agricultural biogas installations up to 1 MW and above 1 MW, respectively. Eight auctions were held in 2020, four of which were open to cogeneration plants, and again no transactions were finalised at many auctions. It is worth noting the auction for biogas from landfills and from sewage treatment plants, other biogas, waste-to-energy, biomass or hybrid systems above 1 MW, in which two

generators were selected, both heating utilities, which means that cogeneration installations were most likely contracted at this auction. In 2021, eight auctions were organised, including four for cogeneration plants. No transactions were finalised at any of these auctions. The situation was similar in 2022, when seven auctions were held, with cogeneration units allowed at three of them; all auctions ended unsuccessfully.

In essence, approximately 8 MW of installed electrical capacity from three new high-efficiency cogeneration units using renewable energy may have been contracted at auctions held in 2019–2022. RES auctions, FIP and FIT could have supported approximately 85 MW of installed electrical capacity of new cogeneration units altogether using renewable energy in 2019–2022, as presented in Graph 6. The RES auctions held so far have not provided significant support for new cogeneration units. Even though several auctions are announced every year at a minimum, the vast majority of them are unsuccessful in regard to CHP.

Graph 6. New cogeneration units contracted under the renewable energy support system – own elaboration



Source: own elaboration

4. Summary

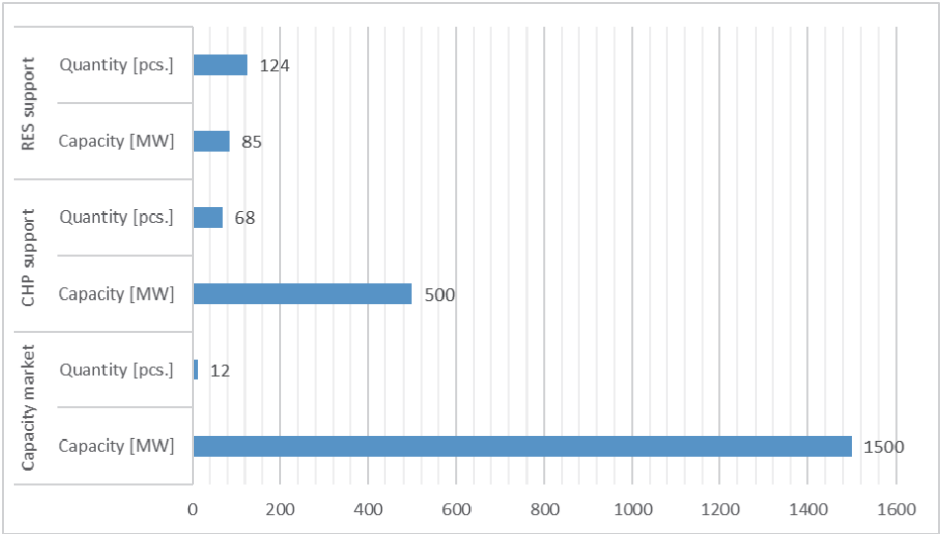
Most high-efficiency cogeneration units have been or are being built thanks to support from the capacity market. Approximately 1.5 GW of capacity of 12 high-efficiency cogeneration units were contracted at all main capacity market auctions conducted so far (2018-2022), of which almost 900 MW (four units) were launched before 2021. Mainly producers operating large CHP units seek support as part of the capacity market.

The support system under the dedicated Act on promoting high-efficiency cogeneration has successfully delivered approximately 500 MW of installed electrical capacity in 68 new high-efficiency cogeneration units

since 2019. Producers mainly receive support in the form of cogeneration premiums, which means that the system supports new units with more than 1 MW of installed capacity.

The support system for renewable energy sources has delivered no more than 85 MW of installed capacity in 124 new cogeneration units supplied with renewable energy. It is worth noting that support is mainly provided through the FIT and FIP systems to biogas units, which are installations of up to 1 MW in capacity. Graph 7 summarises the new generation capacities of cogeneration units built under the auspices of the above support mechanisms.

Graph 7. New high-efficiency cogeneration units supported under various systems – own elaboration



Source: own elaboration

The Polish power system and heating sector require new installed capacity of cogeneration, particularly that supplied with renewable energy. These types of units have a special role to play in the context of the EU climate and energy policy and the policies of individual member states, including Poland. The development of Poland's major large cities is associated with increased demand for heat and electricity. New residential buildings under construction, as well as industrial and commercial facilities, are being connected to the district heating network. This determines the development of district heating systems. High-efficiency cogeneration units can bring ready-made technological solutions for these systems while strengthening the goals of improving energy efficiency, reducing emissions and developing the use of renewable energy sources.

Despite the great potential for the development of cogeneration in Poland and the various support mechanisms implemented for these units, the spectacular effects of these systems are not observed. The

assumed goals, as indicated by statistical data, have not been realised. Regulations bring moderate development of high-efficiency cogeneration units. The statistics collected for this paper indicate that the growth rate of high-efficiency cogeneration in Poland is insufficient. The support systems established are not effective in terms of realising the full development potential of these units. There are reasons to review the support mechanisms, assess their impact on the development of cogeneration and district heating in Poland, formulate recommended revisions to the law and make the necessary legislative changes to ensure the desired development of these sources. Revision and changes are needed in particular in the dedicated Act on promoting the use of high-efficiency cogeneration. Neither has the Act on renewable energy sources led to the construction of cogeneration units using biomass, biogas and other renewable resources that would stabilise the operation of generating units in the National Power System.

The development of cogeneration in Poland is conditioned by numerous regulations at the EU level. Energy utilities formulate their development strategies based on European Union and national regulations. Heating utilities using cogeneration should adopt a proactive approach to the changing regulatory environment, including by taking an active part in debates on energy sector development at both the national and EU levels. In this respect, a broad presentation of the national conditions of the Polish heating sector would be reasonable.

Literature

- [1.] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC (OJ EU. L. 2003 No. 275, p. 32 as amended).
- [2.] Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (OJ EU. L. 2010 No. 153, p. 13 as amended).
- [3.] Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast) (OJ EU. L. 2023, No. 231, p. 1).
- [4.] Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources and repealing Council Directive (EU) 2015/652.
- [5.] Kaszyński P, Komorowska A., Zamasz K., Kinelski G., Kamiński J., *Capacity Market and (the Lack of) New Investments: Evidence from Poland*, *Energies*, 14(23), 7843.
- [6.] Komorowska A., Kaszyński P., Kamiński J., *Where does the capacity market money go?* *Energy Policy*, no. 173, 113419.
- [7.] Kryzia D, Kuta M, Matuszewska D, Olczak P.: *Analysis of the Potential for Gas Micro-Cogeneration Development in Poland Using the Monte Carlo Method*. *Energies*. 2020.
- [8.] Matuszewska D., Kuta M., Górski J.: *Cogeneration – development and prospect in Polish energy sector*. *Energy and Fuels*. 2016.
- [9.] Paska J., Surma T.: *New support system for high-efficiency cogeneration*. *Electrotechnical Review*. ISSN 0033-2097, R. 95 NO. 10/2019.
- [10.] Paska J., Surma T.: *The impact of the European Union's energy policy on the operation of energy companies in Poland*. *Energy Market* 2016, no. 2 (123), pp. 17-26.
- [11.] *Energy Policy of Poland until 2040 – Annex to Resolution No. 22/2021 of the Council of Ministers of 2 February 2021*.
- [12.] Polish Association of Combined Heat and Power: *Report on cogeneration in the heat industry 2019*, Warsaw. October 2019.
- [13.] Rubczyński A., Ph.D. Mackowiak-Pandera J., Dziadykiewicz A., *The power system needs district heating*, *Energy Forum* analysis online access: [27.07.2023]: <https://www.forum-energii.eu/pl/analizy/kse-kogeneracja>.
- [14.] Surma T., Leśniak A.: *Prospects for the development of high-efficiency cogeneration in Poland in light of the Fit for 55 regulation package*, *Energy Market* 2023, No. 3 (166).
- [15.] Energy Regulatory Office: *Thermal power generation in numbers – 2022*, Warsaw, October 2023, ISBN 978-83-948942-6-9.
- [16.] Energy Regulatory Office: *Report of the President of the Energy Regulatory Office on the conditions for undertaking and carrying out business activities in the field of generation, transmission or distribution of electricity and gaseous fuels and the implementation by electricity and gas system operators of development plans taking into account the satisfaction of current and future demand for electricity and gaseous fuels*, Warsaw, June 2023.
- [17.] Act of 20 February 2015 on Renewable Energy Sources (i.e. *Journal of Laws* 2022, item 1378, as amended).

- [18.] Act of 8 December 2017 on the power market (i.e. Journal of Laws of 2021, item 1854, as amended).
- [19.] Act of 14 December 2018 on the promotion of electricity from high-efficiency cogeneration (i.e. Journal of Laws of 2022, item 553).
- [20.] Zamasz K., *Economic efficiency of the power utility under the conditions of the introduction of the power market*, PWN, 2015.
- [21.] Zamasz K., Kaplan R., Kaszyński P., Saługa P.W., An analysis of support mechanism for new CHPs: the case of Poland, *Energies*, 13(21), 5635.
- [22.] Zamasz K., Surma T., Leśniak A.: *Assessment of the support schemes for new high-efficiency cogeneration units in Poland*, *Energy Market* 2023, No. 5 (168).
- [23.] Kinelski G. 2020. *The main factors of successful project management in the aspect of energy enterprises' efficiency in the digital economy environment*, *Polityka Energetyczna – Energy Policy Journal*. DOI: 10.33223/epj/126435.
- [24.] Jasiński, J.; Kozakiewicz, M.; Sołtysik, M., *The Effectiveness of Energy Cooperatives Operating on the Capacity Market*, *Energies* 2021, 14, 319. <https://doi.org/10.3390/en14113226>
- [25.] Central Statistical Office, *Energy efficiency in the years 2011–2021*, Warsaw, June 2023.
- [26.] Mucha-Kuś K., Sołtysik M., Zamasz K., Szczepańska-Woszczyna K., *Coopetitive nature of energy communities—The energy transition context*, *Energies* 2021, 14(4), 931–944.
- [27.] Smirnova E., Szczepańska-Woszczyna K., Yessetova S., Samusenkov V., Rogulin R., Supplying energy to vulnerable segments of the population: Macro-financial risks and public welfare, *Energies* 2021, 14(7), 1834–1852

Tomasz Surma, Ph. D, graduate of the Warsaw University of Technology and the AGH University of Science and Technology in Cracow. Currently, Director of Regulation and Public Relations at Veolia Energia Polska S.A. His scientific interests include market analyses of the impact of regulations on the activities of energy companies, monitoring the industry's impact on the environment and development of renewable energy sources. Author and co-author of many publications on the energy market, renewable energy sources, energy efficiency, energy policy and reliability of power systems.

Artur Leśniak, graduate of the AGH University of Science and Technology in Cracow and Jagiellonian University in Cracow. Currently, Lead Regulatory Specialist at Veolia Energia Polska S.A. His scientific interests include regulation of the heat and electricity sectors in Poland and the European Union, legal aspects of the functioning of energy companies and development of renewable energy sources. Co-author of publications on the energy market and high-efficiency cogeneration.

Katarzyna Szczepańska-Woszczyna, Ph.D., is an associate professor in the Management Department at WSB University, Dąbrowa Górnicza, Poland. She specialises in theoretical and practical issues related to management and strategic management. She is the author of numerous scientific papers on innovation management, entrepreneurship, managerial competencies, leadership, sustainable business, corporate culture, the organisational context of the influence of competencies on innovations as well as family business, published in peer-reviewed international journals. She is also a member of the scientific councils of several journals and conferences organised by a number of European universities. She was appointed as an Assessor in the Ministry of Science and Higher Education within the frame-work of the Science Operational Programme Human Resources Development as well as an expert of the Ministry of Regional Development. She holds a Ph.D. in

management from the University of Economics in Katowice, as well as a postdoctoral degree (habilitation) from the Cracow University of Economics. ORCID no. <https://orcid.org/0000-0003-0731-8049>

Krzysztof Zamasz is a Polish manager and economist, and an Associate Professor at WSB University in Dąbrowa Górnicza and the Silesian University of Technology. He is the author of a number of publications devoted to the management of energy companies and scientific expertise in the field of energy economics, the energy market, mergers and acquisitions, innovation and logistics process management. He is a recognised authority and expert who for many years had merged the theory of economy and management with practice as a member of the management boards of the biggest Polish and international energy groups. During the 25 years of his professional life, he pursued his career in the energy sector, where he implemented projects related to the transformation of the sector. He currently serves on the boards of companies in the energy sector and he is also the Director of the Institute of Energy Transformation at WSB University. ORCID no. <https://orcid.org/0000-0003-4090-8737>

The Role of Serendipity in the Innovation Management Cycle

MAGDALENA SZCZYRBA, DIÁNA PACSI

Abstract

This paper describes the importance of “lucky chance” in innovations and the marketing of inventions. It addresses the essence and role of models for managing innovation, using authentic examples of marketed products. The author presents an overview and analysis of factors that stimulate the processes leading to the emergence of innovations and circumstances that influence marketing success. When does an ‘invention’ become a ‘product’? How do we identify the thin red line separating the effects of strokes of genius from inventions that never gained market recognition? For years, scientists have asked themselves to what extent chance generates innovation. Chance is the simplest and the easiest source of innovation. It is, however, challenging to determine when chance transforms from being a mere ‘irritating disorganisation’ and turns into a business opportunity. In all likelihood, there is no unequivocal answer to any of the above questions; however, it does not mean that such answers should not be sought.

Key words

lucky chance; innovation; model; management; case; innovation management; serendipity.

DOI: 10.23762/FSO_VOL11_N04_7

Magdalena Szczyrba

e-mail: magdaszczyrba@interia.pl
ITG KOMAG, Gliwice, Poland
Silesian University of Technology,
Gliwice, Poland

Diána Pacsi

e-mail: paksi.diana.phd@gmail.com
Hungarian University of Agriculture and
Life Sciences, Gödöllő, Hungary

Introduction

When does an ‘invention’ become a ‘product’? How do we identify the thin red line separating the effects of strokes of genius from inventions that never gained market recognition? History has known numerous examples of brilliant technological solutions emerging by accident. For years scientists have asked themselves to what extent chance generates innovation. According to Peter Drucker, chance

is the simplest and the easiest source of innovation (Drucker, 1985). It is, however, challenging to determine when chance transforms from being a mere “irritating disorganisation” (Tidd and Bessant, 2013) into a business opportunity. Probably there is no unequivocal answer to any of the above questions; however, it does not mean that such answers should not be sought.

There are numerous models for the management of innovation. In Poland the so-called 'chance mode' is internationally referenced under the tag 'serendipity' ('lucky chance' or, in accordance with PONS dictionary, 'the faculty or phenomenon of finding valuable or agreeable things not sought for'). The serendipity model became famous in the 20th century when Nobel Prize winner Francis Crick considered chance to be "the only source of true novelty". The very concept of 'serendipity' explained as 'coincidence' has been frequently quoted in specialist publications. In the last decade of the 20th century alone, it occurred in almost 13,000 scientific works. The Google search engine allows us to find more than 3 million instances of the phrase "serendipity". However, as Campanario or Bandura have shown, research regarding this model is often unsystematic or even 'anecdotal' (De Rond, 2005). Why is the role of chance in scientific research so questionable and why does the assessment of values of inventions created by chance display so many extreme opinions?

The aim of this paper is to highlight how significant the impact of chance in the creation of innovations and technological solutions is, while recognising the complex context of business processes. Selected typologies of the 'serendipity' effect are illustrated by examples and sources of innovation. Particular attention is also given to practical aspects of the creation, utilisation, and significance of several selected scientific discoveries, as well as their evolution to commercial successes.

The authors claim that none of the established innovation management models meet modern demands. This does not result only from the fact that the "lucky spark" is undervalued in these models. Accidental innovations disputed in this paper still require the coexistence of many intertwined factors in order to evoke success in business ventures. Each factor can be described and

measured in terms acknowledged in the management of innovation. The authors aspire to develop a new model for the management of innovation, particularly for science and research institutions, which would encompass significant external and internal factors determining the success of innovative projects and ventures.

1. 'To see bridges where others see holes' (R.S. Burt, 2004) – chance as a sources of innovation

"I did not invent penicillin. Nature did that. I only discovered it by accident." This quote is attributed to Alexander Fleming, Scottish physician and bacteriologist, who is known as 'the father of antibiotics'. The 'discovery' of penicillin was indeed the result of Fleming's mistake, but also his perceptiveness. In September 1928, he was investigating the pathogenic bacteria *Staphylococcus*, but paused his work to go on vacation. Upon his return, he noticed that a sort of bluish and greenish mould had appeared on a Petri dish which had been left uncovered by accident. The area around the mould was free of bacteria. Fleming investigated why bacteria did not develop in the vicinity of the mould. It turned out that 'mould sauce' is characterised by bactericidal properties; this sauce is today known as penicillin (Letek, 2020). The bactericidal properties of penicillin helped to save many lives at the end of WWII, while to Fleming they brought the Nobel Prize in 1945 (Domoslawski, 2007).

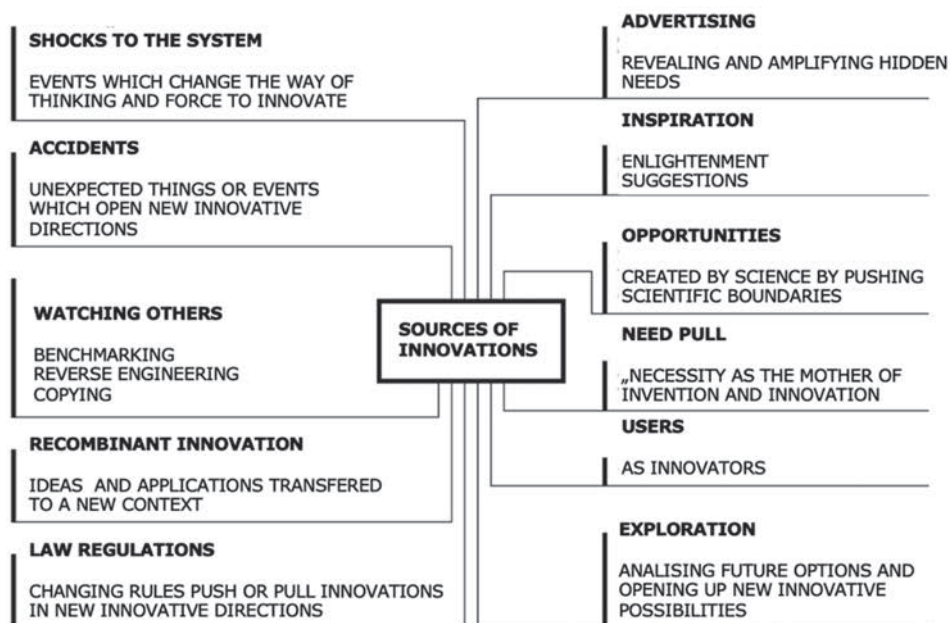
A melted chocolate bar in the pocket of Percy Spencer, a military expert specialising in radar devices, became the igniting spark for the discovery of technology applied in household microwaves. The self-taught engineer, who was researching magnetron use in radar technologies for military purposes, noticed one day that a chocolate bar hidden in his shirt pocket melted during consecutive experiments.

The observant scientist added two and two together and linked this effect to magnetron testing. The next day he conducted his usual experiments using some corn and one egg (which simply exploded under the impact of the microwave). The entire device was put into a metal enclosure for security reasons. Spencer received just two dollars for patent No. S2495429 from his employers. Microwave ovens revolutionised home cooking (H. Zhang, 2017) while for many years Mr. Spencer mostly enjoyed the respect of his colleagues employed at Raytheon, which became the

first manufacturer of microwave ovens in the USA.

In the eyes of the public, 'chance' innovations are less appreciated. Less scientific attention is paid to them, even though they often constitute a popular topic in the daily press. The author does not wish to evaluate the sources of innovative solutions, but rather point out the ones that seem to be less noticed or even fully depreciated by the public. An array of impulses (stimuli) for initialising the search for innovation (Figure 1) was set and described by Tidd and Bessant (2013).

Figure 1. Array of impulses for initialising innovation



Source: developed by the authors based on Tidd J., Bessant J., Zarządzanie innowacjami – integracja zmian technologicznych, rynkowych i organizacyjnych, Wolters Kluwer SA (2013)

In the early 21st century we have access to modern research laboratories financed by corporations, highly trained staff, equipment, and research facilities at our disposal. It is difficult to imagine more suitable conditions for the emergence of innovation. However, even when innovation seems to be

aimed at through a meticulously planned process, with great attention to detail, quite often inspiration comes from a very accidental breakthrough. Hence, is it justified to distinguish purely scientific approaches from the use of 'chance'? It does not seem reasonable to draw such divisions. Quite often,

discovery by chance simply constitutes an impulse for further research. If there is no place for further research, investigation, and modification of the invention, we cannot develop a product ready to conquer the market. On the other hand, the market itself often produces distinct impulses or inspirations to search for groundbreaking solutions. It has been said, and truly, that “necessity is the mother of invention”. Anybody who knows anything about the market (be it only a one-time acquaintance) recognises the fact that without customers, any invention is to be shelved once and for all.

Searching for responses to market needs is also a complex and ambiguous process. While it seems safe to focus on the main group of customers, it might not be sufficient to maintain a competitive position. The concept of disruptive innovation (Tidd and Bessant, 2013) related to the requirements of entrepreneurs not present in the market mainstream shows that sometimes innovation is able to re-evaluate the reality. The beginnings of Apple and the rapid development of personal computers testify to this. Initially a niche product, PCs became a dominant trend in the technological market for decades. The example of Xerox, discussed later in this paper, proves that sometimes an innovation abandoned by one company is developed and commercially used by its competitors.

The participation of leading and niche users is inextricably related to the development of innovations, as well as the evolution of innovations. Examples showing that end-users become the inspiration for innovation are quite well-known. Polaroid cameras, medical/laboratory apparatus or sporting goods exemplify this trend (Tidd and Bessant, 2013). A great deal of credit goes to so-called boundary or extreme users; their requirements (many times of a niche type) influenced the dissemination of some solutions which are nowadays popular or even obvious (e.g. a system that

prevents car wheels locking up during braking – ABS) (Tidd and Bessant, 2013). Among sources of innovation, authors also list the benchmarking method, which is popular today; comparison with other entities quite often brings about inspiration for corrections, changes, development, or generation of entirely new solutions. This trend may be used in many ways, of which one of the most popular is lean thinking, e.g. showing how to build values and maximise effects while waste and outlay are minimised. The source of this phrase may be traced back to Toyota. One of its directors, Mr. Taiichi Ohno, was a staunch opponent of waste (Japanese ‘muda’) (Womack and Jones, 1996).

The abovementioned examples show that inspiration for innovation may come from almost anywhere. It may be rational or not, it may be accidental, or it may result from a scientific process. It may be an original inspiration or an impulse from the market. Many innovations gain a second life due to changing life and technological environment. Sometimes, the development of some innovations is limited by legal regulations, while in some other cases, the rules effectively encourage the creation of innovations. All these spheres intertwine, and chance plays a remarkable role in the entire process.

Many researchers who analyse the factors determining the successful creation and commercialisation of innovations underline the role of management style aimed at harnessing an innovative entourage for experiments (Baruk, 2018). They also point out the necessity of changing managers’ state of mind and their awareness of the demands of the future, not of the past, as well as viewing clients as a source of knowledge and experience, not only as a source of income.

The reshaping of mentality and companies being open to innovation can lead them towards continuous development and systemic innovation-based competition with others (Baruk, 2017).

2. Definition and the role of a 'stroke of luck' in the inventory process

As far as the process of creating innovations is concerned, can we equate 'luck' with 'chance'? The definitions of both concepts are not very accurate. Innovation by chance may not always be the result of pure luck. 'Luck' assumes passivity, while any search conducted within the 'serendipity' model should be considered an outcome of activity, commitment, and receptiveness to non-obvious results of research or investigations (Dew, 2009). A remarkably important aspect of this concept is the attitude of the researcher and his open-mindedness ('mindfulness'). The receptiveness of the innovator impacts the ability (among others) not to reject unexpected results (Kamprath and Henike, 2019), but to accept their potential value in the process of searching and interpreting the origin of new solutions. Apart from this type of approach, many authors indicate other key aspects in inventive pursuit such as motivation and life experience. In terms of the acquisition of different types of information such as historical knowledge, wisdom or basic knowledge (Kamprath and Henike, 2019), if we analyse them jointly – and only then – we are able to determine the significance of discovery or to assign to it a value significant from the novelty point of view.

The proponents of the chance model of innovation dissociate themselves from the thought of equating chance and luck. Still, it is worth dedicating some attention to the concept of 'meritocracy', which is defined somewhat ambiguously. Generally, it builds upon an assumption that the social status of the innovator depends solely and exclusively on his/her own merits such as achievements, work, competence, talent, or professed values. As such, luck is completely overlooked as a step on the way to success. We may debate whence this extreme need for stressing

talent and hard work arises, while the significance of other factors contributing to the upward climb is totally excluded.

Robert Frank gives two reasons, one of which is strengthening the right to earn a significant amount of money or to attain a great deal of prestige, and the other is the conviction that if we believe that success is due to ourselves and our hard work and effort (it follows that we overrate our own abilities), we are more prone to striving for success. The attitudes which appreciate the importance of luck assume that even the greatest effort does not guarantee success; this might potentially tempt people to passively wait for events to turn (Frank, 2018).

Is there something wrong with being born into a prosperous family if one utilises favourable external conditions or mere coincidences, both in one's private life and for business decisions? Indeed, nobody likes it if the significance of his/her work is depreciated; this does not, however, mean that other circumstances allowing us to attain a set objective should be discriminated against. A broad outlook and complex approach to internal and external determinants allow us to maximise the potential effects and, what is most essential in the case of innovations, evade or minimise uncertainty in market-oriented decision making.

3. From chance to an innovation management model

The 'serendipity' model imposes several standards (patterns), to which we may assign those innovations that were crucial in the history of mankind. The author will attempt to allocate and describe selected examples of innovations developed with chance as a factor using, to some extent, the classification offered by Kamprath and Henike.

Chance discoveries are based on several observed patterns that arise, e.g. being "in the right place at the right time" and from the perception of something potentially

novel. We might ask whether chance constitutes discovery itself or it is a key factor in the process of arriving at a discovery. Quite often, we cannot determine a time–place hierarchy since these two are closely related to each other (e.g. by Galileo’s discovery of Jupiter’s moons). History shows us that frequently something more than just these two indicated aspects have a key impact on chance discoveries.

In accordance with Kamprath and Henike’s classification, innovation may also be created when two materials are joined together by chance (Viagra, X-rays, rubber vulcanisation), or when the right people cooperate with each other (vitamin C), or with unknown associations of data or as aftermaths of earlier inventions (spontaneous radioactivity) (Kamprath and Henike, 2019).

This classification presents a simplified solution to all 17 patterns of coincidences provided by van Anandel in one of his publications (Van Anandel, 1994). Another classification, which is somewhat limited to medicinal inventions from the author’s point of view, is presented by De Rond in ‘Structure of serendipity’. Its author distinguishes the concept of ‘pseudo-serendipity’, where invention is the goal, but the way to discovery is accidental and unexpected (PCR and DNA). Another example in the classification is ‘true serendipity’, where the goal changes during the inventing process (sildenafil substance). De Rond (2005) furthers the research by differentiating between chance, as an unplanned consequence of the research process, and purely random coincidences, as shown below in Figure 2.

Figure 2. Structure of serendipity

<i>Pseudo-serendipity</i> <i>A → A</i>	<i>PCR</i>	<i>DNA</i>
	<i>Sildenafil citrate</i>	<i>Penicillin</i>
<i>Intention</i>	<i>Causal</i>	<i>A-causal</i>
<i>Serendipity</i> <i>A → B</i>	<i>Relation</i>	

Source: based on De Rond M., Structure of serendipity, Judge Business School, University of Cambridge (2005), p. 20

The predominant approach in Polish scientific publications on innovation management is that hardly any role is assigned to chance. Researchers focus on several classifications and categorisations, and very effectively omit any reference to ‘lucky chance’, even though its role is arguably significant. Fortunately, scientists from (mainly) the United States, the United Kingdom or Germany endorse the role of chance among innovation sources and, moreover, for years they have been trying to systematise it and include it in a coherent model of innovation management.

While analysing classifications of models for managing innovations, the lack of an unequivocal definition of the concept of a ‘business model of innovation’ (Ćwiklicki, 2015) becomes apparent. For A. Afuah, the key feature of such a business model is to set up an organisational framework for value creation purposes (Afuah, 2014). In relation to innovation, Afuah differentiates four models of managing innovations (Table 1) based on two criteria summarised in the table below.

Table 1. The innovation management model classification

	<i>Low level of potential unsuitability</i>	<i>High level of potential unsuitability</i>
<i>High level of losing product competitiveness</i>	Position-building model – present potential is used and products are rendered non-competitive	Revolutionary model – new resources are needed and products are rendered non-competitive
<i>Low level of losing product competitiveness</i>	Regular model – using present potential for innovations, while products remain competitive	Resource-building model – new resources are needed, while products remain competitive

Source: based on Afuah A., *Business Model Innovation. Concepts, Analysis, and Cases*, Routledge, New York and London (2014)

In principle, models evolve all the time; therefore, an exchange of models within the organisation may take place. The key notion is that selection of the model depends on the external environment where a given organisation functions.

An interesting typology of innovation management models was proposed by Taran, Boer, and Lindgren. It is based on the following criteria: radicalism, range, and complexity of innovations. Here we also encounter four models: open/proactive, characterised by low complexity of innovations, but with a high degree of radicalism and range; the opposite closed/reactive model; closed/proactive, where all three criteria are at a high level; and open/reactive, where only

innovation range is at a high level (Taran, Boer, and Lindgren, 2015).

Many classifications presented in publications are based on a simple categorisation ‘open/closed innovation’; they differ mainly in the approach towards the use of intellectual resources and the level of control that the organisation has over them. The latest theories emphasise the complexity of innovative processes and the impact of internal/external interactions (Kozioł-Nadolna, 2017) not only on the emergence of innovation, but also on its development and market implementation. The openness principle relates in this context mainly to sharing knowledge and using the achievements of other people to maximise the obtained

effects. At this point it is worth mentioning the research input of the Polish scientist A.H. Jasiński, who compared innovation to theatre: the foremost actors are science and industry, the supporting roles are played by infrastructure and transfer of technology, while customers become the spectators (Jasiński, 2006). Similarly, E. von Hippel (mentioned earlier in this paper) based his research on consumers as a source of innovation and its model solution. His investigations have shown the predominant role of users throughout the innovation process.

The examples quoted above are not an exhaustive list, in the author's opinion, since their focus is on the very structure of the organisation or on delineated directions of progress. In most cases, the wider background of innovation is not considered while it should include, on the one hand, the technological and general context, and on the other hand, mechanisms of chance in the model of innovation management. In most cases, these mechanisms provide an impulse or a starting point for further research and development work.

4. Xerox versus Pfizer – chance utilised, and chance wasted

Randomness in scientific research has always been controversial. Initially, it was considered chaotic and a contributing factor to work disorganisation; however, over time, it gradually gained prominence due to observation. Searching for standards and building models for innovation management became indispensable because we cannot regard a brilliant byproduct of research targeted in totally different directions or with a totally dissimilar goal as a failure. Henry Chesbrough aptly summarised this process as a “managing false negative” (Chesbrough, 2016). An analysis of the differences between success and failure can be showcased by two examples. The story of the invention of Viagra is one on how

to transform failure into marketing success. The other is the story of the personal computer invented by Xerox and its market potential missed by the very same corporation.

Viagra was introduced onto the American market in 1998 and quickly became one of the bestselling drugs, simultaneously earning its place in popular culture. Sociologists even define ‘the turning point’, which was the airing of an episode of the popular series ‘Sex and the City’ (Akass and McCabe, 2004) in 1999. The script of this episode focused on the blessings offered by the ‘blue pill’ (Tiefer, 2006). The invention of Viagra occurred by chance, since the active component of the drug (sildenafil) was initially developed as a drug that counteracts arterial pulmonary hypertension and angina pectoris through relaxation of blood vessels causing an improved blood flow. A separate drug for hypertension, based on the same substance, was commercialised after all and sold as ‘Revatio’. Even though the results of clinical trials for other diseases were not as satisfactory as the manufacturer could have wished for, nonetheless someone managed to appreciate the market potential in one of the side effects of the use of sildenafil.

Patients participating in the tests began to report that within several dozen minutes after the oral administration of the drug, they experienced a long-lasting erection persisting for four to six hours (Conrad and Leiter, 2004). The potential of the drug was observed by the Pfizer experts, but some changes in legislative definitions were necessary to market the drug. In the 1990s the problem of erectile disorders was redefined from a psychogenic effect to a medical phenomenon, called ‘erectile dysfunction’ (M. Wiczorkowska, 2016), which made it possible to introduce a drug containing sildenafil under the trademark ‘Viagra’.

The promotional campaign was initially targeted at elderly men. Some statements uttered by well-known figures were used for the promotion of impotence cures – among

others, the then-US senator Robert Dole took part in some spots. Promising sales reports for this age segment inspired Pfizer to extend the advertising campaign. As a result Viagra became an exemplary solution that helps to improve the quality of one's sex life for the entire male population (P. Conrad, 2007). In a world where "there is a pill for everything", the accidental invention of sildenafil was a source of market success and became an important element of pop culture.

Xerox was previously famous for numerous remarkable innovations, although many of them were never used. An interesting point to note here is that in the world of technology, Xerox was renowned for its expertise in the protection of intellectual property. The inventor and first manufacturer of copiers is often portrayed as an ideal example of using synergy and organising work in groups (Op den Kamp and Hunter, 2019). In the market of document copying, Xerox was extremely successful, and it is no coincidence that today we speak colloquially of a 'xerox' when having in mind an exact replica of a document page, as the term is derived directly from the company's name. Yet, the fates of innovations that emerged incidentally while the main business line of Xerox was developed and strengthened were completely different.

To find new fields for market expansion, a different company called Palo Alto Research Center (PARC) was established in 1969 by Xerox, based on the company Scientific Data Systems (SDS) which had earlier been taken over. The management of the corporation, realising that the profits from foundational Xerox activity were falling, indicated a new direction for the company's development: 'Architecture of Information' (Chesbrough and Rosenbloom, 2002).

In the 1970s there were no 'personal computers'. In fact, the very concept of a 'computer' evoked associations with gigantic machines which barely fit into university laboratories. PARC workers accepted the challenge of creating a complete office computing system

that could be handled by a single person and would occupy standard office premises. The idea drafted by the engineering team included an 875-line monitor, a keyboard with a 'pointing device', 'mass storage' of 2.5 megabytes, communication interface (ethernet), micro-processor and 16 (ultimately 256) kilobytes of operational memory (Thacker and McCreight, 1979). The hardware was supervised by the 'Star' environment, which automated office work. This 1981 environment used ideas which are common today: bitmap graphics, icons, windows, and interface controlled by a "mouse" (J. Johnson, T. Roberts, 1989). There was a real chance of these sets revolutionising office work. However, the market reception of the product was a failure. Fewer than 25,000 customers bought 'personal office systems', despite the fact that subsequent iterations of the product were supplemented by the first models of laser printers. The market fiasco was determined by the lack of coherent market strategy and internal rivalry within Xerox between representatives of the main business line, responsible for production and improvements of copying machines, and the team working on computer systems.

The PARC team, in fact, had invented the very first personal computer. In addition, they developed the ecosystem that connected the equipment with dedicated software, laying down foundations for the operating system applying the WYSIWIG philosophy ("what you see is what you get") (Smith and Alexander, 1988).

The ideas derived from the Star environment became hugely successful a few years later in the interfaces of operating systems ("OS") such as Windows or Mac OS. However, Xerox did not gain anything from these innovations: no one noticed them at the time and they were overlooked. They were, however, used at another time and in other business environments. The case of 'personal office systems' was neither the first nor the last commercial disaster for Xerox. Out of 35 abandoned (not implemented)

products, 11 began their new life elsewhere (Tidd and Bessant, 2013).

The case of ‘omitted innovations’ occurring in PARC shows that proper research and development (R&D) infrastructure and fantastic scientific ideas are not sufficient to turn them into a success story. To commercialise the inventions effectively, corporations need transparent processes, tools, and resources. but most of all, an accurate vision of how to utilise the original research.

Conclusions

“Fortune favours a prepared mind” – this simple travesty of the Roman saying “audaces fortuna iuvat” may be used successfully as a motto by all inventors. Keeping an open mind, being acquainted with innovation management models, and being able to adjust them to results of corporate work determine success in the commercialisation of inventions. The story of the ‘sole inventor’, who astonishes experts with his/her invention, is for the most part mythical (Lemley, 2012). Most significant inventions were created (and successfully commercialised) because of a planned process executed by an appropriately configured workgroup. A ‘lucky break’ can change the course of history and define new market roles for products. Still, apart from a ‘lucky break’, it is just as important to correctly plan how to transform innovations into products and to inscribe this process in an appropriate model.

The examples provided in this paper show how following routines shortsightedly and failing to notice changes and new market trends can damage business. These very same examples illustrate how courage and determination to absorb new trends and ideas can boost businesses.

Many more examples can be cited including, among others, the infamous Nokia case. Once the former leader of the mobile telecom devices market discarded the idea of a mobile phone with a touch screen instead

of a keyboard, it took only a few months for Apple to take over the market with their flagship product. The iPhone took the market by storm and Nokia sank into bankruptcy. Failure to meet market demands and ignoring the “spark of luck” lead to the downfall of a market giant.

Innovation by chance is not a rare occurrence in science. In order to assess the market potential for commercialising innovation discovered by chance, it is crucial to properly analyse a variety of factors determining successful ventures. These include, apart from market demands and lucky chance, the regulatory environment, technological development path, and last but not least the charisma of the manager who decides to commercialise innovation for the benefit of the organisation.

The “spark of luck” should be included in innovation management models. Models described in scientific sources acknowledge serendipity as a factor but fail to fully notice its importance. Therefore, the authors of this dissertation claim that it is crucial to analyse it more thoroughly. Serendipity, or the spark of luck, merits inclusion in a management model that properly describes and measures the “spark of luck” factor, among others, determining the market success of innovation.

References

- Afuah A. (2014) *Business Model innovation. Concepts, Analysis, and Cases*, Routledge: New York and London.
- Assass, K. and McCabe, J. (2004) *The man, the myth, the Viagra’ Reading Sex and the City*. London: I.B.Tauris.
- Burt R.S. (2004) Structural holes and good ideas. *American Journal of Sociology*.
- Baruk J. (2018) Wiedza i innowacje jako czynniki rozwoju organizacji – podejście zintegrowane, *Marketing instytucji naukowo badawczych* nr 3(29), s. 84-108.

- Baruk J. (2017) Strategiczne aspekty zarządzania innowacjami, *Marketing instytucji naukowo badawczych* nr 4(26), s. 56-79.
- Chesbrough H. (2002) Rosenbloom R., The Role of Business Model in Capturing Value from Innovation; Evidence from Xerox Corporation's Technology Spinoff Companies, *Industrial and Corporate Change*, no. 11 (3), p. 13.
- Chesbrough H., *Managing your false negative*, Harvard Managing Updates, no 8.
- Conrad P., Leiter V. (2004) Medicalization, Markets and Consumers, *Journal of Health and Social Behavior*, Vol. 45 (Extra Issue), p. 158-176.
- Conrad P. (2007) *The Medicalization of Society. On the Transformation of Human Conditions into Treatable Disorders*, The Johns Hopkins University Press, Baltimore, Maryland. p. 44.
- Ćwiklicki M. (2015) Klasyfikacja modeli zarządzania innowacjami, *Management Forum*, no. 4, p. 28.
- Dew N. (2009) Serendipity in entrepreneurship, *Organization studies*, 30(7), p. 735-753.
- De Rond M. (2005) Structure of serendipity, *Judge Business School*, University of Cambridge, p. 3-6, 19-20.
- Domosławski Z. (2007) *Wprowadzenie do Medycyny*, wydawnictwo Kolegium Karkonoskiego, Jelenia Góra, p. 54.
- Drucker P.F. (1985) *Innovation and entrepreneurship*, Harpers & Row.
- Frank R. H. (2018) *Sukces i szczęście. Dobry los a mity merytokracji*, PWN, Warszawa.
- Jasiński A.H. (2006) *Innowacje i transfer techniki w procesie transformacji*, Difin, Warszawa.
- Johnson J., Roberts T., Verplank W., Smith D. (1989) The Xerox Star: A Retrospective, *Computer* no 22(9), p. 11.
- Kamprath M., Henike T. (2019) *Serendipity and innovation, The Routledge companion to innovation management*, Routledge.
- Kozioł-Nadolna K. (2017) Modele zarządzania innowacjami w XXI wieku, *Innowacyjność organizacji – istota i pomiar*, p. 297-298.
- Lemley M. (2012) *The Myth of Sole Inventor*, Michigan Law Review, nr. 709
- Letek M. (2020) Alexander Fleming – The Discoverer of the Antibiotic Effect of Penicillin, *Frontiers for Young Minds*, vol. 7, p. 2.
- Op den Kamp C., Hunter D. (2019) *A History of Intellectual Property of 50 Objects*, Cambridge University Press, Cambridge.
- Smith D., Alexander R. (1988) *Fumbling the Future; How Xerox Invented Then Ignored the First Personal Computer*, William Morrow and Company Inc, Nowy York, p. 14.
- Taran Y., Boer H., Lindgren P. (2015) A business model innovation typology, *Decision Sciences*, vol. 46, no. 2, p. 301-331.
- Tidd J., Bessant J. (2013) *Zarządzanie innowacjami – integracja zmian technologicznych, rynkowych i organizacyjnych*, Wolters Kluwer SA, p. 314-346.
- Tiefer L. (2006) The Viagra Phenomenon, *Sexualities* no. 9 (3), p. 288.
- Thacker C., McCreight E., Lampson B., Sproul R., Boggs D., Alto (1979) *A Personal Computer*, Xerox Corporation, p.1.
- Van Andel P. (1994) Anatomy of the unsought finding. Serendipity: origin, history, domains, traditions, appearances, patterns and programmability. *The British Journal for the Philosophy of Science*, p. 631-648.
- Wieczorkowska M. (2016) *Medykalizacja męskiego ciała*, Acta Universitatis Lodziensis Folia Sociologica, p. 78.
- Womack J., Jones D. (1996) *Lean Thinking*, Simon and Schuster, p. 19-20.
- Zhang H. (2017) *The History of Microwave Heating, Microwave Heating of Foods*.

Magdalena Szczyrba, MA. In 2009 graduated from the Silesian University Faculty of Political Science with MA in European Studies. She currently serves as Communication Advisor to KOMAG Institute of Mining Technology, having gained professional experience as Marketing Manager in Lukasiewicz Research Network - Institute of Electrical Drives and

Machines KOMEL and Communication and Marketing Director in Lukasiewicz Research Network Upper Silesian Institute of Technology. She has vast expertise in communication and innovation management, presented during many panels and conferences on innovation and applied research. As a PhD candidate at the Silesian University of Technology in Gliwice, Poland, Ms. Szczyrba authored many publications on innovation management. ORCID no. <https://orcid.org/0009-0000-2078-2941>.

Diána Pacsi, MA. She is a PhD student of Hungarian University of Agriculture and Life Sciences. She researches the role of the personality and gamification in the tourism marketing. She works as a marketing manager in her own company, has wide knowledge in the online marketing, especially in the Social Media Marketing. Her scientific interest include digital marketing, tourism marketing, marketing psychology and gamification. ORCID no. <https://orcid.org/0009-0009-9364-0915>.

The Impact of the COVID-19 Pandemic on the Evolution of Investment Markets in Central and Eastern Europe

ALEKSY KWILINSKI, RAFAL REBILAS, DMYTRO LAZARENKO,
NADIIA STEZHKO, HENRYK DZWIGOL

Abstract

The COVID-19 pandemic profoundly affected the economies of Central and Eastern Europe, particularly investment activities. Said impact varied, with some countries maintaining or boosting their investment attractiveness, while others suffered drastically. Understanding these dynamics is vital due to the key role of investment in economic growth, job creation, and competitiveness. The literature review highlights gaps in understanding the pandemic's impact on investment in Central and Eastern Europe. These gaps include limited analysis of sector-specific investment market transformations, the inadequate assessment of the pandemic's influence on investment behaviours, and insufficient research on effective measures to enhance investment activity. This study aims to evaluate the effect of the COVID-19 pandemic on investment attractiveness and enterprise activities in Central and Eastern European countries. Utilising methods such as dialectical scientific cognition, system and statistical analysis, and regression analysis (examining the relationship between FDI and GDP), the research uncovers imbalances in investment activity due to the pandemic. It identifies a direct correlation between GDP and investment volumes and examines sectoral disproportions and national/regional investment peculiarities. The study delves into the pandemic-induced shift in investor orientation and caution, as well as the effects of subsequent COVID-19 waves and macroeconomic policies on investment and economic growth. It addresses how the pandemic exacerbated income inequality and social tensions, influencing investment stability and decisions. In conclusion, the pandemic prompted cautious investment behaviour and a partial investor reorientation. Future research should investigate the detailed impact of the pandemic on the investment attractiveness of specific Central and Eastern European

DOI: 10.23762/FSO_VOL11_N04_8

Aleksy Kwilinski¹

e-mail: a.kwilinski@london-asb.co.uk
The London Academy of Science and
Business, London, United Kingdom
WSB University, Dabrowa Gornicza,
Poland

Rafal Rebilas

e-mail: rrebilas@wsb.edu.pl
WSB University, Dabrowa Gornicza,
Poland

Dmytro Lazarenko

e-mail: lazd77@gmail.com
National University of Life and
Environmental Sciences of Ukraine, Kyiv,
Ukraine

Nadiia Stezhko

e-mail: nadijastezhko@gmail.com
Kyiv National Economic University
named after Vadym Hetman, Kyiv,
Ukraine

Henryk Dzwigol

e-mail: henryk.dzwigol@poczta.fm
The London Academy of Science and
Business, London, United Kingdom
Silesian University of Technology,
Gliwice, Poland
WSB University, Dabrowa Gornicza,
Poland

¹Corresponding author

countries, providing a deeper understanding of how the pandemic affected investment market transformations and investor decisions.

Key words

investment, COVID-19, financial imbalances, Central and Eastern Europe.

Introduction

In the aftermath of the COVID-19 pandemic, the Central and Eastern European (CEE) investment landscape is at a critical turning point. The extensive impact of the pandemic has significantly altered the region's previously stable investment markets, causing disruptions and, in certain instances, hastening changes. This paper explores how the pandemic has necessitated a reassessment of risk perceptions and priorities across various industries and regions amidst economic volatility and changing investor sentiment. The focus is on identifying emerging trends that could potentially redefine the CEE investment landscape in the post-pandemic era, underscoring both the opportunities and challenges.

The research seeks to dissect the complexities of these transformations, recognising the resilience and adaptability of the CEE region in confronting adverse conditions. It aims to provide a detailed perspective on the changing narrative of the post-pandemic investment market, highlighting significant aspects such as the acceleration of digitalization, a greater emphasis on sustainability, and the re-evaluation of risk management practices. The objective is to present a comprehensive overview of the forces reshaping the investment landscape during these transformative times.

The COVID-19 pandemic, one of the most impactful crises in recent history, has had widespread effects on numerous facets of life, including the economy. The CEE countries, with their relatively young and

rapidly evolving economies, have not been spared. This strategically significant region, due to its geopolitical and geographical position, has encountered formidable challenges during the pandemic. These challenges include a decrease in investment volumes, shifts in investment structures, and a redirection of investor focus to other countries and sectors, accompanied by a decline in GDP, increased unemployment, and diminished investment activity.

Quarantine measures have had a severe impact on the economies of the CEE region, resulting in reduced production and sales, limitations on services, and heightened unemployment, all of which have significantly influenced investment activities. Nonetheless, certain enterprises have adapted to these conditions, benefitting from the augmented demand for pandemic-related goods and services.

According to the European Commission, there was a 22% decrease in foreign direct investment in the CEE in 2020 compared to 2019, the largest reduction in over a decade (European Commission, 2023). Furthermore, the global stock market crash on 12 March 2020 precipitated a recession in the region. Christine Lagarde (2008), the President of the European Central Bank, indicated that without prompt actions in response to the pandemic, Europe might experience an economic shock akin to the 2008 crisis.

Therefore, an investigation into the investment processes in CEE during this crisis

is imperative, considering the critical importance of investment in economic growth. A decline in investment could lead to the further deterioration of the economic conditions in the region.

This article provides an in-depth analysis of the dynamic shifts in the CEE investment market, elucidating the comprehensive impact of the COVID-19 pandemic. It seeks to detail the initial market shocks and the subsequent adjustments in investment strategies, illuminating the transformative path of the investment landscape.

The structure of the paper includes an introduction that sets the context and outlines the research objectives, followed by an extensive literature review. The methodology section describes the research approach and data analysis techniques utilised. Subsequently, the research findings are presented, with the discussion section interpreting these findings within the framework of existing knowledge. The paper culminates with a summary of the findings, their implications, and proposals for future research directions.

1. Literature review

For the literature review, the Scopus database, along with its integrated analytical capabilities, and VOSviewer software were employed. These tools provided a robust framework for conducting a comprehensive and detailed analysis of the literature.

The selection of Scopus for the literature review in this research was influenced by the comparative evaluations by Mongeon and Paul-Hus (2016), Prancute (2021), and Singh et al. (2021). These evaluations highlight the comprehensive journal scope of Scopus and its proficiency in the analysis of bibliographic data. When contrasted with Web of Science (WoS), Scopus exhibits a broader spectrum of journals, especially in fields such as social sciences and humanities. This extensive scope makes Scopus highly

suitable for in-depth and diverse literature reviews.

Scopus comes equipped with a suite of sophisticated analytical tools that are pivotal for detailed bibliometric analysis. These tools are crucial for monitoring citation patterns over periods, analysing trends in publications, and evaluating the impact of particular articles, journals, or authors. Scopus also allows for the generation of intricate reports that illuminate aspects of research performance, collaborative trends, and emerging academic areas. An important aspect of Scopus is its ability to create graphical representations such as citation maps, which are essential to a deeper understanding of the linkages between different research areas and the progression of scholarly disciplines.

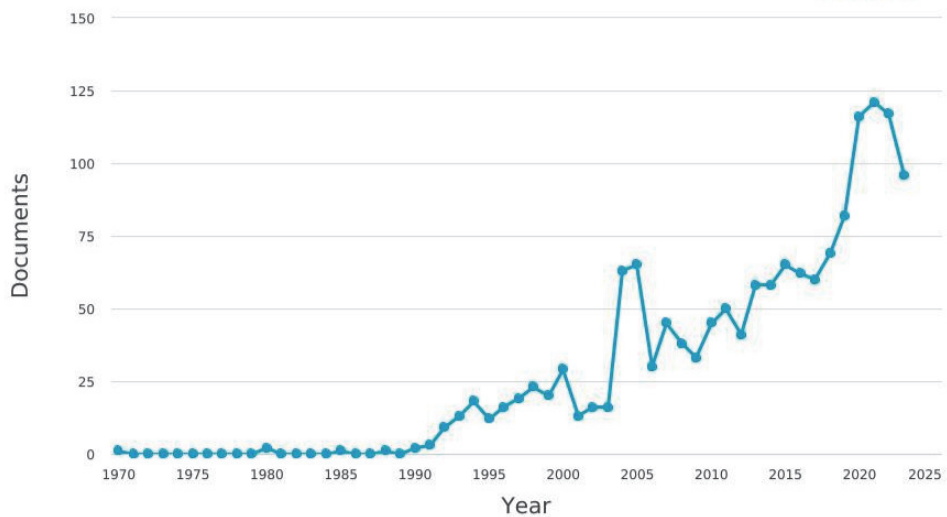
In conjunction with Scopus, VOSviewer stands out as specialised software for creating and analysing bibliometric maps. Its primary advantage is its capacity for the graphical depiction of bibliometric data, which is immensely beneficial for visualising complex relationships in large data sets. VOSviewer excels in generating maps from various data forms, including co-citation, bibliographic coupling, and co-authorship networks. The software is user-friendly for interpreting sizable bibliometric maps and offers multiple perspectives such as density and cluster density views to aid in comprehension. VOSviewer utilises sophisticated mapping techniques, including the VOS mapping method, and features such as zoom, scroll, and search functions, enhancing the analysis and exploration of intricate bibliometric maps (van Eck and Waltman, 2010).

To refine the literature search, specific constraints were applied. The search parameters were set to include only the “article title, abstract, keywords” in the “search within” query. The “search documents” query was formulated using the keywords “investment AND Central AND Eastern AND Europe”. Furthermore, a timeframe from

1970 to 2024 was specified, with the focus solely on articles published in English and appearing in scholarly journals. These criteria yielded a total of 862 documents. The trend in the publication of these documents over time is depicted in Figure 1. Upon

analysing the publication trends based on the specified parameters, the decision was made to narrow the timeframe to a 20-year period, from 2003 to 2023. This adjustment was implemented to enhance the empirical reliability and validity of the research study.

Figure 1. Documents by year



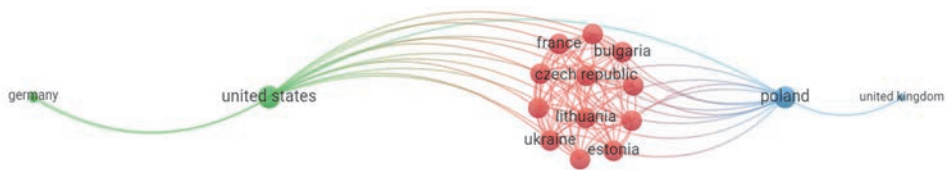
Source: own elaboration using Scopus data and tools [Scopus, 2023]

Following the refinement of the search time interval, the total number of relevant papers was narrowed down to 722. These articles were then downloaded and imported into VOSviewer for further in-depth analysis.

Subsequently, an analysis was conducted to segregate and cluster researchers based on their article publication volume (as depicted in Figure 2). The Republic of

Poland and the United Kingdom emerged as frontrunners in the volume of research studies. In the second tier, the United States and Germany were notable for their contributions. Hungary, Romania, Italy, France, Austria, Bulgaria, the Czech Republic, the Netherlands, China, Spain, Lithuania, Ukraine, and Estonia shared the third tier in terms of the number of studies conducted on this topic.

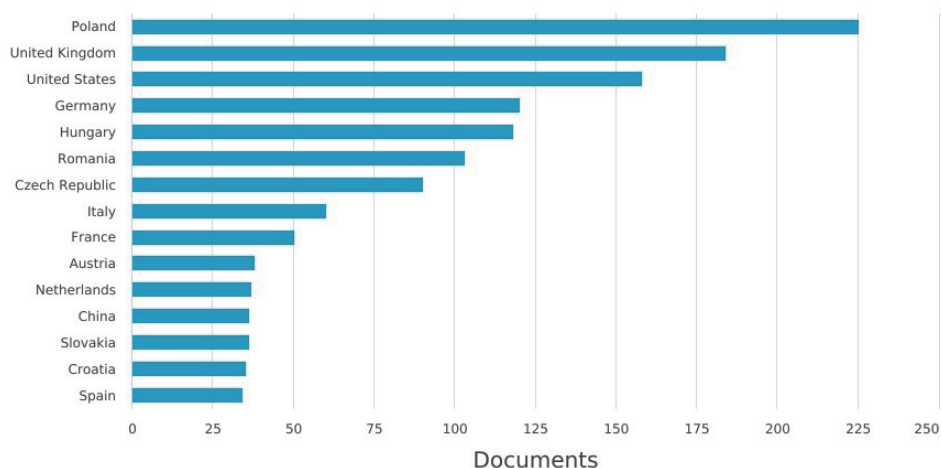
Figure 2. Countries



Source: own elaboration using Scopus (2023) data and VOSviewer tool [van Eck and Waltman, 2010]

Figure 3 shows the number of studies by country.

Figure 3. Documents by country or territory

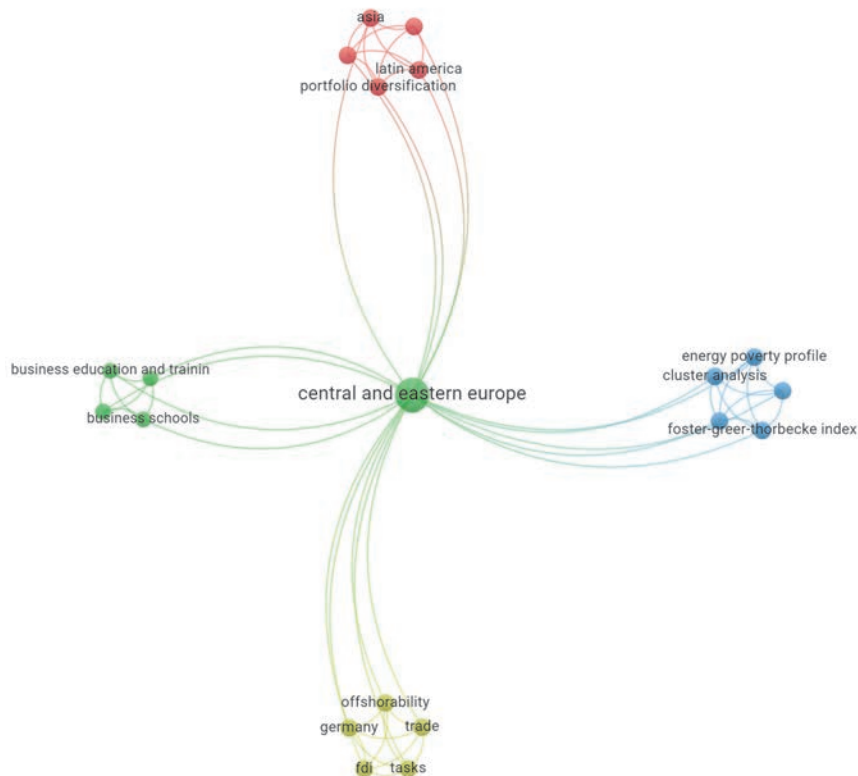


Source: own elaboration using Scopus data and tools (Scopus, 2023)

Figure 4 illustrates the results of clustering key words and research directions based on the number of studies conducted. Adhering to the criteria of the sampling, all article themes are linked to the search focused on Central and Eastern Europe. The clustering results have led to the formation of four distinct clusters, representing various interconnected themes related to “Central and Eastern Europe”:

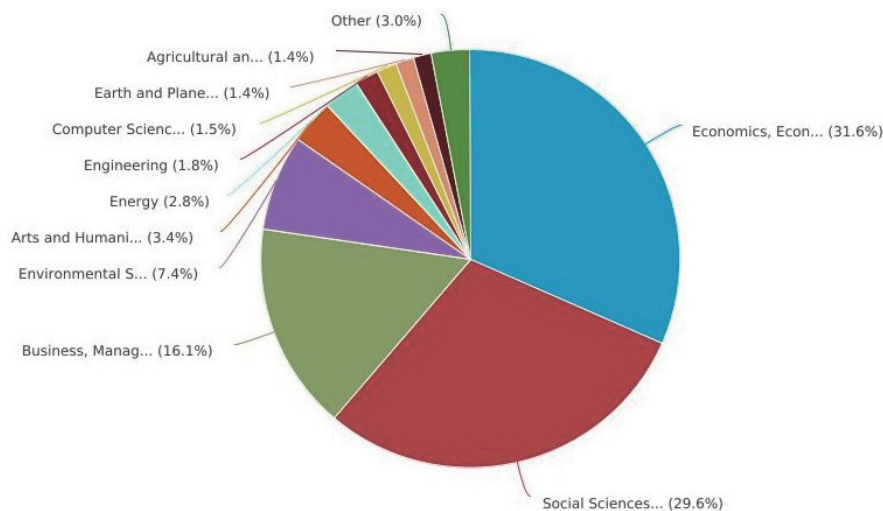
1. The first cluster encompasses topics related to business schools, business education, and training.
2. The second cluster includes subjects such as Latin America, the Middle East, North Africa, Asia, and the portfolio mix.
3. The third cluster focuses on trade, tasks, offshorability, foreign direct investment (FDI), and Germany.
4. The fourth cluster pertains to housing, costs, energy poverty, partitioning around medoids, and the Foster-Greer-Thorbecke Index.

Figure 4. Topics



Source: own elaboration using Scopus (2023) data and the VOSviewer tool (van Eck and Waltman, 2010)

Figure 5. Documents by subject area



Source: own elaboration using Scopus data and tools (Scopus, 2023)

Figure 5 shows the correlation of studies according to subject areas.

The next stage in the research process entailed a detailed examination of the studies that were of the greatest relevance to the central theme of this investigation. This involved systematically evaluating the content, methodologies, and findings of these selected studies to extract insights directly applicable to the scope and objectives of the current research.

Research by Vilchynska et al. (2023) offered a detailed microeconomic analysis of the impact of the COVID-19 pandemic, with a specific focus on household expenditures in Central and Eastern Europe. This study underscored the considerable reduction in household income and the shift towards savings rather than investments, leading to significant changes in expenditure patterns across diverse sectors. The stability of education costs during this economic shift emerged as a key finding, suggesting the resilience of the education sector during crises.

Gajewski and Kutan's (2023) study employed a dynamic econometric model to dissect the varied effects of the pandemic on Polish enterprises, distinguishing these impacts by both region and industry. This research provides critical insights into the asymmetric impacts of government support, shedding light on the disparities in economic recovery efforts and offering valuable policy implications.

In their 2023 study, Hegerty and Weresa investigated the factors driving innovation in the medical sector during the pandemic. Their research emphasised the influence of macroeconomic variables and R&D investments on medical innovation across EU nations, particularly focusing on Central Europe. The study notably revealed how fluctuations in the real exchange rate affect patent applications in Central and Eastern Europe, thus providing a nuanced perspective on the region's innovation landscape.

Purcărea et al. (2022) explored the changes in sustainable consumer behaviour in Romania, highlighting the pandemic's role in expediting digital adoption and green business practices. This study offers significant insights into the adaptability of the Romanian retail sector to these changes, reflecting the evolving dynamics of consumer-retailer interactions in the post-pandemic environment.

A paper by Bălăcescu et al. (2021) addressed the increased adaptability to teleworking across Europe, a trend greatly accelerated by the pandemic. The study categorised European countries based on their digital readiness and teleworking adaptability, identifying disparities and potential strategies to harness the benefits of the digital environment.

Cao et al. (2021) examined the repercussions of COVID-19 on Sino-Bulgarian economic relations within the context of China's "Belt and Road" Initiative and the "17+1" mechanism. This study offers a distinctive view on how the pandemic has reshaped bilateral economic relations and trade dynamics, underlining the changing landscape of international economic collaboration.

Lewkowicz (2020) provided an insightful analysis of the Three Seas Initiative, focusing on regional cooperation in Central Europe amid the pandemic. The paper assesses the initiative's investment fund and projects, presenting both the opportunities and challenges within the region's economic framework.

Gorynia et al. (2022) presented a comparative analysis of the investment development paths (IDP) of Central and Eastern European countries, emphasising the impact of EU membership on foreign direct investment. This paper illuminates the ways in which economic integration affects both inward and outward FDI, contributing to the broader discourse on EU integration and investment trends.

A 2019 study by Gorynia et al. explored the influence of institutional reforms on the investment development path in CEE economies. Integrating insights from institutional theory into the IDP framework, this research offers a comprehensive analysis of how institutional changes shape both inward and outward FDI, highlighting the complexities of post-transition economic development in the region.

Moreover, the investigation into the impact of the COVID-19 pandemic on investment market evolution in Central and Eastern Europe is enriched by an array of scholarly contributions from esteemed economists and researchers. Vernon L. Smith's seminal work (1982) laid the groundwork by elucidating the interplay between international investment and the life cycle of global goods production. John H. Dunning (1958) notably advanced this field by harmonising the growth trajectories of direct investment across countries at various levels of industrialisation.

Contemporary research has significantly broadened these perspectives. D. Li and J. M. Cruz (2022) delved into the factors contributing to a safe investment environment, with a particular focus on sustainability and consumer payment preferences. Yaroshenko et al.'s (2023) study examined the social protections for cross-border and seasonal workers in Europe during the COVID-19 pandemic and other international crises. In the same vein, Herrera-Echeverri et al. (2022) highlighted the competitive struggles of export-oriented companies in global markets, especially in relation to attracting foreign direct investment.

Kentor et al. (2023) undertook an in-depth analysis of the wide-reaching effects of global economic integration on international investment, including military investment. Klayme et al. (2023) explored the mechanisms through which countries have tightened control over corporate investments during the pandemic. Curtale

et al. (2023) investigated the pandemic's influence on European tourism demand, while Geels et al. (2022) offered practical strategies to improve investment risk management amid pandemic-induced challenges. Additionally, Caetano et al. (2023) scrutinised the environmental impacts of private investments in energy infrastructure.

In a post-COVID context, K. Forbes et al. (2023) shed light on the transformations in financial investment activities and enterprise resilience to pandemic-related disruptions. J. Paul and M. Feliciano-Cestero's 2021 research centred on foreign direct investment within multinational and transnational corporations. J. Scott Davis and A. Zlate (2023) probed the global financial cycle and capital movements in European nations during the pandemic. T. Walmsley et al. (2023) offered a macroeconomic perspective on the effects of the COVID-19 pandemic in diverse regions worldwide.

Additionally, a substantial number of the papers present a thorough exploration of diverse aspects impacted by the COVID-19 pandemic. These studies encompass a wide range of topics, including sustainable development and green investments, the acceleration of digital transformation, shifts in the global economy, regional development, advancements in agriculture, and the overall stability of economic systems within Central and Eastern Europe. This breadth of research illustrates the multifaceted effects of the pandemic across various sectors and geographical regions.

Thus, for example, Chen et al. (2021, 2023) and Dzwigol et al. (2023) collectively analysed the green competitiveness of businesses and the role of environmental regulation in renewable energy and innovation. These studies highlight the shift towards sustainable practices in businesses and investments, accentuated by the pandemic. Arefieva et al. (2021) contributed to this theme by discussing sustainable development management, which ties into the broader narrative of how

companies have adapted their sustainability strategies during the pandemic. Spicka (2018) and Spicka et al. (2019) focused on green investments, specifically in the agricultural sector, providing insights into the pandemic's impact on agricultural sustainability and biogas investments.

Dzwigol (2019, 2021a, 2021b, 2022a, 2022b, 2023) offers an extensive body of work on new management trends and sustainable development, which is instrumental in understanding how management practices have evolved in response to the economic challenges posed by the pandemic. Karnowski et al. (2021) and Karnowski and Rzońca (2023) provided analyses centred around the financial sector's response to climate challenges and economic stability in Poland, respectively, underlining the financial and economic repercussions of the pandemic.

Kwilinski (2019, 2023) and Kwilinski et al. (2019, 2023a, 2023b) explored the integration of blockchain technology in accounting and the evolution of e-commerce, reflecting on how digital transformation has been accelerated by the pandemic. Miśkiewicz (2019) and Miśkiewicz et al. (2022) delved into the impacts of Industry 4.0 and cryptocurrency trading, offering insights into how these technological trends have influenced economic stability and investment strategies during the pandemic.

Kwilinski et al. (2022) and Hussain et al. (2021) together examined the broader economic and social impacts of the pandemic. They explore international migration drivers and the effects of globalisation on the ecological footprint, providing a comprehensive view of how global crises such as COVID-19 have reshaped economic and social landscapes.

Letunovska et al. (2022, 2023) contributed to understanding the interplay between public health and regional economic development during the pandemic, offering a critical analysis of how health issues have influenced regional economic strategies.

Stępień et al. (2023) focused on the sustainability and technological advancements in small farms, particularly in Poland, Romania, and Lithuania, highlighting how the agricultural sector has adapted to the challenges and opportunities presented by the pandemic.

Kharazishvili and Kwilinski (2022) introduced a novel approach using artificial intelligence to determine national security indicators which are relevant to an assessment of economic security during the uncertain times brought about by the pandemic.

Szczepańska-Woszczyzna et al. (2022a, 2022b) assessed the economic convergence among EU countries and key competencies in R&D project management, providing valuable insights into how the pandemic has influenced economic integration and innovation management within the high-tech sector. Collectively, these sources contribute to a comprehensive understanding of the multifaceted impacts of the COVID-19 pandemic on investment markets in Central and Eastern Europe, encompassing shifts in various sectors and regions, and highlighting both challenges and emergent opportunities in the global economic landscape.

Simultaneously, the examination of these scholarly sources reveals that several aspects concerning the transformative effects of the COVID-19 pandemic on the investment processes in Central and Eastern European (CEE) countries are yet to be fully addressed. These identified gaps in existing research have guided the selection of the study's topic, objectives, and scope. Consequently, the primary aim of this article is to conduct a comprehensive analysis of the COVID-19 pandemic's influence on the investment appeal of CEE countries and the operational dynamics of enterprises within this region. This study endeavours to fill the existing research void by shedding light on how the pandemic has reshaped investment landscapes and business activities in these countries.

2. Methodology

The research methodology employed in this study is grounded in the principles of modern economic theory and incorporates insights from the scientific works of eminent domestic and foreign scholars specialising in the field of investment during the COVID-19 pandemic. Throughout the research process, the dialectical method of scientific cognition was utilised, accompanied by a comprehensive array of general scientific methods and approaches. These included:

1. System analysis and theoretical generalisation: Applied to the examination of the theoretical foundations of investment and the transformation of the economy in Central and Eastern European (CEE) countries. This approach facilitated the development of a conceptual and categorical framework to understand the essence of investment attractiveness in these countries.
2. Logical generalisation: Ensured the coherence and consistency of the objectives set within the research.
3. Statistical analysis methods: These methods were pivotal in examining the empirical data characteristic of countries' investment attractiveness and in identifying the relationships between various factors influencing this attractiveness.

A key methodological tool used in this study was correlation analysis, often used in economic analysis to investigate interdependencies within a general population comprising random variables with a normal distribution. The prerequisites for conducting this analysis included a sufficient number of observations, a well-defined set of factor and result indicators, and their quantitative measurement and documentation

in information sources. The primary objectives of the correlation analysis were:

- Determining the nature of relationships;
- Measuring the strength or density of these relationships;
- Identifying the influence of various factors on the resultant attribute.

To execute the correlation analysis, the following sequential stages were undertaken:

1. Establishing cause-and-effect relationships: This initial stage involved identifying factors and selecting those that most significantly impact the resultant indicator.
2. Formation of the correlation and regression model: This stage entailed evaluating the collected information, choosing the type and form of relationship, and compiling the model. Additional statistical criteria, such as mean square deviation and the coefficient of variation, were utilised.
3. Determination of correlation characteristics: At this stage, link indicators were determined.
4. Statistical evaluation of relationship parameters: This involved the economic interpretation and evaluation of the significance of correlation coefficients, assessing how selected factors explain the variation of the resultant indicator and their applicability in addressing practical issues.

In the first stage of analysis, the relationships between the resultant and factor attributes were determined, considering the nature of dependence, direction of action, and analytical expression. The second stage involved the assessment of initial data for the study, forming a model of stochastic relationships.

The correlation coefficient was calculated using the following formula:

$$\rho = M((x-a)/\sigma_x * (y-b)/\sigma_y), (1)$$

where $a = Mx$; $b = My$ are the distribution centres of x and y , while σ_x and σ_y are their dispersions.

When accurately employed, correlation methods enable the discernment of the intrinsic nature of interrelational processes. It is

essential to recognise that correlations manifest not in isolated instances but generally across numerous cases. These causative links do not always exhibit direct correspondence; instead, they present varying degrees of correlation. Within the framework of correlation theory, two primary objectives emerge: firstly, to ascertain the theoretical form of the relationship through regression analysis, and secondly, to quantify the intensity of this relationship via correlation analysis.

The task of determining the theoretical form of the relationship (regression analysis) involves identifying the functional relationship that most accurately encapsulates the essence of the observed correlation. Meanwhile, the measurement of the density of the relationship (correlation analysis) requires the utilisation of specific indicators to gauge the extent to which the observed correlation approximates the underlying functional relationship. This methodology is crucial for understanding the dynamics of economic relationships (Dzwigol, 2022b; Kharazishvili and Kwilinski, 2022; Stezhko et al., 2020).

For this particular study, we focused on indicators from Central and Eastern European countries for the period of 2015–2022. These indicators included gross domestic product, exports, imports, and foreign direct investment, which was considered a relative value. The correlation analysis was conducted to elucidate the ramifications of the COVID-19 pandemic on the influx of foreign investment and, more broadly, on the economic development of Central and Eastern European nations.

The empirical data underpinning this analysis were sourced from a combination of reputable databases, including Eurostat, the National Statistical Offices of various CEE countries, the World Bank, and the State Statistics Service of Ukraine. This diverse collection of data ensures a comprehensive and nuanced understanding of the economic impacts and trends across the region in the context of the COVID-19 pandemic.

3. Research results

The COVID-19 pandemic has catalysed significant alterations in investment promotion strategies across Central and Eastern Europe, underscoring a renewed emphasis on infrastructure and service sectors. While investments targeting the utilisation of production factors, resources, and affordable labour remain vital, the scope for attracting such investments has begun to diminish. This trend necessitates a strategic pivot towards bolstering domestic and regional demand for services. Notably, investments in the green (ecological) and blue high-tech economies, along with infrastructure and domestic services, are emerging as pivotal areas with substantial potential to contribute to the achievement of sustainable development goals.

Adjustments in policy direction, prompted by the pandemic and reflected in specific regulatory measures, do not inherently signify designated funding for a particular sector. However, they can serve as indicators of potential accelerated growth in these sectors. A nuanced understanding of the sectors earmarked for promotion under the European Green Deal (EGD) is instrumental in forecasting the trajectory of investment flows into these areas in the foreseeable future.

In the context of EU investment policy, the nations of Central and Eastern Europe warrant particular attention. The COVID-19 pandemic has uniformly impacted investment climates across these countries, albeit to varying degrees. Slovenia, Hungary, and Croatia have been among the most severely affected, witnessing investment declines exceeding 2% between 2019 and 2022. Conversely, Poland, Romania, and Slovakia have been relatively less impacted, experiencing investment reductions of less than 1% in the same period (as illustrated in Table 1).

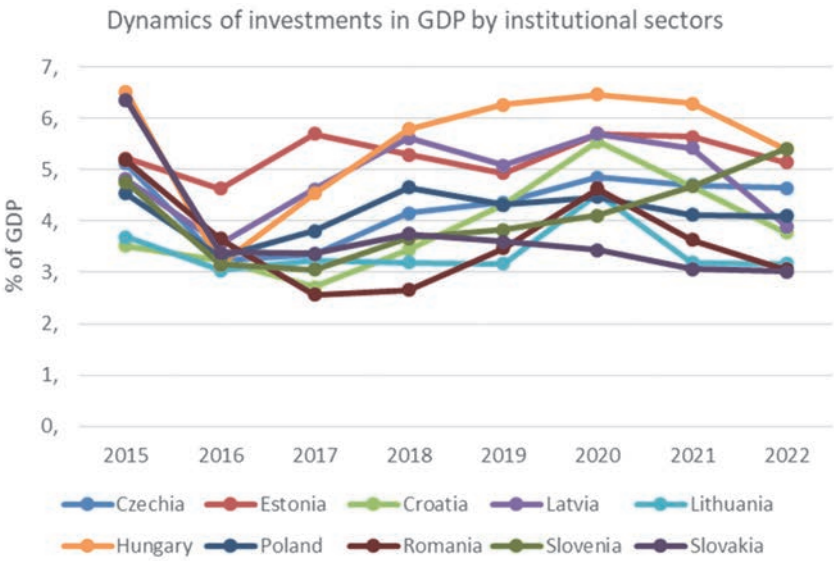
Table 1. Share of investment in GDP in Central and Eastern European countries

Country	Year				Change from 2019 to 2022
	2019	2020	2021	2022	
Czechia	23.9%	22.0%	21.9%	22.2%	-1.7%
Estonia	24.5%	20.4%	21.6%	22.8%	-1.7%
Croatia	21.2%	17.7%	20.1%	20.9%	-0.3%
Latvia	23.8%	19.7%	21.4%	22.2%	-1.6%
Lithuania	24.3%	20.6%	22.2%	23.1%	-1.2%
Hungary	24.1%	22.0%	22.8%	23.5%	-0.6%
Poland	23.3%	20.6%	21.9%	22.9%	-0.4%
Romania	22.8%	20.0%	21.4%	22.2%	-0.6%
Slovenia	21.9%	17.5%	20.4%	21.3%	-0.6%
Slovakia	23.8%	21.7%	22.3%	22.6%	-1.2%

Source: own elaboration based on data from the European Commission (2023)

An analysis of the dynamics of investment as a percentage of GDP across different institutional sectors of the economy is presented in Figure 6. This analysis provides valuable insights into the shifting landscape of investment distribution, highlighting the resilience and adaptability of certain sectors and economies within the Central and Eastern European region in the face of the challenges posed by the pandemic.

Figure 6. Share of investment in the GDP of Central and Eastern European countries by institutional sector

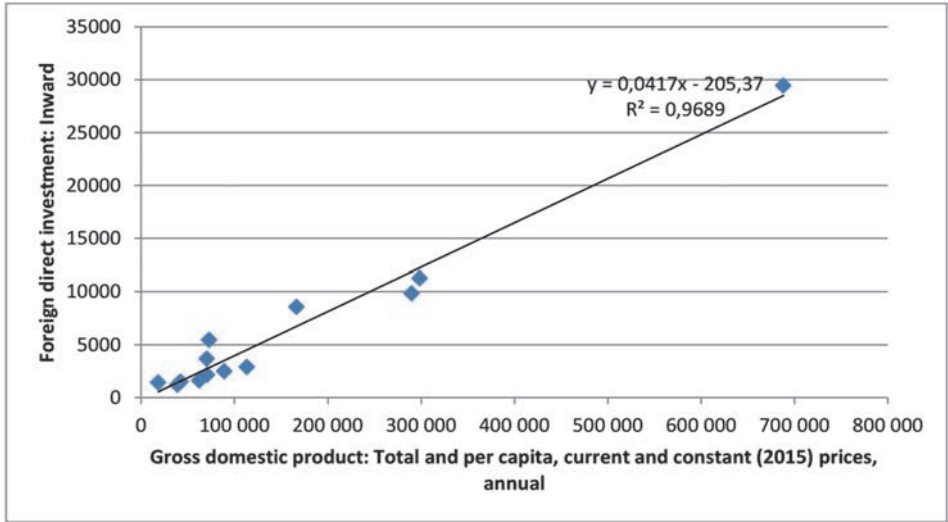


Source: own elaboration based on data from the European Commission (2023)

To comprehensively assess the influence of the COVID-19 pandemic on investment dynamics and economic expansion, the research utilised regression analysis to explore the correlation between foreign direct investment (FDI) volumes and gross domestic product (GDP) across Central and Eastern European countries (illustrated in Fig. 7).

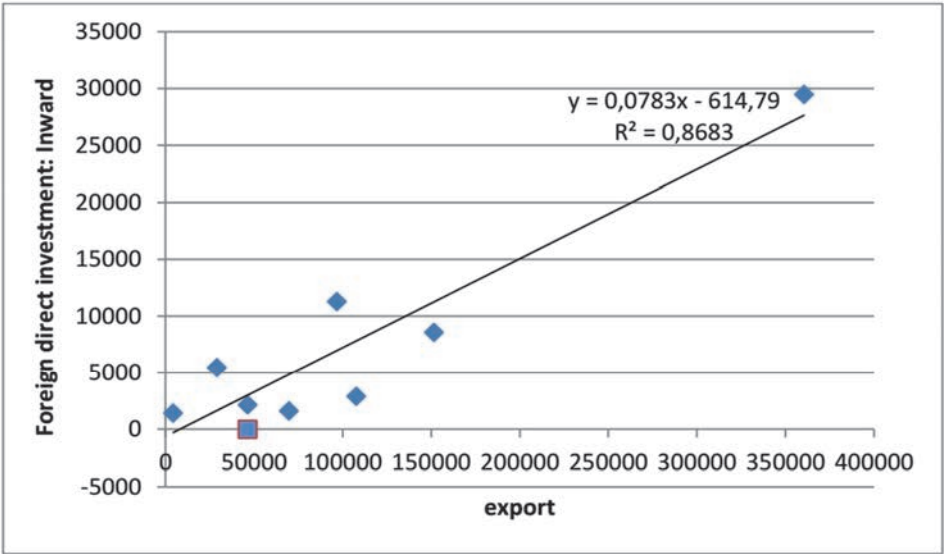
Additionally, the study examined the inter-relationships among exports, imports, and FDI, providing a multifaceted view of the economic impact (depicted in Figs. 8-11). This approach enabled a nuanced understanding of how the pandemic has affected investment trends and overall economic health in these regions.

Figure 7. The correlation between gross domestic product and foreign direct investment in the CEE countries for the period of 2019–2022



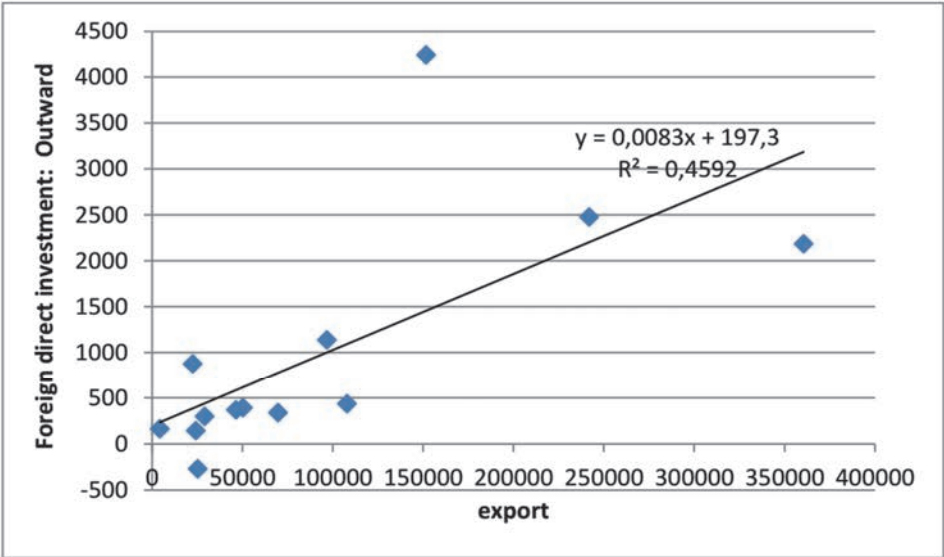
Source: own elaboration based on data from the European Commission (2023)

Figure 8. The correlation between exports and foreign direct investment in the CEE countries for the period of 2019–2022



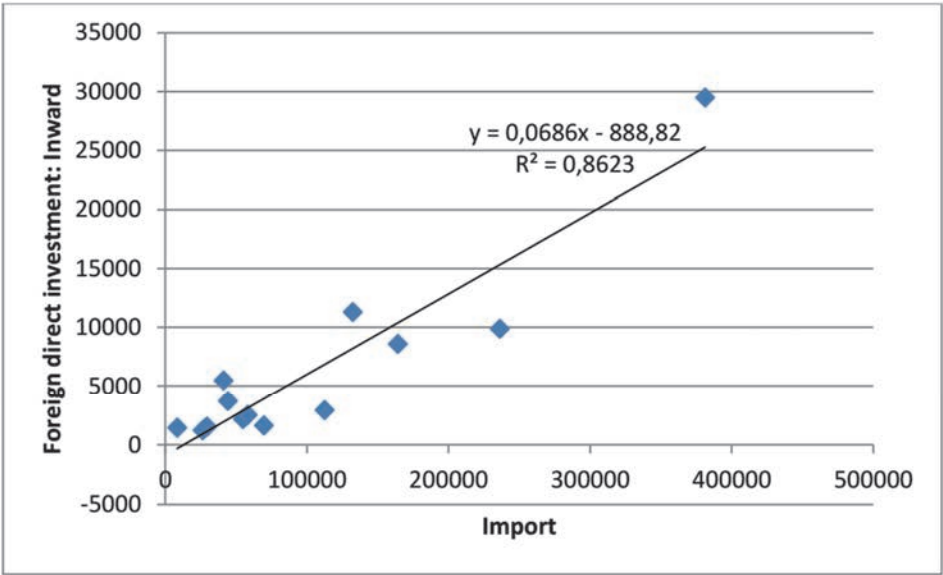
Source: own elaboration based on data from the European Commission (2023)

Figure 9. The correlation between exports and foreign direct investment from CEE countries for the period of 2019–2022



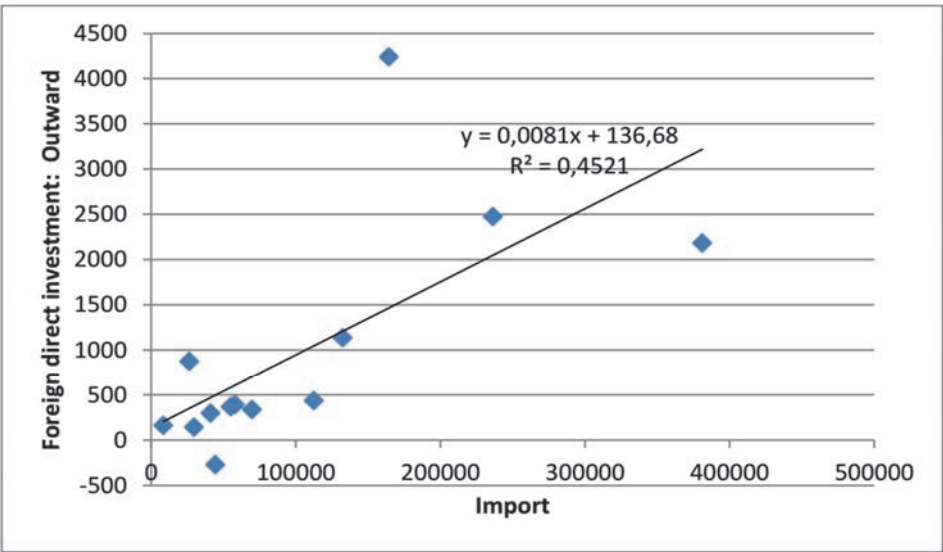
Source: own elaboration based on data from the European Commission (2023)

Figure 10. The correlation between imports and foreign direct investment in CEE countries for the period of 2019-2022



Source: own elaboration based on data from the European Commission (2023)

Figure 11. The correlation between imports and foreign direct investment from CEE countries for the period of 2019-2022



Source: own elaboration based on data from the European Commission (2023)

To investigate the impact of the COVID-19 pandemic on investment activity and economic growth, a regression analysis was conducted to explore the relationship between foreign direct investment (FDI) volumes and gross domestic product (GDP) in Central and Eastern European (CEE) countries for the period of 2019-2022. The analysis also examined the interconnections between exports, imports, and FDI.

It is important to note that the derived models are adequately aligned with experimental data. The statistical characteristics of these models are significant according to Fisher's F-criterion, exhibiting high R^2 and R coefficients. This allows one to draw economic conclusions based on these findings. A high correlation coefficient ($R=0.9689$) indicates a dense relationship between the data calculated by the regression equation and the empirical data, demonstrating a direct correlation between GDP volume and investment. In other words, an increase in investments positively affects GDP volume.

Based on the research, it is observed that the Balkan countries were most severely affected by the COVID-19 pandemic. The volume of FDI in these countries decreased by 30% in 2020 compared to 2019, marking the largest decline in the last 12 years. This decrease in investment was influenced by several factors, including quarantine measures leading to business closures and limited economic activity, uncertainty regarding global economic prospects, and increased production and logistics costs. Additionally, the Balkan countries were particularly vulnerable to the pandemic due to their weaker healthcare systems and relatively lower income levels.

The closure of borders triggered a chain reaction; transportation links with the global economy were disrupted, and

export-oriented production was severely affected (World Investment Report, 2023).

According to UNCTAD (2023), the crisis exacerbated the particular challenges faced by countries with structurally weak and vulnerable economies in attracting FDI. The prospects for FDI in CEE countries are extremely unfavourable. These countries' reliance on commodity production investments, which are negatively impacted by shocks in oil and commodity prices, plays a significant role.

The pandemic led to a notable increase in energy prices. Oil, natural gas, and coal prices reached record highs in 2022.

The analysis of the COVID-19 pandemic's impact on investment activities in Central and Eastern European countries reveals varying degrees of economic disruption across the region. Given this backdrop, it becomes pertinent to focus on specific countries that exemplify unique aspects of these challenges. Albania, in this case, emerges as a particularly significant example due to its unique economic structure and the notable intensity of the pandemic's impact there.

The COVID-19 pandemic exerted a considerable negative influence on investments across all sectors of Albania's economy, providing an insightful case study of the pandemic's broader economic ramifications. This impact was most pronounced in sectors crucial to Albania's economic framework, particularly in the production of goods. Industries such as mining and quarrying, as well as utilities such as electricity, gas, water supply, and waste management, were significantly affected. These sectors are vital components of Albania's industrial landscape and serve as key contributors to its GDP. The detailed extent of this impact is encapsulated in Table 2, which presents a comprehensive overview of the effects of the pandemic on these critical sectors.

Table 2. Investment volumes by economic sectors in Albania (million EUR)

Investment sector	2017	2018	2019	2020	2021	Change from 2019 to 2021
All market producers	231,713	238,145	241,821	193,880	174,008	-28.1%
Goods producers	160,174	146,305	150,117	92,209	81,176	-44.5%
Mining and quarrying	30,389	18,528	18,784	6,615	4,357	-76.8%
Manufacturing	33,128	33,540	28,553	25,312	22,987	-19.6%
Electricity, gas, water supply, and waste management	70,876	55,335	76,742	25,252	17,326	-77.5%
Construction	25,781	38,903	26,038	35,031	36,506	40.5%
Services producers	71,539	91,840	91,704	101,670	92,832	1.2%
Trade	33,262	44,259	40,498	39,140	34,965	-14.0%
Accommodation and food services	5,968	7,712	10,378	9,810	17,755	70.3%
Transport, information, and communication	13,270	15,489	16,153	21,351	15,958	-2.1%
Services	19,039	24,379	24,675	31,369	24,154	-4.4%

Source: own elaboration based on data from the Institute of Statistics (INSTAT) (2023)

This focused examination of Albania not only highlights the specific challenges faced by the country but also sheds light on potential recovery paths and resilience strategies that could be relevant to other countries in the region experiencing similar difficulties.

All economic sectors in Albania are reliant on foreign investments, which experienced a significant decrease due to the pandemic. However, the service-producing sectors were less impacted by the pandemic, with some areas, such as accommodation and food services, even witnessing an increase in investments. This can be attributed to the heavier reliance of these sectors on domestic consumption, which was less affected by quarantine restrictions.

Overall, it is anticipated that Albania's investment market will gradually recover from the effects of the pandemic in the medium term. However, this recovery is expected to be slow and uneven.

In the context of Albania, an interesting dichotomy is observed in the investment

patterns across different sectors. While traditional industries which are heavily dependent on foreign investment faced a downturn, service-oriented sectors demonstrated resilience, underlining the diverse impact of the pandemic on the Albanian economy. This resilience in service sectors, buoyed by domestic consumption, suggests a potential area of focus for economic recovery strategies.

As Albania navigates the post-pandemic landscape, the investment market's path to recovery will likely be marked by cautious optimism, with sector-specific trends playing a crucial role in shaping the overall economic resurgence.

As mentioned earlier, Romania experienced the least impact from the pandemic among the Central and Eastern European (CEE) countries. In 2020, net investment in the national economy increased by 0.1% compared to 2019. The dynamics of net investment in the economy, presented in the national currency and broken down by structural components compared to 2019, are shown in Table 3.

Table 3. Dynamics of investment in the Romanian economy

Investment sector	2020 – prices in million lei	in % compared to 2019	Structure, %	
			2019	2020
Total	106,195.3	100	100	100
– New construction works	57,834.8	109.3	50.1	54.5
– Equipment (including vehicles)	36,553.1	91.2	37.7	34.4
– Other expenses	11,807.4	89.5	12.2	11.1

Source: own elaboration based on data from the National Institute of Statistics (2023)

Romania’s relative resilience in the face of the pandemic underscores a notable aspect of the region’s economic landscape. The slight increase in net investments during a globally challenging year highlights the country’s robust economic underpinnings and potential for continued growth amidst adversity. Table 3 provides a detailed breakdown of these investments, offering insight into which sectors and components contributed most to this resilience.

This data is particularly significant as it not only reflects Romania’s economic stability during a period of global uncertainty but also may serve as an indicator for potential investment opportunities and areas of growth within the country. Understanding the nuances of Romania’s investment landscape during the pandemic can provide valuable lessons for other CEE countries navigating similar challenges.

In 2020, investment in new construction amounted to a total of 57,834.8 million lei, which represents 54.5% of the total amount, compared to 50.1% in 2019. Investment

in equipment (including vehicles) also increased to 36,553.1 million lei, accounting for 34.4% of the total amount, compared to 37.7% in 2019. Investment in construction and trade/services significantly increased.

In 2020, net investment, predominantly from the private sector, amounted to 80,904.7 million lei, which is 76.2% of the total amount, compared to 76.6% in 2019. Investment in this sector was mainly oriented towards the acquisition of new construction works and equipment (including vehicles).

The volume of FDI in the Baltic countries decreased by 25% in 2020 compared to 2019. This decline was also significant, albeit less so than in the Balkan countries.

The Estonian economy also suffered losses from the COVID-19 pandemic. Investments in buildings, structures, and land significantly increased from 2019, while investments in vehicles remained relatively unchanged. The pandemic most heavily impacted the sale of tangible investment goods, which decreased by almost 50% from 2019 (Table 4).

Table 4. Volumes of investment in the Estonian economy by sector (thousand EUR)

Sector	2019	2020	2021	2022	Change from 2019 to 2022
Investment in tangible fixed assets (included financial leasing)	2,374,475.3	2,572,200.9	2,909,811.8	4,243,220.0	79.1%
Investment in buildings and structures	880,650.7	762,121.0	1,153,870.4	1,457,856.8	65.5%
Investment in vehicles	420,870.2	304,290.2	435,340.8	520,558.2	23.7%
Investment in computers	70,923.6	63,303.8	116,946.8	148,317.2	109.2%
Investment in other equipment, machinery, and inventory	950,839.5	1,137,496.9	1,082,749.2	1,646,536.8	73.2%
Investment in land	51,958.6	100,985.0	101,904.5	169,049.0	221.5%
Sales of tangible investment goods	573,278.8	521,432.6	722,901.8	858,210.8	53.2%

Source: own elaboration based on data from Statistics Estonia (2023)

According to data from the Estonian Department of Statistics, the effects of the COVID-19 pandemic were significantly felt in the Estonian economy, especially in the fourth quarter of 2021. During this period, overall investment in the country declined by 38.4%. This downturn was primarily driven by a drastic reduction in enterprise investment in software and databases, which plummeted by 93.9%. Additionally, there was a notable decrease in household investment in real estate, which fell by 12.6%. In contrast, there were areas of growth: investment in transportation equipment by enterprises increased by 36.2%, and there was a 12.4% rise in investment in other machinery, equipment, and defence systems.

In 2020, foreign direct investment (FDI) in the V4 countries saw a reduction of approximately 20% compared to 2019. Although this decline was less severe than

that experienced in the Balkan countries, it was still substantial. The factors contributing to the reduced investment volume in these countries were similar to those in the Balkans. However, the V4 nations, with their more developed economies and stronger healthcare systems, demonstrated less vulnerability to the impact of the pandemic than their Balkan counterparts.

The COVID-19 pandemic in Poland had a pronounced impact on various sectors (Table 5), with the most significant effects observed in public sector investment. Data indicate a substantial contraction in investment across different public sectors:

- General public sector investment plummeted by 46.6%.
- Public enterprises with more than nine employees faced a 44.6% reduction.
- Budgetary institutions and territorial units within the public sector saw a decrease of 48.1%.

Table 5. Trend of change in investment by sector in Poland (thousand EUR)

Sector	2019	2020	2021	Change from 2019 to 2021
Public sector	150,117	92,209	81,176	-46.6%
Public sector, enterprises with more than 9 employees	108,598	66,087	59,505	-44.6%
Public sector, budgetary units, territorial government units	41,519	26,122	21,671	-48.1%
Private sector, enterprises with more than 9 employees	92,067	78,955	97,011	5.4%
Total	242,184	171,164	178,187	5.8%

Source: own elaboration based on data from Statistics Poland (2023)

These sectors are directly or indirectly funded by the government, which encountered significant budgetary constraints due to the pandemic. Consequently, there was a notable reduction in investment expenditures within these public sectors.

In contrast, the private sector, particularly in enterprises employing more than nine people, exhibited a 5.4% growth in investment. This sector demonstrated greater resilience to the adverse effects of the pandemic compared to the public sector, primarily due to its independence from direct government financing. Moreover, the private sector

was able to invest more strategically to adapt to the new economic environment and capitalise on emerging opportunities.

In Hungary, the COVID-19 pandemic exerted its most substantial influence on investments within diverse sectors of the economy, likely encompassing a wide array of businesses such as restaurants, hotels, and tourism operators (Table 6). These enterprises were particularly hard-hit by the pandemic, with many being forced to temporarily shut down or scale back operations. Consequently, investments in these sectors experienced a sharp decline in 2020.

Table 6. Trend of change in investments by sectors in Hungary (thousand EUR)

Sector	2018	2019	2020	2021	Change from 2019 to 2021
Buildings and structures	417,961,879	34,676,611	88,729,635	61,414,552	14.7%
Machinery and equipment	39,433,432	23,026,067	2,239,517	10,1367,038	2.5 times
Land	102,554,480	81,398,285	9,421,9371	19,363,789	18.9%
Other	2,195,616	510,357	59,235,512	15,719	0.7%

Source: own elaboration based on data from the Hungarian Central Statistical Office (2023)

This analysis underscores the differential impacts of the pandemic on investment trends in Poland and Hungary. The Polish public sector, heavily reliant on government funding, faced significant investment challenges, highlighting the

vulnerability of state-dependent sectors during economic downturns. Conversely, the resilience of Poland's private sector reflects the flexibility and adaptive capacity of businesses not tethered to government finances.

In Hungary, the widespread impact across various economic sectors, especially those reliant on consumer interaction such as hospitality and tourism, illustrates the broad-based economic vulnerabilities to pandemic-induced disruptions. The sharp decline in investment in these sectors reveals the fragility of businesses heavily dependent on physical customer engagement.

The COVID-19 pandemic has led to a notable transformation in the investment structure across countries in Central and Eastern Europe (CEE). Investors have become more cautious, shifting their focus towards sectors less sensitive to economic fluctuations, such as technology, pharmaceuticals, and healthcare.

The response to COVID-19 has been a significant component of the investment policy in CEE countries. Governments in these nations implemented various measures to mitigate the adverse impact of the pandemic on foreign direct investments (FDI). Common strategies included providing financial support to pandemic-affected businesses. This encompassed subsidies, concessional loans, and tax benefits. Governments also introduced measures to create a favourable investment climate, including simplifying regulatory requirements, improving infrastructure, and developing human capital. Additionally, some CEE countries introduced protective measures for their domestic industries against foreign takeovers, including restrictions on the sale of controlling stakes in domestic companies to foreign investors.

Poland implemented a support programme for small and medium-sized businesses, including subsidies for capital investments and concessional loans. The Czech government introduced a support programme for the tourism sector, offering grants for marketing and advertising. Hungary launched a support programme for the technology industry, including grants for research and development. These measures are expected to positively impact the investment climate in CEE

countries in the short term. However, there is also a risk that these interventions could lead to increased protectionism and trade restrictions, potentially adversely affecting the global economy.

In 2022, there were notable differences in the recovery pace between Central and Eastern Europe. Central Europe maintained an economic growth rate of 4.7% in 2022, but Eastern Europe's growth rate halved to 1.4%, indicating slower recovery rates and potential variations in investment activity. Simultaneously, strengthened economic activity in the Eurozone and rising commodity prices contributed to increased exports and remittances, providing additional support for recovery processes in the region. The investment market in CEE countries is expected to continue its recovery in 2024. However, it is likely to evolve at a slower pace than before the pandemic.

4. Discussion

The research indicates that the coronavirus pandemic has had a profound impact on the global economy, leading to a reduction in overall investment levels by more than 50%. This aligns with the findings of researchers such as Bjarne Steffen et al. (2020), who highlighted the pandemic as a socioeconomic crisis, as opposed to merely a health crisis. Their studies emphasised the various quarantine forms that led to a 3.5% contraction of the global economy in 2020, increased unemployment, and reduced investment activity.

The impact of the pandemic varied across different sectors and industries. Jiaqi Shi et al. (2023) pointed out the devastating global consequences due to strict social distancing, travel bans, and lockdowns. Different sectors accumulated numerous lessons in combating COVID-19, demonstrating the varying degrees of resilience and adaptability.

The study reveals that, despite the economic and political interconnections among European countries, anti-epidemic

measures were diverse and depended on the severity and timing of implementation (Werth et al., 2021). This resulted in varied investment patterns in the CEE region. While some countries maintained or even boosted their investment attractiveness, others suffered drastic reductions.

While the primary focus of this study is on the Central and Eastern European (CEE) countries, incorporating Ukraine into the comparative analysis is essential due to its unique geopolitical positioning. As a country straddling the Eastern edge of Europe and with close historical and economic ties to both CEE nations and Russia, Ukraine’s experience offers valuable insights into how geopolitical factors can influence investment dynamics in times of global crises, such as the COVID-19 pandemic.

Ukraine’s economy, already grappling with challenges such as political instability and ongoing conflict, has faced additional strains due to the pandemic. This situation is markedly different from the CEE countries, most of which are EU members and

have more stable political environments and stronger economic support systems. The comparative analysis allows for an understanding of how these distinct geopolitical and economic conditions can impact investment patterns differently.

For Ukraine, the consequences are similar, despite a 7% increase in direct foreign investments in 2019 (see Table 7). In the first 10 months of 2020, investment inflows amounted to \$220 million. Over the past 30 years, Ukraine has been subject to a chronic lack of investment. Since the dawn of Ukrainian independence, the Ukrainian economy has attracted approximately \$50 billion in U.S. dollars. In contrast, Poland amassed about \$240 billion in investments over the same period. This disparity is linked to the higher level of investment risk in Ukraine, reflected in credit ratings, and currently exacerbated by the ongoing conflict. To enhance the country’s attractiveness to investors, it is necessary to create incentives, such as a unified coordination body for investors, tax holidays, and industrial parks.

Table 7. Direct foreign investment (DFI) in Ukraine from 2017 to 2023 (million USD)

Year	DFI in Ukraine		DFI from Ukraine		Balance	
2017	3,692	-118	8	-8	3,684	-2.9%
2018	4,455	763	-5	-13	4,460	21.1%
2019	5,860	1,405	648	653	5,212	16.9%
2020	-868	-6,728	82	-566	-950	-118.2%
2021	6,687	7,555	-198	-280	6,885	-824.7%
2022	1,152	-5,535	529	727	623	-91.0%
2023	2,468	1,316	19	-510	2,449	293.1%

Source: own elaboration based on data from the National Bank of Ukraine (2023)

From the state fund designated to combat COVID-19, totalling around US\$2.5 billion, the Ukrainian government allocated US\$270 million to combat unemployment, US\$616 million to the health-care system, and US\$1.3 dollars for road reconstruction.

In response to the crisis triggered by the COVID-19 pandemic, the European Commission introduced a recovery plan for 2021–2027 – the EU’s Next Generation or the European Union Recovery Act. This plan envisages a funding amount of EUR 750 billion, aimed at ensuring sustainable and resilient

economic recovery. Access to this funding under the Act requires member states to prepare recovery project plans, detailing their investment objectives. The priority areas to be covered by the national plans include the development of renewable energy sources, energy efficiency in buildings, intelligent and sustainable transportation, expansion of corresponding infrastructure, digitisation of government and public services, and the development of industrial data cloud capacity.

Moreover, state regulatory measures aimed at investments in the healthcare sector suggest that private enterprises can receive support if they pivot towards producing goods and services essential for combating the COVID-19 pandemic.

The priority directions of the European Green Deal present opportunities for Ukraine and its private sector, especially in areas where the EU sees potential for alliance formation. This scenario opens up a variety of opportunities for suppliers of goods or services. Although EU funding is primarily available to member states, there are several sources open to third countries as well. These opportunities enable Ukraine to align its political and economic course with the new political frameworks of the EU. Attracting investments in the Ukrainian economy under the European Green Deal and increasing Ukraine's exports to the European Union will depend on collaboration between the government and the private sector. Without consistent state policies and support for the investment climate, it will be more challenging for exporters to capture a larger share of the European market or to utilise opportunities for additional funding.

Until November 2020, Ukraine provided more support to the fossil fuel sector than to green energy. According to the Energy Policy Tracker, from the beginning of 2020, Ukraine allocated at least US\$63.34 million to fossil fuel sectors either from the state budget or as expenditures of state enterprises. As for renewable energy sources,

the government reduced payments under the "green" tariff by approximately US\$2.2 billion until 2030, and the state enterprise "Guaranteed Buyer" owed about US\$1 billion to renewable energy producers. This also pertains to policies in the fields of mobility, agriculture, and industry. The government allocated some funds to building energy efficiency; however, these programmes were operational before the pandemic and, therefore, are not part of the recovery policy.

Thus, summarising the above points, CEE countries responded to the pandemic with various measures to mitigate its adverse impact on investments. These included financial support to affected businesses, subsidies, concessional loans, tax benefits, and measures to create a favourable investment climate. However, there is a risk that these interventions could lead to increased protectionism and trade restrictions.

Looking ahead, the investment market in CEE countries is expected to continue its recovery in 2024, albeit at a slower pace than before the pandemic. This forecast is based on strengthened economic activity in the Eurozone, rising commodity prices, and increased exports and remittances.

The pandemic has underscored the need for flexible and robust economic policies that can adapt to sudden market changes. For future research, there is a need to investigate the detailed impact of the pandemic on the investment attractiveness of specific CEE countries. This will aid in understanding how the pandemic has affected investment market transformations and investor decisions.

In conclusion, the varied responses and strategies adopted by the CEE countries, as well as Ukraine, in response to the COVID-19 pandemic have highlighted the critical importance of adaptive and resilient economic policies. These measures range from direct financial support to strategic realignments towards sectors less impacted by the pandemic, such as renewable energy and digital services. The disparities in economic resilience and

recovery among these countries underscore the complex interplay between health crises and economic structures. Additionally, the geopolitical positioning of countries such as Ukraine adds another layer to this dynamic, influencing both the challenges faced and the strategies employed in navigating the impact of the pandemic.

Conclusions

The pandemic has led to a reorientation of investor focus towards different countries and regions. Investors have become more cautious about investing in Central and Eastern European (CEE) countries, which are perceived as riskier compared to developed nations. Additionally, the European Green Deal aims to facilitate sustainable investments for both public and private sectors. The sustainable finance strategy includes creating a taxonomy of sustainable activities, a standard for EU “green” bonds, and labelling for “green” financial products, among other measures. This approach will encourage transparency and a long-term vision in capital markets.

The COVID-19 pandemic significantly impacted investment activity in CEE countries, characterised by several key trends:

- Economic slowdown: In 2022, economic growth in CEE was expected to slow to 4.1%, partly due to the pandemic, reduced fiscal support, and supply chain disruptions.
- Exacerbated income inequality and fears of social unrest could affect investment stability in CEE countries.
- Changes in consumer confidence significantly influenced investment trends in CEE. Reduced new export orders and increased uncertainty due to COVID-19, inflation, and political instability affected regional investment decisions.
- Implementing cluster models of economic integration, based on synergy, can stimulate investments in innovative

productions. This approach involves enterprises collaborating in clusters, sharing experience, resources, innovations, and knowledge.

Industry 5.0, representing a modern and attractive model for circular production investment, can be a critical factor in unlocking post-COVID investment funds. Digital cognitive clones, merging human behaviour in decision-making, are seen as favourable technologies for the future hybrid of digital and human worlds, accelerating the convergence of these realms (Nahavandi, 2019; Golovianko et al., 2023).

In the context of investment market evolution during the pandemic, the concept of Industry 5.0 is of particular relevance. Unlike its predecessor, Industry 4.0, which emphasised automation and technology, Industry 5.0 focuses on the integration of human creativity and craftsmanship with technological advancements. It represents a shift towards a more sustainable, resilient, and customised production model, placing equal emphasis on economic growth and societal wellbeing. Industry 5.0 can be pivotal in addressing the new post-COVID-19 market dynamics by promoting investments that are not only technologically advanced, but also socially responsible and environmentally sustainable.

In conclusion, the varied responses and strategies adopted by CEE countries and Ukraine to the COVID-19 pandemic highlight the need for adaptive and resilient economic policies. These measures range from direct financial support to strategic realignments towards sectors less impacted by the pandemic, such as renewable energy and digital services. The disparities in economic resilience and recovery among these countries underscore the complex interplay between health crises and economic structures. Additionally, the geopolitical positioning of countries such as Ukraine adds another layer to this dynamic, influencing both the challenges faced and the strategies employed in navigating the impact of the pandemic.

The emerging concept of Industry 5.0 offers a framework for future research and investment strategies, emphasising the blend of technological innovation with human-centric approaches. This new paradigm could potentially reshape the investment landscape, fostering a more holistic and sustainable economic recovery in the post-pandemic world.

Given these observations, there are optimistic and pessimistic approaches to forecasting the post-COVID economic situation. Optimistically, the pandemic has accelerated innovation across all economic sectors, with increased legislative encouragement for funding environmental projects and a rise in automation and social responsibility. However, some trends, such as investments in companies producing parts and equipment, continue to be popular among investors. Data from 2021 indicate the beginning of the recovery of global production and renewed international cooperation, especially in investments, prompting more active work by investment promotion agencies in developed economies. The pandemic is expected to lead to controlled acceleration of global inflation rates, making the crisis recovery uneven and challenging.

In light of these developments, future research should focus on comprehensively analysing the evolving landscape of global investment following COVID-19, with a special emphasis on the role and impact of Industry 5.0. This entails a deeper exploration into how the integration of human-centric approaches with advanced technologies under Industry 5.0 is reshaping investment patterns, particularly in the context of sustainable and resilient economic growth. Such studies could provide valuable insights into the effectiveness of current investment strategies and the potential for innovative models in fostering economic recovery and growth.

Moreover, there is a need to investigate the long-term effects of the pandemic on different sectors, especially those that have shown

resilience and are aligned with the principles of Industry 5.0. This includes examining the role of digital transformation, circular economy models, and green investments in driving economic recovery and sustainability.

Additionally, given the uneven recovery and varying degrees of economic resilience among countries, further research should consider the diverse geopolitical and economic contexts, particularly in CEE countries and Ukraine. This would involve assessing the effectiveness of different economic policies and investment incentives in these regions and their alignment with broader global economic trends.

Finally, the potential shifts in consumer behaviour, market demands, and global supply chains in the post-pandemic era present another crucial area for future research. Understanding these shifts will be key to identifying new investment opportunities and challenges, thereby enabling investors and policymakers to make informed decisions in a rapidly changing global economic landscape.

References

- Arefieva, O., Polous, O., Arefiev, S., Tytykalo, V., Kwilinski, A. (2021), Managing sustainable development by human capital reproduction in the system of company's organizational behavior, *IOP Conference Series: Earth and Environmental Science*, 628(1), 012039. <https://doi.org/10.1088/1755-1315/628/1/012039>.
- Caetano, R.V., Marques, A.C., Afonso, T.L., Isabel Vieira, (2023), Could Private Investment in Energy Infrastructure soften the environmental impacts of Foreign Direct Investment? An assessment of developing countries, *Economic Analysis and Policy*, 80, 961-977. <https://doi.org/10.1016/j.eap.2023.09.030>.
- Chen, Y., Kwilinski, A., Chygryn, O., Lyulyov, O., Pimonenko, T. (2021), The Green Competitiveness of Enterprises: Justifying the Quality Criteria of Digital Marketing Communication Channels, *Sustainability*, 13, 13679. <https://doi.org/10.3390/su132413679>.

- Chen, Y., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2023), Green development of the country: Role of macroeconomic stability, *Energy & Environment*. <https://doi.org/10.1177/0958305x231151679>.
- Curtale, R., Silva, F., Proietti, P., Barranco, R. (2023), Impact of COVID-19 on tourism demand in European regions – An analysis of the factors affecting loss in number of guest nights, *Annals of Tourism Research Empirical Insights*, 4(2), 100112. <https://doi.org/10.1016/j.annale.2023.100112>
- Dementyev, V., Dalevska, N., Kwilinski, A. (2021), Innovation and Information Aspects of the Structural Organization of the World Political and Economic Space, *Virtual Economics*, 4, 54–76. [https://doi.org/10.34021/ve.2021.04.01\(3\)](https://doi.org/10.34021/ve.2021.04.01(3)).
- Dunning, J. H. (1958), *American investment in British manufacturing industry*, London: Allen & Unwin.
- Dzwigol, H. (2019), Research Methods and Techniques in New Management Trends: Research Results, *Virtual Economics*, 2(1), 31–48. [https://doi.org/10.34021/ve.2019.02.01\(2\)](https://doi.org/10.34021/ve.2019.02.01(2)).
- Dzwigol, H. (2021), The Uncertainty Factor in the Market Economic System: The Microeconomic Aspect of Sustainable Development, *Virtual Economics*, 4(1), 98–117. [https://doi.org/10.34021/ve.2021.04.01\(5\)](https://doi.org/10.34021/ve.2021.04.01(5)).
- Dzwigol, H. (2022a), Comparing Idiographic and Nomothetic Approaches in Management Sciences Research, *Virtual Economics*, 5(4), 27–49. [https://doi.org/10.34021/ve.2022.05.04\(2\)](https://doi.org/10.34021/ve.2022.05.04(2)).
- Dzwigol, H. (2022b), Research Methodology in Management Science: Triangulation, *Virtual Economics*, 5, 78–93. [https://doi.org/10.34021/ve.2022.05.01\(5\)](https://doi.org/10.34021/ve.2022.05.01(5)).
- Dzwigol, H. (2023), The Quality Determinants of the Research Process in Management Sciences, *Virtual Economics*, 6(2), 35–54. [https://doi.org/10.34021/ve.2023.06.02\(3\)](https://doi.org/10.34021/ve.2023.06.02(3))
- Dzwigol, H., Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023), Renewable Energy, Knowledge Spillover and Innovation: Capacity of Environmental Regulation, *Energies*, 16(3), 1117. <https://doi.org/10.3390/en16031117>.
- European Commission. (2023). *Investment*. Retrieved from: https://policy.trade.ec.europa.eu/help-exporters-and-importers/accessing-markets/investment_en.
- Forbes, K., Friedrich, Ch., Reinhardt, D. (2023), Stress relief? Funding structures and resilience to the covid shock, *Journal of Monetary Economics*, 137, 47–81. <https://doi.org/10.1016/j.jmoneco.2023.05.005>.
- Geels, F.W., Pereira, G.I., Pinkse, J. (2022), Moving beyond opportunity narratives in COVID-19 green recoveries: A comparative analysis of public investment plans in France, Germany, and the United Kingdom, *Energy Research & Social Science*, (84), 102368, <https://doi.org/10.1016/j.erss.2021.102368>.
- Golovianko, M., Terziyan, V., Branytskyi, V.I., & Diana Malyk, D. (2023) Industry 4.0 vs. Industry 5.0: Co-existence, Transition, or a Hybrid. *Procedia Computer Science*, 217, pp. 102–113, <https://doi.org/10.1016/j.procs.2022.12.206>.
- Gorynia, M., Nowak, J., Trąpczyński, P., Wolniak, R. (2019), Friend or Foe? On the role of institutional reforms in the investment development path of Central and East European economies, *International Business Review*, 28(3), 575–587.
- Gorynia, M., Nowak, J., Trąpczyński, P., Wolniak, R. (2022), Integration and investment development paths of CEE countries. Does EU-membership make a difference? *Eurasian Geography and Economics*, 63(1), 27–54.
- Hungarian Central Statistical Office. (2023), Retrieved from: <https://www.ksh.hu/?lang=en>.
- Herrera-Echeverri, H., Nandy, D., Fragua, D. (2022), The role of private equity investments on exports: Evidence from OECD countries, *Journal of Multinational Financial Management*, 65, 100739. <https://doi.org/10.1016/j.mulfin.2022.100739>.
- Hussain, H.I., Haseeb, M., Kamarudin, F., Dacko-Pikiewicz, Z., Szczepańska-Woszczyna, K. (2021), The role of globalization, economic growth and natural resources on the ecological footprint in Thailand: Evidence from nonlinear causal estimations, *Processes*, 9, 1103. <https://doi.org/10.3390/pr9071103>.
- Institute of Statistics (INSTAT). (2023), Retrieved from: <http://pxweb.instat.gov.al>.

- Investment plans of the EU: opportunities for Ukraine in the sphere of implementation of the European Green Course (2020). Retrieved from: <https://dixigroup.org/wp-content/uploads/2021/02/%D0%86%D0%BD%D0%B2%D0%B5%D1%81%D1%82%D0%B8%D1%86%D1%96%D0%B9%D0%BD%D1%96-%D0%BF%D0%BB%D0%B0%D0%BD%D0%B8-%D0%84%D0%A1-ua.pdf>.
- Karnowski, J., Miśkiewicz, R. (2021), Climate Challenges and Financial Institutions: An Overview of the Polish Banking Sector's Practices, *European Research Studies Journal*, XXIV (3), 120-139. <https://doi.org/10.35808/ersj/2344>.
- Karnowski, J., Rzońca, A. (2023), Should Poland join the euro area? The challenge of the boom-bust cycle, *Argumenta Oeconomica*, 1(50), 227-262. <https://doi.org/10.15611/aoe.2023.1.11>.
- Kentor J., Clark, R., & Jorgenson, A. (2023), The hidden cost of global economic integration: How foreign investment drives military expenditures, *World Development*, 161, 106105. <https://doi.org/10.1016/j.worlddev.2022.106105>.
- Kharazishvili, Y., Kwilinski, A. (2022), Methodology for Determining the Limit Values of National Security Indicators Using Artificial Intelligence Methods, *Virtual Economics*, 5, 7-26. [https://doi.org/10.34021/ve.2022.05.04\(1\)](https://doi.org/10.34021/ve.2022.05.04(1)).
- Klayme, T., Gokmenoglu, K. K., & Rustamov, B. (2023), Economic policy uncertainty, COVID-19 and corporate investment: Evidence from the gold mining industry, *Resources Policy*, 85(Part A), 103787. <https://doi.org/10.1016/j.resourpol.2023.103787>.
- Kwilinski, A. (2019), Implementation of Blockchain Technology in Accounting Sphere, *Academy of Accounting and Financial Studies Journal*, 23(SI2), 1-6.
- Kwilinski, A. (2023), The Relationship between Sustainable Development and Digital Transformation: Bibliometric Analysis, *Virtual Economics*, 6(3), 56-69. [https://doi.org/10.34021/ve.2023.06.03\(4\)](https://doi.org/10.34021/ve.2023.06.03(4)).
- Kwilinski, A., Volynets, R., Berdnik, I., Holovko, M., Berzin, P. (2019), E-Commerce: Concept and Legal Regulation in Modern Economic Conditions, *Journal of Legal, Ethical and Regulatory Issues*, 2019, 22(Special Issue 2), 1-6.
- Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023), Environmental Sustainability within Attaining Sustainable Development Goals: The Role of Digitalization and the Transport Sector, *Sustainability*, 15, 11282. <https://doi.org/10.3390/su151411282>.
- Kwilinski, A., Lyulyov, O., Pimonenko, T., Dzwigol, H., Abazov, R., Pudryk, D. (2022), International Migration Drivers: Economic, Environmental, Social, and Political Effects, *Sustainability*, 14(11), 6413. <https://doi.org/10.3390/su14116413>.
- Kwilinski, A., Slatvitskaya, I., Dugar, T., Khodakivska, L., Derevyanko, B. (2020), Main Effects of Mergers and Acquisitions in International Enterprise Activities, *International Journal of Entrepreneurship*, 24, 1-8.
- Lagarde, Ch. (2008), European Central Bank. Retrieved from: <https://www.ecb.europa.eu/ecb/orga/decisions/html/cvlagarde.en.html>.
- Lazarenko, D., & Vicen, V. (2018). Trends in the Transition of European Countries to Alternative Energy Sources. *European Science*, 2, 18-21.
- Letunovska, N., Abazov, R., Chen, Y. (2022), Framing a Regional Spatial Development Perspective: The Relation between Health and Regional Performance, *Virtual Economics*, 5, 87-99. [https://doi.org/10.34021/ve.2022.05.04\(5\)](https://doi.org/10.34021/ve.2022.05.04(5)).
- Letunovska, N., Offei, F. A., Junior, P. A., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2023), Green Supply Chain Management: The Effect of Procurement Sustainability on Reverse Logistics, *Logistics*, 7, 47. <https://doi.org/10.3390/logistics7030047>.
- Li, D., Cruz, J. M. (2022), Multiperiod supply chain network dynamics under investment in sustainability, externality cost, and consumers' willingness to pay, *International Journal of Production Economics*, 247, 108441. <https://doi.org/10.1016/j.ijpe.2022.108441>.
- Melnychenko, O. (2019), Application of artificial intelligence in control systems of economic activity. *Virtual Economics*, 2, 30-40. [https://doi.org/10.34021/ve.2019.02.03\(3\)](https://doi.org/10.34021/ve.2019.02.03(3)).
- Melnychenko, O. (2021a). The Prospects of Retail Payment Developments in the Metaverse. *Virtual Economics*, 4(4), 52-60. [https://doi.org/10.34021/ve.2021.04.04\(4\)](https://doi.org/10.34021/ve.2021.04.04(4)).

- Melnychenko, O. (2021b), Energy Losses Due to Imperfect Payment Infrastructure and Payment Instruments, *Energies*, 14(24), 8213. <https://doi.org/10.3390/en14248213>.
- Miśkiewicz, R. (2019), Challenges facing management practice in the light of Industry 4.0: The example of Poland, *Virtual Economics*, 2, 37-47. [https://doi.org/10.34021/ve.2019.02.02\(2\)](https://doi.org/10.34021/ve.2019.02.02(2)).
- Miśkiewicz, R., Matan, K., Karnowski, J. (2022), The Role of Crypto Trading in the Economy, Renewable Energy Consumption and Ecological Degradation, *Energies*, 15, 3805. <https://doi.org/10.3390/en15103805>.
- Mongeon, P., & Paul-Hus, A. (2016), The journal coverage of Web of Science and Scopus: a comparative analysis, *Scientometrics*, 106, 213-228. <https://doi.org/10.1007/s11192-015-1765-5>.
- Moskalenko, B., Lyulyov, O., Pimonenko, T. (2022a). The investment attractiveness of countries: coupling between core dimensions, *Forum Scientiae Oeconomica*, 10, 153-172. https://doi.org/10.23762/FSO_VOL10_NO2_8.
- Moskalenko, B., Lyulyov, O., Pimonenko, T., Kwilinski, A., Dzwigol, H. (2022b), Investment Attractiveness of the Country: Social, Ecological, Economic Dimension, *International Journal of Environment and Pollution*, 69(1-2), 80-98. <https://dx.doi.org/10.1504/IJEP.2021.10050183>.
- Nahavandi, S. (2019), Industry 5.0 – A Human-Centric Solution, *Sustainability*, 11(16), 4371. <https://doi.org/10.3390/su11164371>.
- National Bank of Ukraine. (2023). Retrieved from: <https://bank.gov.ua/>.
- National Institute of Statistics. (2023). Retrieved from: <https://insse.ro/cms/>.
- Paul, J., Feliciano-Cestero, M. (2021). Five decades of research on foreign direct investment by MNEs: An overview and research agenda. *Journal of Business Research*, 124, pp. 800-812. <https://doi.org/10.1016/j.jbusres.2020.04.017>.
- Polcyn, J., Us, Y., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2022), Factors Influencing the Renewable Energy Consumption in Selected European Countries, *Energies*, 15, 108. <https://doi.org/10.3390/en15010108>.
- Pranckutė, R. (2021), Web of Science (WoS) and Scopus: the titans of bibliographic information in today's academic world, *Publications*, 9(1), 12. <https://doi.org/10.3390/publications9010012>.
- Scott Davis, J., & Zlate, A. (2023), The global financial cycle and capital flows during the COVID-19 pandemic, *European Economic Review*, 156, 104477. <https://doi.org/10.1016/j.euroecorev.2023.104477>.
- Shi, J., Liu, N., Wang, J., Ruan, G., Fan, M., Sun, K. (2023), Characterizing load profile-based enterprise profiling under COVID-19 lockdown policy: A provincial case in China, *Electrical Power and Energy Systems* 155, 109567. <https://doi.org/10.1016/j.ijepes.2023.109567>.
- Singh, V.K., Singh, P., Karmakar, M., Leta, J., & Mayr, P. (2021), The journal coverage of Web of Science, Scopus and Dimensions: A comparative analysis, *Scientometrics*, 126, 5113-5142. <https://doi.org/10.1007/s11192-021-03948-5>.
- Spicka, J. (2018), How Do Agricultural Biogas Investments Affect Czech Farms?, *Central European Business Review*, 7(4), 34-60. <https://doi.org/10.18267/j.cebr.205>.
- Spicka, J., Hlavsa, T., Soukupova, K., Stolbova, M. (2019), Approaches to estimation the farm-level economic viability and sustainability in agriculture: A literature review, *Agricultural Economics*, 65(6), 289-297. <https://doi.org/10.17221/269/2018-AGRICECON>.
- Statistics Estonia. (2023). <https://www.stat.ee/>.
- Statistics Poland. (2023). <https://stat.gov.pl/>.
- Steffen, B., Egli, F., Pahle, M., Schmidt, T.S. (2020), Navigating the Clean Energy Transition in the COVID-19 Crisis, *Joule* <https://doi.org/10.1016/j.joule.2020.04.011>.
- Stępień, S., Smędzik-Ambroży, K., Polcyn, J., Kwiliński, A., Maican, I. (2023), Are small farms sustainable and technologically smart? Evidence from Poland, Romania, and Lithuania, *Central European Economic Journal*, 10(57), 116-132. <https://doi.org/10.2478/ceej-2023-0007>.

- Stezhko, N., Golovchenko, O., Hrazhevskaya, N., Omelchenko, H., Miziuk, S., & Liubchik, K. (2020). Development of a Decision Support System in the International Economy Based on Economic and Mathematical Models. *International Journal of Scientific & Technology Research*, 9(3), 3939-3943.
- Szczepańska-Woszczyńska, K., Gedvilaitė, D., Nazarko, J., Stasiukynas, A., Rubina, A. (2022a), Assessment of Economic Convergence among Countries in the European Union, *Technological and Economic Development of Economy*, 28, 1572-1588. <https://doi.org/10.3846/tede.2022.17518>.
- Szczepańska-Woszczyńska, K., Gatnar, S. (2022b), Key Competences of Research and Development Project Managers in High Technology Sector, *Forum Scientiae Oeconomia* 2022, 10, 107-130. https://doi.org/10.23762/FSO_VOL10_NO3_6.
- Trushkina, N., Abazov, R., Rynkevych, N., Bakhautdinova, G. (2020), Digital Transformation of Organizational Culture under Conditions of the Information Economy, *Virtual Economics*, 3, 7-38. [https://doi.org/10.34021/ve.2020.03.01\(1\)](https://doi.org/10.34021/ve.2020.03.01(1)).
- Trzeciak, M., Kopec, T.P., Kwilinski, A. (2022), Constructs of Project Programme Management Supporting Open Innovation at the Strategic Level of the Organization, *Journal of Open Innovation: Technology, Market, and Complexity*, 8, 58. <https://doi.org/10.3390/joitmc8010058>.
- UNCTAD. (2023). Retrieved from: <https://unctad.org/>.
- UN study documents devastating impact of COVID-19 in Ukraine. (2020). Retrieved from: <https://www.undp.org/press-releases/un-study-documents-devastating-impact-covid-19-ukraine>.
- United Nations News. (2022). Retrieved from: <https://news.un.org/en/story/2022/01/1109702>
- van Eck, N.J., Waltman, L. (2010), Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84, 523-538. <https://doi.org/10.1007/s11192-009-0146-3>.
- Vernon, L. (1982). Smith Microeconomic Systems as an Experimental Science, *American Economic Review*, 72(5), 923-955.
- Walmsley, T., Rose, A., John, R., Wei, D., Hlávka, J.P., Machado, J., Byrd, K. (2023). Macroeconomic consequences of the COVID-19 pandemic, *Economic Modelling*, 120, 106147. <https://doi.org/10.1016/j.econmod.2022.106147>.
- Werth, A., Gravino, P., Prevedello, G. (2021), Impact analysis of COVID-19 responses on energy grid dynamics in Europe, *Applied Energy*, 281, 116045. <https://doi.org/10.1016/j.apenergy.2020.116045>.
- World Investment Report. (2023). Retrieved from: <https://unctad.org/publication/world-investment-report-2023>.
- Yaroshenko, O. M., Prokopiev, R. Ye., Velychko, V. O., Burniagina, Y. M., Zatyanaichenko, K. V. (2023), Social guarantees for cross-border and seasonal workers in Europe during COVID-19 and other global crises, *Research in Globalization*, 7, 100166. <https://doi.org/10.1016/j.resglo.2023.100166>.
- Zhanibek, A., Abazov, R., Khazbulatov, A. (2022), Digital Transformation of a Country's Image: The Case of the Astana International Finance Centre in Kazakhstan, *Virtual Economics*, 5, 71-94. [https://doi.org/10.34021/ve.2022.05.02\(4\)](https://doi.org/10.34021/ve.2022.05.02(4)).

Aleksy Kwilinski, Ph.D., Sc.D. in Economics, is a researcher, economist, and entrepreneur. He holds a prestigious position as a Research Professor at the London Academy of Science and Business. Dr. Kwilinski has an impressive portfolio of over 300 scientific publications to his credit. He serves on the editorial boards of various international scientific journals and is a recognised expert in economic, parliamentary, governmental, and local government advisory groups. Additionally, he is an active participant in research teams for international scientific projects. His areas of academic interest encompass a wide range of topics including the information economy, artificial intelligence, strategic management, development strategies, sustainable development, energy management, investment management, and migration policy. ORCID no. <https://orcid.org/0000-0001-6318-4001>.

Rafal Rebilas, Ph.D., a Polish economist specialising in financial market products and corporate investments, boasts over two decades of experience in finance. His career includes managing sales structures in top financial institutions such as Getin Holding SA Group, PKO BP SA, and Bank Zachodni WBK SA from 2001 to 2011. Beginning in 1996 at Bank Handlowy w Warszawie SA, he later enhanced his skills at Dresdner Bank Luxembourg SA. Dr. Rebilas, who earned his doctorate in economic sciences in 2001 from the University of Economics in Katowice, also excels in recruitment, mentoring, and negotiation within the banking sector. He has been a lecturer at WSB University since 2005 and served as Deputy Dean and later Vice-Rector for International Cooperation. His academic achievements include being honoured as Doctor Honoris Causa by the Poltava State Agrarian Academy and a professorship at Kyiv International University. His expertise makes him a prominent figure in both academic and financial circles. ORCID no. <https://orcid.org/0000-0001-7926-1155>.

Dmytro Lazarenko, an esteemed Doctor of Economic Sciences specialising in economics and business management (categorised by types of economic activity), is a professor at the National University of Life and Environmental Sciences of Ukraine in Kyiv. His academic prowess extends to his role as an academician at the Academy of Economic Sciences of Ukraine, where he focuses on accounting and auditing. Further enhancing his professional portfolio, Dr. Lazarenko also serves as a Professor at the European Institute of Further Education in Slovakia. With a prolific academic career, Dr. Lazarenko has made significant contributions to his field, authoring over 160 scientific publications. He is actively involved in the scholarly community, serving as a member on the editorial boards of various international scientific journals. His research interests span a wide range of topics, including the circular economy, international statistics, and the accounting and analysis of economic activities. ORCID no. <https://orcid.org/0000-0002-9957-6311>.

Nadiia Stezhko, a Doctor of Economic Sciences specialising in the world economy and international economic relations, serves as a professor at the Kyiv National Economic University named after Vadym Hetman in Ukraine. Renowned in her field, she is an academic at the Academy of Economic Sciences of Ukraine in Kyiv, focusing on international economic relations. Additionally, she is a member of the Union of Scientists of Bulgaria, based in Sofia, Bulgaria, and has been honoured with a Doctorate from the International Diplomatic Organisation for Development and Peace (IDODP), recognised by the United Nations Economic and Social Council, for her significant contributions to scientific knowledge and peace efforts. Dr. Stezhko's prolific academic career is marked by the authorship of over 120 scientific publications. She plays an active role in the academic community as a member of editorial boards for various international scientific journals. Her research interests predominantly revolve around the development of theoretical and methodological frameworks addressing the global food problem. This includes an emphasis on the asymmetric development of the world economy, where she advocates for food supply strategies and mechanisms rooted in sustainable development principles. ORCID no. <http://orcid.org/0000-0001-7292-5617>.

Henryk Dzwigol is a habilitated doctor of economic sciences in the discipline of management and a professor at the Silesian University of Technology in Poland. He is a research professor at the London Academy of Science and Business, London, UK, and Sumy State University, Sumy, Ukraine. He has authored over 250 scientific publications and is a member of international scientific journal editorial boards. His scientific interests include enterprise management, change management, controlling, enterprise and economy restructuring, research methodology in management and quality, development management, development strategies, management methods, sustainable development, energy policy, energy management, digital economy, artificial intelligence, investment management, and digital marketing. ORCID no. <https://orcid.org/0000-0002-2005-0078>.

The Long-run Response of Under-five Mortality to Corruption: Evidence from Nigeria

NURUDEEN ABU, BEN OBI, ONYEWUCHI AMAECHI BEN-Obi

Abstract

DOI: 10.23762/FSO_VOL11_N04_9

The importance of health to a nation and its citizens cannot be over-emphasised. Better health contributes to human capital development and enhances labour productivity, all of which promote economic growth. Reducing under-five mortality remains one of Nigeria's major challenges in the health sector and the country has achieved little in her fight against corruption. Despite the co-existence of corruption and high under-five mortality in Nigeria, empirical research on the connection between these two undesirables is minimal. We evaluate the long-term response of under-five mortality to corruption in Nigeria by using an Augmented ARDL (AARDL) method to analyse quarterly data for the 2000-2021 period. There is an evidence of a long-term relationship between corruption and under-five mortality alongside control variables including health expenditure, income growth and rural population, based on cointegration tests. The empirical results confirm that improving corruption control lowers long-term under-five mortality. Furthermore, greater openness to trade and higher spending on public health reduce long-term under-five mortality, while a growing rural population contributes to it. Thus, we recommend measures that lower corruption to reduce long-term under-five mortality in Nigeria.

Keywords

Under-five mortality, corruption, Augmented ARDL, Nigeria.

Nurudeen Abu¹

e-mail: abu.nurudeen@yahoo.com
Baba-Ahmed University, Nigeria

Ben Obi

e-mail: benonyi@gmail.com
University of Abuja, Nigeria

Onyewuchi Amaechi Ben-Obi

e-mail: benobiaa@gmail.com
Central Bank of Nigeria, Nigeria

¹Corresponding author

Introduction

The role of better health on economic development in both developed and developing economies has long been recognised.

Better health contributes to a nation's human capital development and raises labour productivity, leading to higher economic

growth rates (Becker, 2007; Linden and Ray, 2017; Lio and Lee, 2016). Improvement in the health status of individuals (and lowering child mortality) around the world is one of the Millennium Development Goals. Whereas governments and international aid organisations have committed vast resources to health projects/programmes, corruption makes it difficult to achieve better health outcomes including lowering under-five mortality in many countries (Lio and Lee, 2016; Sommer, 2019).

The pervasive nature of corruption in the health sector not only threatens public sector reform efforts and/or health programmes, it also limits the capacity of nations to achieve Sustainable Development Goal 3 (García, 2019), and the 2030 Agenda for Sustainable Development which includes the attainment of universal health coverage. Corruption promotes income and health inequalities, the embezzlement and diversion of funds allocated to public health, contract inflation by government officials, and the supply of substandard drugs and medical equipment. Coupled with these, are the de-motivation of health workers, limiting patients' access to quality and affordable healthcare, all of which can lead to worsening health outcomes such as under-five mortality (Chattopadhyay, 2013; García, 2019; Lio and Lee, 2016; Sommer, 2019; Swaleheen, 2019; Vian, 2008). By contrast, reducing corruption fosters better and more efficient resource allocation to the health sector, leading to the improved health status of the populace (Makuta and O'Hare, 2015).

Nigeria is one of the leading contributors to under-five mortality due to diseases such as pneumonia, diarrhoea and malaria, and lack of access to quality treatment, amongst others (Popoola, 2018; UNICEF, 2023). In addition, it is one of the nations with the lowest public expenditure on health and high levels of corruption (Sommer, 2019; Transparency

International, 2015). Supporting the claims of reputable agencies such as Transparency International, authors have reported that corruption thrives in every facet of Nigeria's economy and it has hindered the country's capacity to attain higher levels of development (Abu and Karim, 2021; Abu and Staniewski, 2021; Abu et al., 2021; 2022a; 2022b).

Notwithstanding the relatively high corruption in Nigeria (Abu et al., 2021; 2022a; 2022b) and the country's under-five mortality (Popoola, 2018; UNICEF, 2023), researchers have done little to explore the empirical relationship between the two undesirable phenomena in the Nigerian context. Interestingly, most studies have submitted that rising corruption tends to promote under-five mortality (Gupta et al., 2000; Holmberg and Rothstein, 2009; Li et al., 2018; Lio and Lee, 2016). However, a study by Makuta and O'Hare (2015) appears not to support the claim that lowering corruption reduces under-five mortality, particularly in Sub-Saharan Africa. Their finding aligns with the "sand the wheels" hypothesis, and re-echoes the beneficial role of corruption in countries with weak institutions. Thus, this research attempts to fill this gap by investigating the response of under-five mortality to corruption in Nigeria using the novel Augmented ARDL (AARDL) method.

1. Literature Review

Research on how corruption is manifested in the health sector has increased over the years in both developed and developing regions of the world (Gupta et al., 2002; Sommer, 2019; Vian, 2008). The literature suggests that high levels of corruption negatively impact the health sector in a number of ways. Corruption ensures that monies allocated for the provision of healthcare are embezzled by public officials, and substantial funds meant for the

payment of health practitioners' wages, the purchase of essential equipment and drugs, and upgrading health facilities are stolen (Dryer, 2006; Engberg-Pedersen et al., 2005; Global Corruption Report, 2006; Lewis, 2006). The limited resources available due to corruption result in poor remuneration of health workers, which in turn pushes some doctors and nurses to demand kickbacks from patients, most of whom are poor, to augment their low wages (Holmberg and Rothstein, 2011; Lewis, 2006; Sommer, 2019). Coupled with this is the inadequate provision of healthcare that makes it very difficult for citizens to access and/or afford quality health service whenever the need arises (Holmberg and Rothstein, 2011; Lewis, 2006; Pandolfelli and Shandra, 2013; Sommer, 2019). The implications of this are increased vulnerability and the exposure of many, including infants, to diseases such as cholera, pneumonia, diarrhoea, measles, polio, etc., leading to under-five mortality.

On the other hand, the "grease the wheels" hypothesis (Huntington, 1968; Leff, 1964; Leys, 1965), further popularised by Lui (1985), Beck and Maher (1986), Lien (1986), and Méon and Sekkat (2005), suggests that corruption may improve efficiency and accelerate the process of service delivery especially in countries with weak and/or ill-functioning institutions. Given that inefficient bureaucracies or government officials constitute barriers to economic activities, offering bribes to them can help circumvent bottlenecks and enhance the efficiency of the system, leading to economic growth. Thus, the offering of bribes by patients seeking healthcare can reduce the hours they spend waiting to see doctors and other medical practitioners. In addition, bribes might be seen as complementing/augmenting the poor wages earned by health workers, and thus

increase their motivation to deliver service in an efficient manner. This can lead to improved health outcomes, including lower under-five mortality.

Efforts have been put into searching for the empirical connection between corruption and under-five mortality, and most of such studies have concentrated on multi-nation and employed panel data. Interestingly, the studies reported that reducing the level of corruption or controlling corruption lowers under-five and/or infant mortality. For example, Lin et al. (2014) employed the fixed effects (FE) method to assess the impact of quality of governance (inclusive of corruption) on under-five mortality in 149 nations from 1996 to 2010, and concluded that raising governance quality (reducing corruption) lessened under-five mortality.

Using a similar estimation procedure, Vaidean et al. (2021) confirmed that controlling corruption reduced under-five mortality in EU nations over the 2005-2020 period. Also, applying ordinary least squares (OLS) and two-stage least squares (2SLS) estimators to panel data, Gupta et al. (2000) and Li et al. (2018) reported that infant/child and under-five mortality decreased with greater corruption control during the 1985-1997 and 1995-2012 periods, respectively, across countries.

Other studies, including those of Holmberg and Rothstein (2009), Hanf et al. (2011), Lio and Lee (2016), and Sommer (2019), found that reducing corruption lowers under-five mortality. However, Makuta and O'Hare (2015) indicated an insignificant influence of less corruption on under-five mortality in Sub-Saharan African (SSA) nations during the 1996-2011 period based on the 2SLS estimation method. A summary of empirical research on the relationship between corruption and under-five mortality is reported in Table 1.

Table 1. Summary of empirical research on corruption and under-five (and infant) mortality

Author(s)	Country(ies)/Period	Method/Model	Major Findings
Lio and Lee (2016)	119 countries (2005-2011)	2-way FE and 2SLS	Less corruption lowers under-five and infant deaths.
Makuta and O'Hare (2015)	43 SSA countries (1996-2011)	2SLS	Corruption appears insignificant in explaining under-five mortality.
Li et al. (2018)	150 countries (1995-2012)	OLS, FE and 2SLS	Corruption gives rise to infant and under-five mortality.
Lin et al. (2014)	149 countries (1996-2010)	FE	Quality of governance (inclusive of corruption) is negatively related to under-five mortality.
Gupta et al. (2000)	Cross country (1985-1997)	OLS and 2SLS	Greater corruption control reduces infant and child deaths.
Holmberg and Rothstein (2009)	120 countries	Regression	Improvement in the fight against corruption lowers under-five mortality.
Hanf et al. (2011)	178 countries (2008)	Multivariate regression	A falling corruption level lowers under-five mortality.
Factor and Kang (2015)	133 countries (2003 and 2009)	SEM	A rising corruption level is related to poorer health outcomes.
Vaidean et al. (2021)	27 EU countries (2005-2020)	FE	A rising level of corruption promotes under-five mortality.
Sommer (2019)	90 middle and low-income countries (1996-2019)	2-way FE	An increasing corruption level is related to high infant deaths.

Note: FE = Fixed Effects; OLS = Ordinary Least Squares; 2SLS = Two-Stage Least Squares; SEM = Structural Equation Modelling

Source: own elaboration

A review of the literature on corruption and under-five mortality reveals that most studies concentrated on a multi-country sample such as the EU or SSA, developing and developed, or middle and low-income nations. Almost all the studies concluded

that corruption contributes to the deaths of under-fives. However, empirical studies on the relationship between corruption and under-five mortality with respect to Nigeria are almost non-existent. Thus, this research fills the gap in the literature by exploring the

relationship between corruption and under-five mortality in Nigeria using the novel Augmented ARDL (AARDL) method to analyse quarterly data for the 2000-2021 period.

2. Methodology

2.1. Theoretical framework

The literature suggests that corruption not only reduces public sector-provided services such as health and education, it also raises the price thereof (Gupta et al., 2000; Shleifer and Vishny, 1993). Coupled with this, is the reduction in government revenue and inadequate investment in human capital that accompanies public sector corruption (Ehrlich and Lui, 1999; Hindriks et al., 1999; Shleifer and Vishny, 1993). All of these have dire consequences for the quality of services provided by the government (Bearse et al., 2000; Gupta et al., 2000).

The health sector is one of the main victims of corruption due to the demand for healthcare and the scope of procurement (Knox, 2009; Sommer, 2019). Corruption promotes the theft of medical equipment and drugs bought with public funds,

increases the supply of substandard medicines and employment of incompetent professionals, lowers health spending, and encourages the diversion of public funds away from the health sector (Delavallade, 2006; Factor and Kang, 2015; Gupta et al., 2000; Lio and Lee, 2016; Mauro, 1998; Sommer, 2019; Swaleheen et al., 2019). These result in the spread of infectious and communicable diseases and poorer health outcomes including increased infant and under-five mortality (Cockcroft et al., 2008; Factor and Kang, 2015; Vian, 2008; Vian et al., 2010). Controlling corruption, however, fosters quality healthcare delivery, and consequently leads to an improvement in the health status of citizens including a reduction in child and under-five mortality (Gupta et al., 2000; Li et al., 2018; Lin et al., 2014; Lio and Lee, 2016). On the other hand, corruption in the form of bribery can serve as motivation for health practitioners or workers and accelerate the delivery of healthcare, leading to a reduction in under-five mortality. Thus, it can be posited that under-five mortality (*UFM*) is affected by corruption (*COR*). The model capturing this postulation is:

$$UFM_t = \beta_0 + \beta_1 COR_t + \mu_t \quad (1)$$

Besides corruption, factors including income level and/or growth, openness to trade, expenditure on health and rural population can impact under-five mortality (Hanf et al., 2011; Li et al., 2018; Sommer, 2019). For example, as a nation witnesses growth in its wealth or income (*GDPG*), it will have more resources to spend on programmes (such as the provision of potable water and sanitation and health awareness campaigns) that lead to an improvement in health status (Biggs et al., 2010). In addition, income growth lessens poverty and increases an individual's capacity to afford quality medical care, leading to an improvement in health conditions and a reduction in infant mortality (Anand and Ravallion, 1993; Biggs et al.,

2010; Bokhari et al., 2007; Pritchett and Summers, 1996).

Moreover, public health expenditure (*HEXP*) tends to be related to infant deaths (Gupta et al., 2003). Low-income households rely heavily on public spending on health compared to their wealthy counterparts. Hence, any increase in government spending on health raises the health status of low-income earners (Bidani and Ravallion, 1997; Bokhari et al., 2007; Deolalikar, 1995; Gallet, 2017; World Bank, 1995). However, certain authors argued that public spending on health does not guarantee an improvement in the health conditions of the populace (Filmer and Pritchett, 1999; Gupta et al., 2000; Terrelonge, 2014).

Furthermore, openness to trade (*TRD*) can determine under-five mortality (Sommer, 2019). Countries such as Nigeria that depend heavily on the trade and export of primary products face declining revenue due to low and fluctuating commodity prices. The inability of these nations to raise substantial revenue contributes to the poor funding of health and other socio-economic programmes (Shen and Williamson, 2001; Sommer, 2019). Toeing this line of argument, certain studies have reported a significant relationship between trade dependence and low quality of life and mortality (Cutright and Adams, 1984; Dixon, 1984; London and Williams, 1990; Ragin and Bradshaw, 1992). Notwithstanding the above, some research

has suggested that involvement in external trade has fostered economic growth and significantly raised the quality of life of citizens (Evans, 1987; Gereffi and Fonda, 1992).

Furthermore, the percentage of the population living in rural areas (*RPOP*) is another factor than can dictate under-five mortality. Rural dwellers have less access to medical facilities relative to their urban counterparts, thus making them highly vulnerable to diseases which can cause child mortality. However, an increasing urban population or urbanisation is associated with lower under-five mortality (Li et al., 2018; Vaidean et al., 2021). Thus, considering these factors, the new under-five mortality model is re-specified as:

$$LUFM_t = \beta_0 + \beta_1 COR_t + \beta_2 GDPG_t + \beta_3 TRD_t + \beta_4 HEXP_t + \beta_5 RPOP_t + \varepsilon_t \quad (2)$$

where *L* is the log introduced to reduce skewness.

The formulated hypotheses are:

H₀: There is no significant long-run impact of corruption on under-five mortality in Nigeria.

H₁: There is a significant long-run impact of corruption on under-five mortality in Nigeria.

2.2. Data and econometric methods

The constraints faced by this research lie in the lack of adequate of data (i.e., $n < 30$) necessary for time-series analysis. Data on under-five mortality is available from the year 2000, and corruption from 1996 only. Data on the remaining series, however, are available for a considerable period. This problem is resolved via the conversion of yearly data for all variables from 2000 to 2021 to quarterly data via Gandolfo's (1981) interpolation procedure. Hence, a higher number of observations are available for 2001:1-2020:4 (i.e. $n=80$) due to the elimination of the first and last years of the original series during interpolation. This procedure has increasingly been adopted in empirical studies constrained by

insufficient data (Abu et al., 2022a; 2022b; Baharumshah et al., 2006; Baharumshah and Rashid, 1999). Moreover, interpolated series do not lead to any bias in estimates computed from cointegrated vectors even if the sample is small (Smith, 1998; Tang, 2008).

Data were obtained from two sources, namely the World Development Indicators (WDI) and World Governance Indicators (WGI) of the World Bank. Corruption data is from the WGI, while income or GDP growth, rural population, trade and health expenditure are from the WDI. Corruption (*COR*) is proxied by the WGI corruption index and it has a range of -2.5 to +2.5, with lower values signalling higher (or lesser control of) corruption, and vice versa. Income growth (*GDPG*) is

measured by growth of real GDP per capita, health expenditure (*HEXP*) is government health spending share in real GDP, under-five mortality (*UFM*) is captured by the number of under-five mortality per 1,000 live births, trade openness (*TRD*) is the summation of the share of exports and imports in real GDP, and rural population (*RPOP*) is measured as the rural population growth rate.

2.3. Unit root test

Prior to AARDL model estimation, we conducted unit root test using both Augmented Dicker-Fuller (ADF) and Phillips-Perron (PP) tests to test the null hypothesis of the unit root in the series. This test is important in order to guide against generating results that are unreliable or invalid. The ADF test (Dickey and Fuller, 1979) is conducted via the equation:

$$\Delta y_t = \alpha + \rho y_{t-1} + \theta_1 \Delta y_{t-1} + \dots + \theta_k \Delta y_{t-k} + \varepsilon_t$$

y_t denotes series, and ε_t the error term. The null hypothesis (H_0) to be tested is:

$\rho = 0$ (presence of unit root in the series)

Also, a complementary test, i.e. the PP test (Phillips and Perron, 1988), was conducted. These statistics are compared to the critical values of 1%, 5% or 10% to either reject or accept H_0 .

2.4. Augmented ARDL (AARDL) bounds method for testing cointegration

The cointegration test was performed via the Augmented ARDL (AARDL) bounds test approach. The AARDL method of McNown et al. (2018) is an extended version of Pesaran et al.'s (2001) linear ARDL. The upgraded version of the model warrants an additional F -test (or t -test) on lagged independent variable(s). Goh and McNown (2015) illustrated that it is insufficient to compute only the F -test statistic on the coefficients of overall variables and the t -test statistic on the lagged dependent variable coefficient (i.e. two cointegration tests) as proposed by Pesaran et al. (2001). They claimed that the results based on these tests can lead to different degenerate cases.

Degenerate case #1 occurs where the lagged level of the dependent variable turns out to be insignificant, while degenerate case #2 arises if the lagged level of the independent variable(s) is not significant

in Equation 3. Interestingly, McNown et al. (2018) and Sam et al. (2019) stated that if degenerate cases are not addressed, the results based on the-test and/or F -test will be misleading. Therefore, McNown et al. (2018) introduced an extra or complementary test (F^* -test) to be performed on the lagged level of explanatory variables in order to resolve these degenerate cases.

Adopting these three tests is critical in distinguishing amongst degenerate and cointegration cases (Sarker and Khan, 2020). Like the conventional ARDL, the advantages of the AARDL model over conventional tests of cointegration (Engle and Granger, 1987; Johansen and Juselius, 1990) lie in its applicability to series with mixed order of integration (i.e. $I[0]$ and $I[1]$) as long as none are integrated to order two (i.e. $I[2]$). Other merits of the AARDL model include its appropriateness for estimating relations between variables which have finite samples and flexibility for variables to have different optimal lags, addressing the endogeneity problem, and using a single reduced-form equation to estimate the long-run and short-run coefficients simultaneously. The model ($p, k_1, k_2, k_3, k_4, k_5$) is specified as:

$$\begin{aligned}
\Delta LUFM_t = & \delta_0 + \sum_{i=1}^p \delta_{1i} \Delta LUFM_{t-i} + \sum_{i=0}^{k_1} \delta_{2i} \Delta COR_{t-i} + \sum_{i=0}^{k_2} \delta_{3i} \Delta GDPG_{t-i} \\
& + \sum_{i=0}^{k_3} \delta_{4i} \Delta TRD_{t-i} + \sum_{i=0}^{k_4} \delta_{5i} \Delta HEXP_{t-i} + \sum_{i=0}^{k_5} \delta_{6i} \Delta RPOP_{t-i} + \beta_1 LUFM_{t-1} \\
& + \beta_2 COR_{t-1} + \beta_3 GDPG_{t-1} + \beta_4 TRD_{t-1} + \beta_5 HEXP_{t-1} + \beta_6 RPOP_{t-1} \\
& + \varepsilon_t
\end{aligned} \quad (3)$$

The three tests of cointegration are conducted via testing these null hypotheses (H_0):

F -test on lagged level of all variables:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$$

t -test on the lagged level of the dependent variable:

$$H_0: \delta_1 = 0$$

F^* -test on the lagged level of the independent variables:

$$H_0: \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$$

For the first two tests, the F -statistic (on lagged level of all variables) and the t -statistic (on the lagged level of the dependent variable) computed are compared to Pesaran et al.'s (2001) upper and lower critical bounds. H_0 is not accepted should the computed F -statistic and t -statistic be larger than the upper bound (i.e., $I[1]$). In contrast, H_0 is accepted where the computed F -statistic and t -statistic are smaller compared to the lower bound ($I[0]$). The decision will be inconclusive in any event that the F -statistic and t -statistic lie between $I(0)$ and $I(1)$. Also, for

the third test, the computed F^* -statistic (on the lagged level of independent variables) is compared with Sam et al.'s (2018) critical values. If the F^* -statistic is higher compared to the upper bound, H_0 is not accepted. In contrast, H_0 is not rejected if F^* -statistic falls below the lower bound. To establish cointegration among the variables (and an absence of any degenerate case), the three tests are required to be significant. Upon the establishment of a cointegrating relation, long-run coefficients are estimated based on the model:

$$LUFM_t = \theta_0 + \theta_1 COR_t + \theta_2 GDPG_t + \theta_3 TRD_t + \theta_4 HEXP_t + \theta_5 RPOP_t + \varepsilon_t \quad (4)$$

Also, to estimate the short-run coefficients, the analysis makes use of an error-correction model written as:

$$\begin{aligned}
\Delta LUFM_t = & \beta_0 + \sum_{i=0}^p \beta_{1i} \Delta LUFM_{t-i} + \sum_{i=0}^{k_1} \beta_{2i} \Delta COR_{t-i} + \sum_{i=0}^{k_2} \beta_{3i} \Delta GDPG_{t-i} \\
& + \sum_{i=0}^{k_3} \beta_{4i} \Delta TRD_{t-i} + \sum_{i=0}^{k_4} \beta_{5i} \Delta HEXP_{t-i} + \sum_{i=0}^{k_5} \beta_{6i} \Delta RPOP_{t-i} + \psi_1 ECT_{t-1} \\
& + \varepsilon_t
\end{aligned} \quad (5)$$

ECT represents the error-correction term, and its coefficient, ψ_1 , measures the speed of adjustment needed to restore equilibrium in

the long-run if there is any deviation in the short-run.

2.5. Diagnostic and stability tests

Post estimation or diagnostic tests are carried out to check the reliability of the results. They include the Breusch-Godfrey serial-correlation test, the Breusch-Pagan-Godfrey heteroscedasticity test, and the Ramsey RESET mis-specification test. Also, the test of stability of the model and parameters estimated is carried out via the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMQ). The estimated parameters and the model are adjudged unstable should the CUSUMQ plots break in the lower and/or upper bounds (Greene, 2003; Tang and Lean, 2007).

3. Discussion of Results

The main aim of this research is to evaluate the response of under-five mortality to corruption over the long-term in Nigeria. Given that time series are employed for analysis, the data were subject to a stationarity test. If the test results reveal that all variables are stationary at I(1), then the findings suggest possible cointegration among the variables. Thus, the analysis will proceed with a cointegration test. The results of the unit root tests (Table 2) based on ADF and PP methods demonstrate that all variables do have a unit root (i.e. non-stationary), but turned out stationary taken after their first difference.

Table 2. Results of the unit root (stationarity) test

Variable	ADF		PP	
	Level	1 st diff.	Level	1 st diff.
LUFM	-2.2676	-12.4259***	-0.3174	-3.7699***
COR	-1.7765	-4.0480***	-1.3530	-4.0480***
GDPG	-1.9683	-5.4507***	-1.5260	-5.4507***
TRD	-1.5460	-3.0986**	-1.8119	-4.7138***
HEXP	-1.8354	-4.9273***	-1.5175	-4.9273***
RPOP	-1.2565	-3.6054***	-0.9520	-3.7939***

*** and ** signify a rejection of the null hypothesis of the unit root (non-stationarity) at 1% and 5%, respectively. L is the log

Source: own elaboration

The results of the cointegration test based on the three tests (Table 3) confirm the existence of a long-run relationship amongst the variables as the *F*-statistic (18.63), *t*-statistic

(7.19), and *F**-statistic (20.94) are greater than their corresponding upper bounds at the 1% level of significance.

Table 3. Results of the cointegration test

Function = $f(LUFM / COR, GDPG, TRD, HEXP, RPOP)$						
	10%		5%		1%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F -statistic=18.6295*** (overall or lagged level of all variables)	2.26	3.35	2.62	3.79	3.41	4.68
t -statistic=7.1916*** (lagged dependent variable)	2.57	3.86	2.86	4.19	3.43	4.79
F^* -statistic=20.9364*** (lagged independent variables)	1.86	3.39	2.24	3.90	3.05	5.02

*** signifies the rejection of the null hypothesis of no cointegration at 1% level. L denotes the lag

Source: own elaboration

The results based on the AARDL method (Table 4) show that an improvement in the control of corruption (*COR*) by one unit in the long-run lowers under-five mortality by 0.02% at the 1% level of significance. This empirical revelation is in line with prior research (Gupta et al., 2000; Hanf et al., 2011; Holmberg and Rothstein, 2009; Lio and Lee, 2016; Li et al., 2018; Vaidean et al., 2021). Thus, reducing corruption goes to decrease the theft of medical equipment and drugs purchased with public monies, reduce the supply of counterfeit medicines and hiring of incompetent professionals, and raise public spending on health programmes including judicious use of funds allocated to the health sector. These reduce the spread of infectious and communicable diseases, improve the health status of the population and lower under-five mortality. Thus, if the Nigerian government sustains the war against corruption and reduces such instances in the health sector, there will be an improvement in healthcare delivery and health outcomes, leading to a lower level of under-five mortality.

Also, greater openness to trade (*TRD*) appears to lower under-five mortality in the long-run. Increased openness to trade in the long-run by 1% reduces under-five mortality by 0.003% at a 1% level of significance. This

outcome aligns with early research (Evans, 1987; Gereffi and Fonda, 1992). This outcome implies that as Nigeria and her citizens engage in more external trade and generate high revenues/incomes, it will raise the capacity of households to afford the basic necessities of life such as decent housing, quality education, a balanced diet and improved healthcare, to mention a few. These in turn raise the standard of living of citizens, reduce their vulnerability to diseases, and consequently lower under-five mortality.

In addition, increasing public spending on health (*HEXP*) by one unit in the long-run causes under-five mortality to reduce by 0.016% at the 1% level of significance. This discovery supports previous and related works (Bidani and Ravallion, 1997; Bokhari et al., 2007; Deolalikar, 1995; Gallet, 2017; World Bank, 1995). This suggests that an increase in government spending on healthcare will improve the health of the populace, especially low-income households who rely heavily on public spending on health, leading to a decline in deaths among under-fives.

Furthermore, an increase in rural population (*RPOP*) by 1% in the long-run, raises under-five mortality by 0.012% at the 1% level of significance. This finding signifies that the majority of a growing rural population,

including children, have limited access to medical facilities and are subject to public health programmes that are grossly inadequate. This, in turn, increases the vulnerability of a significant number of the populace

including infants to diseases that can cause under-five mortality. However, rising urbanisation increases access to healthcare, leading to fewer deaths among under-fives (Li et al., 2018; Vaidean et al., 2021).

Table 4. Results of the AARDL model (Dependent variable: $\Delta LUFM$)

Long-run model		Short-run model	
Regressor	Coeff./Std. Error	Regressor	Coeff./Std. Error
C	0.3802*** (0.0033)	$\Delta LUFM_{-1}$	0.3787*** (0.0945)
COR	-0.0235*** (0.0051)	$\Delta LUFM_{-2}$	0.2515** (0.1032)
$GDPG$	-0.0001 (0.0003)	$\Delta LUFM_{-3}$	0.2857*** (0.0884)
TRD	-0.0025*** (0.0006)	ΔCOR	0.0005** (0.0002)
$HEXP$	-0.0160*** (0.0037)	$\Delta GDPG$	-0.2320*** (0.0659)
$RPOP$	0.0117*** (0.0002)	$\Delta RPOP$	0.4320*** (0.0001)
		$\Delta RPOP_{-1}$	-0.0157** (0.0041)
		$\Delta RPOP_{-2}$	-0.0102** (0.0044)
		$\Delta RPOP_{-3}$	-0.0117*** (0.0037)
		ECT_{-1}	-0.0214*** (0.0019)
R^2	0.9999		
Results of diagnostic (post-estimation) tests			
Test Statistic	Results		
Serial Correlation: χ^2	2.5777[0.2756]		
Heteroscedasticity: χ^2	6.8625[0.9399]		
Mis-specification: F-stat.	0.7067[0.4039]		

***, **, and * signify statistical significance at 1%, 5% and 1%, respectively. signifies the log. [] denotes standard error

[] signifies probability values

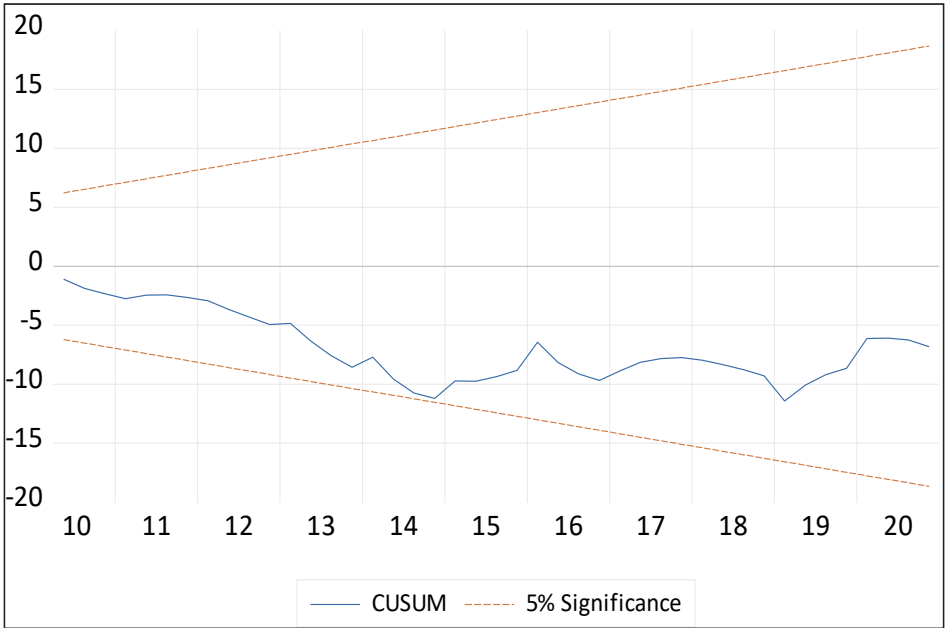
Source: own elaboration

Although not the main focus of this research, the short-run results confirm that lowering corruption raises under-five mortality at the 5% level of significance, thus supporting the beneficial role of corruption in countries with weak institutions in the short-term (Huntington, 1968; Leff, 1964; Leys, 1965). Furthermore, improving income growth in the short-term reduces deaths among under-fives at the 1% level of significance. Moreover, a growing rural population contributes significantly to under-five mortality at the 1% level of significance. This outcome suggests that an increase in the rural population reduces the access of many, including children, to healthcare due to a lack of such facilities. This, in turn, contributes to the outbreak of diseases which raise

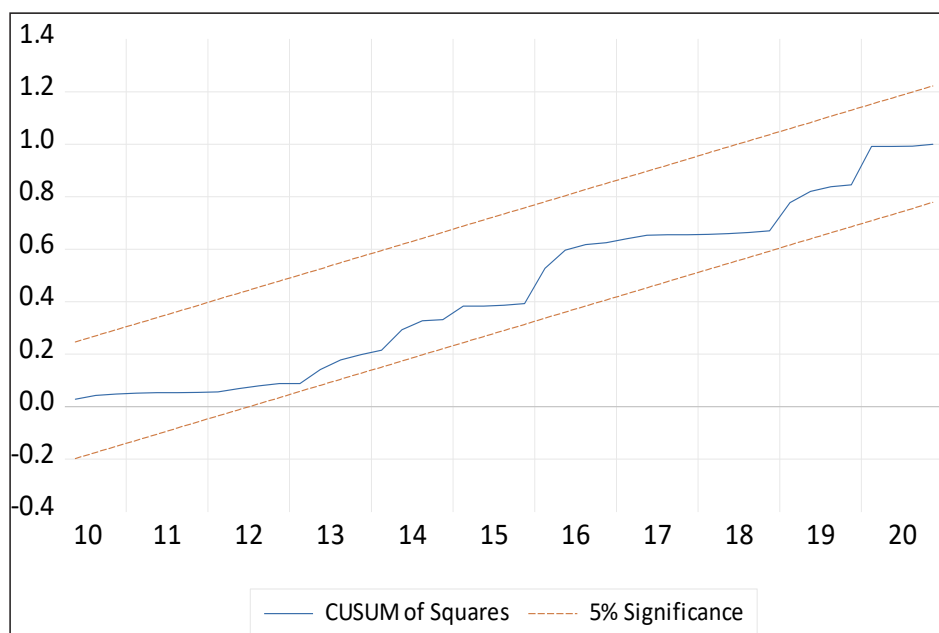
under-five mortality. The *ECT* (error correction term) lagged by one period appears significant with the expected sign at the 1% level of significance, suggesting that 0.02% of deviation from equilibrium is corrected during the fourth quarter of the year.

The diagnostic tests, namely serial-correlation, heteroscedasticity and mis-specification tests (Table 4), establish that the residuals are uncorrelated and homoscedastic, and the estimated model is correctly specified at the 5% level of significance. The results of the stability test based on CUSUM and CUSUMQ tests (Figure 1 and Figure 2) confirm that the plots lie within the boundaries at the 5% level of significance. Thus, both the estimated model and parameters depict long-run stability.

Figure 1. Plots of the cumulative sum of recursive residuals



Source: own elebotarion

Figure 2. Plots of the cumulative sum of squares of recursive residuals

Source: own elaboration

5. Conclusion

Corruption remains one of Nigeria's major challenges and the country has not been spared the problem of under-five mortality. This study evaluates the long-term influence of corruption on under-five mortality by applying the novel Augmented ARDL method to Nigeria's quarterly data for the 2000-2021 period. There is an evidence of a long-term relationship between corruption and under-five mortality alongside variables including health expenditure, income growth, openness to trade and rural population based on cointegration tests. Improving corruption control lowers long-term deaths among under-fives. This finding implies that if the Nigerian government sustains its efforts to reduce corruption, it will lower income and health inequalities, lessen embezzlement and the diversion of public funds allocated to health. Also, less corruption will guarantee the supply of

standard drugs and medical equipment, counter contract inflation by government officials, and increase patients' access to quality and affordable healthcare. These can go a long way to boosting health outcomes such as lower under-five mortality. The negative influence of openness on under-five mortality suggests that as Nigeria intensifies efforts to engage in external trade, it will benefit the country by fostering economic growth. The sustained expansion of the economy will raise citizens' income and capacity to afford quality healthcare, resulting in lower under-five mortality. The positive impact of a growing rural population on under-five mortality indicates that a rising number of rural dwellers will only put more pressure on the already scarce medical facilities and further limit their access to healthcare. There is no doubt that this will increase their vulnerability to diseases which contribute to under-five mortality. Thus, we recommend measures that

lower corruption to reduce deaths among the under-five cohort.

Corruption in the health sector can be reduced via increased funding of anti-graft bodies and continuous training of their personnel. This will enhance their capacity and effectiveness in detecting, apprehending and prosecuting corrupt individuals. Also, the judicial system needs to be overhauled/revamped so that corruption and related cases can be dispensed without unnecessary delay and offenders sanctioned appropriately. In addition, the Nigerian government should increase co-operation with the international community in its fight against corruption. This will ensure that those who have stolen the nation's wealth and stashed it abroad can be arrested and brought back to Nigeria to face justice, while illegally acquired assets kept in foreign banks are repatriated. These measures, if complemented with policies that foster income growth, raise public spending on health, and promote foreign trade and urbanisation, can reduce deaths among under-fives in Nigeria in the long-term.

Although this research has unravelled the impact of corruption on under-five mortality in Nigeria, it has some limitations which future studies can improve upon. First, the study uses only one measure of corruption, i.e. World Governance Indicators' control of corruption. Therefore, future research can employ different measures of corruption including the Transparency International corruption perception index and the International Country Risk Guide control of corruption. In addition, the present study did not consider insecurity (which has become a daily occurrence in Nigeria) as a potential driver of under-five mortality. Hence, future studies should determine the likely effect of insecurity on under-five mortality.

References

- Abu, N., David, J., Sakanko, M. A., Amaechi, B-O. O., (2022a), Oil price and public expenditure relationship in Nigeria: Does the level of corruption matter? *Ikonomicheski Izsledvania*, 31(3): 59-80.
- Abu, N., Kadandani, B., Obi, B., Modibbo, M., (2019), How does pensions affect savings in Nigeria? Evidence from quarterly data. *Scientific Annals of Economics and Business*, 66(4): 541-558. DOI: 10.2478/saeb-2019-0038
- Abu, N., Karim, M. Z. A., (2021), Is the relationship between corruption and domestic investment non-linear in Nigeria? Empirical evidence from quarterly data. *Estudios de Economia Aplicada*, 39(3): 1-18. DOI: 10.25115/eea.v39i3.3953
- Abu, N., Karim, M. Z. A., David, J., Sakanko, M. A., Ben-Obi, O. A., Gamal, A. A. M., (2022b), The behaviour of tax revenue amid corruption in Nigeria: Evidence from the non-linear ARDL approach. *Ikonomicheski Izsledvania*, 31(4): 55-76.
- Abu, N., Staniewski, M. W., (2022), An empirical investigation of the effect of corruption on domestic savings in Nigeria. *Economic Research-Ekonomska Istraživanja*, 35(2): 4092-4112. DOI: 10.1080/1331677X.2021.2010113
- Anand, S., Ravallion, M., (1993), Human development in poor countries: On the role of private incomes and public services. *Journal of Economic Perspectives*, 7(1): 133-150.
- Baharumshah, A. Z., Rashid, S., (1999), Export, imports and economic growth in Malaysia: Empirical evidence based on multivariate time series. *Asian Economic Journal*, 13(4): 389-406.
- Baharumshah, A. Z., Lau, E., Khalid, A. M. (2006), Testing twin deficits hypothesis using VARs and variance decomposition. *Journal of the Asia Pacific Economy*, 11(3): 331-354.
- Bearse, P., Glomm, G., Janeba, E., (2000), Why poor countries rely mostly on redistribution in-kind. *Journal of Public Economics*, 75: 463-81.
- Beck, P. J., Maher, M. W., (1986), A comparison of bribery and bidding in thin markets. *Economics Letters*, 20: 1-5.

- Becker, G. S., (2007), Health as human capital: Synthesis and extensions. *Oxford Economic Papers*, 59: 379-410.
- Bidani, B., Ravallion, M., (1997), Decomposing social indicators using distributional data. *Journal of Econometrics*, 77: 125-139.
- Biggs, B., King, L., Basu, S., Stuckler, D., (2010), Is wealthier always healthier? The impact of national income level, inequality, and poverty on public health in Latin America. *Social Science & Medicine*, 71: 266-273. doi:10.1016/j.socscimed.2010.04.002
- Bokhari, F. A. S., Gai, Y., Gottret, P., (2007), Government health expenditures and health outcomes. *Health Economics*, 16: 257-273. DOI: 10.1002/hec.1157
- Chattopadhyay, S., (2013), Corruption in healthcare and medicine: Why should physicians and bioethicists care and what should they do? *Indian Journal of Medical Ethics*, X(3): 153-159. DOI: 10.20529/IJME.2013.049
- Cockcroft, A., N. Andersson, S. Paredes-Solis, D. Caldwell, S. Mitchell, D. Milne, et al., (2008), An inter-country comparison of unofficial payments: Results of a health sector social audit in the Baltic states. *BMC Health Services Research*, 8(5): 1-12.
- Cutright, P., Adams, R., (1984), Economic dependency and fertility in Asia and Latin America, 1960-1980. *Comparative Social Research*, 7: 111-132.
- Delavallade, C., (2006), Corruption and distribution of public spending in developing countries. *Journal of Economics and Finance*, 30(2): 222-239.
- Deolalikar, A. B., (1995), *Government health spending in Indonesia: Impacts on children in different economic groups*. In: *Public Spending and the Poor: Theory and Evidence*, van de Walle D, Nead K (eds). Johns Hopkins University Press: Baltimore.
- Dickey, D. A., Fuller, W. A., (1979), Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366a): 427-431.
- Dixon, W. J., (1984), Trade concentration, economic growth, and the provision of basic human needs. *Social Science Quarterly*, 65: 761-774.
- Dryer, O., (2006), New report on corruption in health. *Bulletin of the World Health Organization Past Issues*, 84(2): 81-160.
- Engberg-Pedersen, P., Kaiser, K., Kisunko, G., Kushnarova, I., Lindelow, M., (2005). *Public expenditure tracking surveys: A stocktaking*. The World Bank, processed.
- Engle, R. F., Granger, C. W. J., (1987), Co-integration and error correction: Representation, estimation and testing. *Econometrica*, 55(2): 251-276.
- Ehrlich, I., Lui, F. T., (1999), Bureaucratic corruption and endogenous growth. *Journal of Political Economy*, 107: 270-293. DOI:10.1007/s11294-017-9631-2
- Evans, P., (1987), *Class, state, and dependence in East Asia: lessons for Latin Americanists*. In: F C Deyo (ed), *The Political Economy of the New Asian Industrialism* (Ithaca, NY: Cornell University Press).
- Factor, R., Kang, M., (2015), Corruption and population health outcomes: An analysis of data from 133 countries using structural equation modeling. *International Journal of Public Health*, 60: 633-641. DOI 10.1007/s00038-015-0687-6
- Filmer, D., Pritchett, L., (1999), The impact of public spending on health: Does money matter? *Social Science & Medicine*, 49: 1309-1323.
- Gallet, C. A., (2017), The impact of public health spending on California STD rates. *International Advances of Economic Research*, 23: 149-159.
- Gandolfo, G., (1981), *Quantitative Analysis and Econometric Estimation of Continuous Time Dynamic*. Amsterdam: North-Holland.
- García, P. J., (2019), Corruption in global health: The open secret. *Lancet*, 394: 2119-2124. doi.org/10.1016/S0140-6736(19)32527-9
- Gereffi, G., Fonda, S., (1992), Regional paths of development. *Annual Review of Sociology*, 18: 419-448.
- Global Corruption Report (2006). *Corruption and health*. Berlin: Transparency International.
- Goh, S. K., McNown, R., (2015), *Examining the exchange rate regime-monetary policy autonomy nexus: Evidence from Malaysia*. *International Review of Economics and Finance*, 35: 292-303. doi.org/10.1016/j.iref.2014.10.006

- Greene, W., (2003), *Econometric Analysis*. 5th ed. New Jersey: Prentice Hall.
- Gupta, S., Davoodi, H., Tiongson, E., (2000), *Corruption and the provision of health care and education services*. IMF Working Paper, WP/00/116.
- Gupta, S., Verhoeven, M., Tiongson, E. R. (2002), The effectiveness of government spending on education and health care in developing and transition economies. *European Journal of Political Economy*, 18(4): 717-737.
- Gupta, S., Verhoeven, M., Tiongson, E. R., (2003), Public spending on health care and the poor. *Health Economics*, 12: 685-696. DOI:10.1002/hec.759
- Hanf, M., Van-Melle, A., Fraisse, F., Roger, A., Carme, B., Nacher, M., (2011), Corruption kills: Estimating the global impact of corruption on children deaths. *PLoS ONE*, 6(11): 1-7. e26990. doi:10.1371/journal.pone.0026990.
- Hindriks, J., Keen, M., Muthoo, A., (1999), Corruption, extortion, and evasion. *Journal of Public Economics*, 74: 395-430.
- Holmberg, S., Rothstein, B., (2009), *Corruption kills*. QoG Working Paper Series, 09/16.
- Holmberg, S., Rothstein, B., (2011). Dying of corruption. *Health Economics, Policy and Law*, 6(04): 529-547.
- Huntington, S. P., (1968), *Political order in changing societies*. New Haven: Yale University Press.
- Johansen, S., Juselius, K., (1990), Maximum likelihood estimation and inference on cointegration-With applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2): 169-210.
- Knox, C., (2009), Dealing with sectoral corruption in Bangladesh: Developing citizen involvement. *Public Administration and Development*, 29(2): 117-132.
- Leff, N. H., (1964), *Economic development through bureaucratic corruption*. *American Behavioral Scientist* 8: 8-14. Reprint in A. J. Heidenheimer, M. Johnston and V. T. LeVine (Eds.), *Political corruption: A handbook*, 389-403, 1989. Oxford, Transaction Books.
- Lewis, M., (2006). *Governance and corruption in public health systems*. Center for Global Development Working Paper, 78.
- Leys, C., (1965), What is the problem about corruption? *Journal of Modern African Studies* 3: 215-230. Reprint in A. J. Heidenheimer, M. Johnston and V. T. LeVine (Eds.), *Political corruption: A handbook*, 51-66, 1989. Oxford: Transaction Books.
- Li, Q., An, L., Xu, J., Balamoune-Lutz, M., (2018), Corruption costs lives: Evidence from a cross-country study. *European Journal of Health Economics*, 19(1): 153-165. DOI 10.1007/S10198-017-0872-z
- Lien, D. H. D., (1986), A note on competitive bribery games. *Economics Letters*, 22: 337-341.
- Lin, R-T., Chien, L-C., Chen, Y-M., Chan, C-C., (2014), Governance matters: An ecological association between governance and child mortality. *International Health*, 6: 249-257. Doi:10.1093/inthealth/ihu018
- Linden, M., Ray, D., (2017), Aggregation bias-correcting approach to the health-income relationship: Life expectancy and GDP per capita in 148 countries, 1970-2010. *Economic Modelling*, 61: 126-136. doi.10.1016/j.econmod.2016.12.001
- Lio, M-C., Lee, M-H., (2016), Corruption costs lives: A cross-country study using an IV approach. *International Journal of Health Planning Management*, 31: 175-190. DOI: 10.1002/hpm.2305
- London, B., Williams, B. A., (1990), National politics, international dependency, and basic needs provision: A cross-national analysis. *Social Forces*, 69: 565-584.
- Lui, F. T. (1985), An equilibrium queuing model of bribery. *Journal of Political Economy*, 93: 760-781.
- Makuta, I., O'Hare, B., (2015), Quality of governance, public spending on health and health status in Sub Saharan Africa: A panel data regression analysis. *BMC Public Health*, 15(932): 1-11. DOI.10.1186/s12889-015-2287-z
- Mauro, P., (1998), Corruption and the composition of government expenditure. *Journal of Public Economics*, 69: 263-279.

- Méon, P. G., Sekkat, K., (2005), Does corruption grease or sand the wheels of growth? *Public choice*, 122: 69-97.
- Pandolfelli, L. E., Shandra, J. M., (2013), The International Monetary Fund, structural adjustment, and women's health: A cross-national analysis of maternal mortality in Sub-Saharan Africa. *Sociological Quarterly*, 55(1): 119-142.
- Pesaran, M. H., Shin, Y., Smith, R., (2001), Bound testing approaches to the analysis of level relationship. *Journal of Applied Econometrics*, 16(3): 289-326.
- Phillips, P. C., Perron, P., (1988), Testing for a unit root in time series regression. *Biometrika*, 75(2): 335-346.
- Popoola, T. O., (2018), Corruption and health sector performances in West Africa countries: A theoretical analysis. *Journal of Economics and Management Sciences*, 1(2): 13-20. doi.org/10.30560/jems.v1n2p13
- Pritchett, L., Summers, L. H., (1996), Wealthier is healthier. *Journal of Human Resources*, 31(4): 841-868.
- Ragin, C. C., Bradshaw, Y. W., (1992), International economic dependence and human misery, 1938-1980: A global perspective. *Sociological Perspective*, 35: 217-247.
- Sam, C.Y., Mcnown, R., Goh, S.K., (2019), An augmented Autoregressive Distributed Lag bounds test for cointegration. *Economic Modelling*, 80: 130-141. doi.org/10.1016/j.econmod.2018.11.001
- Sarker, B., Khan, F., (2020), Nexus between foreign direct investment and economic growth in Bangladesh: An augmented autoregressive distributed lag bounds testing approach. *Financial Innovation*, 6(10): 1-18. doi.org/10.1186/s40854-019-0164-
- Shen, C., Williamson, J. B., (2001), Accounting for cross-national differences in infant mortality decline (1965-1991) among less developed countries: Effects of women's status, economic dependency, and state strength. *Social Indicators Research*, 53: 257-288.
- Shleifer, A., Vishny, R. W., (1993), Corruption. *Quarterly Journal of Economics*, 108: 599-617.
- Smith, S. F., (1998), *Cointegration tests when data are linearly interpolated*. Unpublished Paper, State University of New York at Albany.
- Sommer, J. M., (2020), Corruption and health expenditure: A crossnational analysis on infant and child mortality. *European Journal of Development Research*, 32: 690-717. https://doi.org/10.1057/s41287-019-00235-1
- Swaleheen, M., Ali, M. S. B., Temimi, A., (2019), Corruption and public spending on education and health. *Applied Economics Letters*, 26(4): 321-325. DOI: 10.1080/13504851.2018.1468549
- Tang, C. F., (2008), A re-examination of the relationship between electricity consumption and economic growth in Malaysia. *Energy Policy*, 36: 3077-3085. doi:10.1016/j.enpol.2008.04.026
- Tang, C. F., Lean, H. H., (2007), Is Phillips curve stable in Malaysia? New empirical evidence. *Malaysian Journal of Economic Studies*, 44(2): 95-105.
- Terrelonge, S. C., (2014), For health, strength, and daily food: The dual impact of remittances and public health expenditure on household health spending and child health outcomes. *Journal of Development Studies*, 50(10): 1397-1410. DOI: 10.1080/00220388.2014.940911
- Transparency International (2015), Corruption: Cost for developing countries. Transparency International: The global coalition against corruption. Berlin: Transparency International (accessed 8/5/2023).
- UNICEF (2023), Under-five mortality. https://data.unicef.org/topic/child-survival/under-five-mortality/ (accessed 8/5/2023).
- Vaidean, V. L., Cuceu, I. C., Florescu, D. R., (2021), The impact of corruption on health outcomes: Empirical evidence on EU-27. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Horticulture*, 78(2): 156-163. DOI: 15835/buasvmcn-hort:2021.0014
- Vian, T., (2008), Review of corruption in the health sector: Theory, methods and interventions. *Health Policy and Planning*, 23: 83-94.

- Vian, T., Savedoff, W., Mathisen, H., (2010), *Anti-corruption in the health sector: Strategies for transparency and accountability*. Kumarian Press: Sterling, VA.
- World Bank (1995). Philippines: Public expenditure management for sustained and equitable growth. World Bank Report No. 14680-PH. World Bank: Washington.

Nurudeen Abu, PhD, is a Professor of economics and Director of Academic Planning at Baba-Ahmed University Kano, Nigeria. He has served as Dean of the School of Management and Social Sciences, Mewar International University, and Head of the Department of Economics at Umaru Musa Yar'adua University Nigeria. He received his PhD in economics from Universiti Utara Malaysia. His research interests include economics of corruption and development, financial and monetary economics, and public sector economics. His research efforts have appeared in leading journals of economics indexed in Web of Science and Scopus including International Journal of Finance and Economics, Economic Change and Restructuring, Economic Research-Ekonomska Istraživanja, Contemporary Economics, and South East European Journal of Economics and Business. ORCID no. <https://orcid.org/0000-0002-9843-977X>.

Ben Obi received his PhD from Nigeria's Premier University (University of Ibadan). The Professor of economics has served as Deputy Dean of the Faculty of Social Sciences, University of Abuja and Lead Economist in the Office of the Economic Adviser to a former President. Obi has consulted for many international organizations including the African Development Bank and European Union. He is currently an External Examiner to post-graduate programmes in many universities. His research interests include energy and resource economics, and he has authored articles published in journals indexed in Scopus and Web of Science among which are Organizations and Markets in Emerging Economies, Scientific Annals of Economics and Business, and Forum Scientiae Oeconomia. ORCID no. <https://orcid.org/0000-0002-6093-7378>

Onyewuchi Amaechi Ben-Obi, MSc, is a PhD candidate in economics at the University of Abuja, Nigeria, and an Assistant Director in the Research Department of the Central Bank of Nigeria. Her research works have appeared in Scopus and Web of Science indexed journals such as Contemporary Economics, Organizations and Markets in Emerging Economies, and Economics Studies-Ikonomicheski Izsledvania. ORCID no. <https://orcid.org/0009-0008-4481-2242>.

Brand Authenticity as the Basis for Creating Perceived Value in the Management of the Most Valuable Polish Brands

HANNA GÓRSKA-WARSEWICZ

Abstract

DOI: 10.23762/FSO_VOL11_N04_10

Recently, there has been increasing interest in brand authenticity and brand value in management theory and practice. However, there are few empirical research papers examining the relationship between brand authenticity and brand value. There are no such studies for the most valuable brands; therefore, the purpose of this research was to determine the relationship between authenticity and perceived value for such brands. The influence of selected determinants (brand consistency, continuity, individuality, and credibility) on the authenticity of the most valuable Polish brands was also analysed. The quantitative survey was conducted in the first quarter of 2023 on a sample of 495 respondents. Structural equation modelling using partial least squares (PLS-SEM) was applied to support the conceptual framework and proposed hypotheses. The results indicate that the authenticity of the most valuable Polish brands positively influences their perceived value. In addition, the consistency, continuity, individuality, and credibility of these brands positively influence their perceived value. The results of this study indicate the importance of the authenticity of the most valuable Polish brands in shaping their perceived value. Brand marketers should make consistent efforts to enhance the authenticity of brands by increasing their credibility, consistency, continuity, and individuality. This is necessary to continuously monitor brand perceptions in terms of fulfilling promises, consistency of actions taken and being trustworthy.

Key words

brand authenticity, perceived value, brand individuality, brand continuity, brand consistency, brand credibility.

Hanna Górską-Warsewicz

e-mail: hanna_gorska-warsewicz@sggw.edu.pl

Warsaw University of Life Sciences,

Warsaw, Poland

Introduction

In recent years, brand authenticity has been subject to theoretical consideration and empirical research by researchers and managers responsible for brand management processes (Becker, Wiegand and Reinartz, 2019; Hernandez-Fernandez and Lewis, 2019; Shirdastian, Laroche and Richard, 2019; Nunes, Ordanini and Giambastiani, 2021; Campagna, Donthu and Yoo, 2023). Brand authenticity reflects an iconic, personal, practical, social, and situational experience (Davis, Sheriff and Owen, 2019), indicating the genuineness, reality, and/or true nature of a market offering (Becker, Wiegand and Reinartz, 2019). In addition, brand authenticity positively influences brand equity (Vredenburg et al., 2020) and brand trust (Portal, Abratt and Bendixen, 2019), generates added value for consumers (Goulding and Derbaix, 2019), and shapes consumer-brand relationships (Oh et al., 2019). Ongoing theoretical analysis and empirical research over the past 25 years have addressed three research streams: the characteristics and attributes of authenticity, its functions, and the emotional aspects (Södergren, 2021). This results in a wide range of dimensions of brand authenticity, including, among others, individuality, consistency (Hernandez-Fernandez and Lewis, 2019), continuity (Morhart et al., 2015; Carsana and Jolibert, 2018; Hernandez-Fernandez and Lewis, 2019), and credibility (Morhart et al., 2015; Carsana and Jolibert, 2018; Becker, Wiegand and Reinartz, 2019).

At the same time, there is growing interest in brand value due to the impact of brand competitiveness on brand value (Gupta et al., 2020), brand resonance, profitability, and market value (Abdellatif and Elsayed, 2023), as well as value co-creation (Merz, Zarantonello and Grappi, 2018; Wang et al., 2020) and consumer choices (Lu, Gursoy and Lu, 2015; Salehzadeh and Pool, 2017; Akkaya, 2021). This is due to the assumption

that consumers buy the products that have the highest perceived value to them (Rajh, 2012). Taking the value of a brand into account, rankings are created that measure this parameter in monetary terms. These include rankings of the world's most valuable brands (Interbrand, 2022), and individual countries also publish rankings of the most valuable national brands (Forbes, 2022). Some of these rankings consider only financial data; others refer to consumer variables such as the size of groups of loyal buyers, perceptions of a brand's uniqueness, its growth perspectives, etc.

Notwithstanding the increasing interest in these two issues, brand authenticity and brand value, there are relatively few publications on the impact of brand authenticity on brand value. The available publications indicate that brand authenticity is relevant to management processes in the context of new product development as a source of economic value (Choi et al., 2015). In this aspect, authenticity leads to enhancing the status of brands, achieving a price premium, and fending off competition (Beverland, 2005). In parallel, the perception of authenticity has become a determinant of brand value, which has a significant impact on consumers' intention to choose a brand (Lu, Gursoy and Lu, 2015).

Given the importance of brand authenticity and brand value, there are a limited number of publications on the interdependence of these two variables. The available studies refer to the luxury segment using ultra-premium wine brands as an example (Beverland, 2006), mass-market context (Alexander, 2009) and brands from selected product segments. Examples include four beer brands and five fast-food chain brands (Schallehn, Burmann and Riley, 2014), or 48 craft beer brands (Hernandez-Fernandez and Lewis, 2019). To determine the positive impact of continuity, 27 authentic brands (Bruhn et al., 2012), 22 well-known brands

(Morhart et al., 2015) and private labels belonging to the Carrefour retail chain (Carsana and Jolibert, 2018) were analysed.

There are no studies analysing the relationship between brand authenticity and brand value for the most valuable brands. Therefore, the purpose of this study was to determine the relationship between the authenticity of brands and their perceived value and the impact of brand consistency, continuity, individuality, and credibility on the authenticity of the most valuable Polish brands. The 20 most valuable Polish brands were analysed according to the 2022 ranking by financial value (Forbes, 2022). The following questions were formulated: Does brand authenticity influence the formation of brand value for the brands considered most valuable? What dimensions are important for the brand authenticity of the most valuable brands?

1. Literature review

1.1. The concept of brand authenticity

Brand authenticity is defined as a consumer assessment described by accuracy, connection, integrity, legitimacy, originality, and proficiency (Nunes, Ordanini and Giambastiani, 2021). It is also perceived as a subjective evaluation of genuineness attributed to a brand by consumers in terms of commitment to quality, sincerity, and heritage (Napoli et al., 2014). In this sense, the concept of brand authenticity is also defined as a consumer assessment of the degree to which a brand is authentic (or inauthentic), real, genuine, superior, traditional, sincere, and honest (Kadirov, 2010). Therefore, authenticity is used when consumers evaluate products they consider valuable because of the way they are produced (Valesia, Nunes and Ordanini, 2016). The literature lists different sets of terms that define brand authenticity. It is indicated that brand authenticity focuses on being original, genuine, and demonstrating integrity (Alexander, 2009),

being authentic, real, and genuine (Newman and Dhar, 2014), as well as genuine, real, and/or true (Becker, Wiegand and Reinartz, 2019).

Authenticity is a multidimensional experience, including iconic, practical/impersonal, productive/situational, and social forms of the authentic experience (Davis, Sheriff and Owen, 2019). The originality of the product related to the place of its production is one of the determinants of authenticity (Newman and Dhar, 2014). This is due to attribute-oriented authenticity, which can be achieved by buying an original or authentic product. In addition, it focuses on the brand experience (Yuan et al., 2014). Therefore, the attributes of authenticity are both real and stylised versions of the truth (Beverland, 2006). In the literature, authenticity is also analysed from the perspective of companies, pointing to its distinguishing features and brand social responsibility (Mazutis and Slawinski, 2015). Authenticity can be achieved through individual acts of authentication or collective activities. Authenticity understood in this way has two dimensions: self-authentication and social identity. Consumers focus on specific cues that indicate what is genuine, real, and true (Beverland and Farrelly, 2010).

In view of the above, authenticity is not only an attribute of what is called genuine, but is also socially constructed (Peterson, 2005). This is indicated by empirical studies linking authenticity to memory and brand recall experiences. Such perceptions are stored in consumers' memories and constitute determinants of their market behaviour (Manthiou et al., 2018). At the same time, brand authenticity positively influences relationship quality, which positively influences behavioural intentions (Fritz, Schoenmueller and Bruhn, 2017).

Many dimensions of brand authenticity are analysed in the literature (Table 1). Among the most commonly analysed are continuity (Bruhn et al., 2012; Schallehn, Burmann and Riley, 2014; Morhart et

al., 2015; Carsana and Jolibert, 2018; Hernandez-Fernandez and Lewis, 2019), consistency (Beverland, 2006; Alexander, 2009; Schallehn, Burmann and Riley, 2014; Hernandez-Fernandez and Lewis, 2019), credibility and reliability (Liao and Ma, 2009; Bruhn et al., 2012; Morhart et al., 2015; Carsana and Jolibert, 2018).

Table 1. Dimensions of brand authenticity

Authors	Dimensions
Grayson and Martinec, 2004	genuineness, truth
Beverland, 2006	heritage and pedigree, stylistic consistency, quality commitments, connection to place, specific production method
Liao and Ma, 2009	originality, commitment to quality and credibility, heritage and style persistence, scarceness, sacredness, and purity
Alexander, 2009	heritage and pedigree, stylistic consistency, commitment to quality, connection to place, specific production method
Beverland and Farrelly, 2010	self-authentication, social identity
Kadirov, 2010	reality, true-self, commercialisation, uniqueness, history, community link, empowerment
Kolar and Zabkar, 2010	cultural motivation, object authenticity, existential authenticity, loyalty
Bruhn et al., 2012	continuity, originality, reliability, naturalness
Schallehn, Burmann and Riley, 2014	individuality, consistency, continuity
Napoli et al., 2014	quality commitment, sincerity, heritage
Morhart et al., 2015	continuity, credibility, integrity, symbolism
Lu, Gursoy and Lu, 2015	brand awareness, brand association, perceived quality
Fritz, Schoenmueller and Bruhn, 2017	brand heritage, brand nostalgia, brand commercialisation, brand clarity, brand's social commitment, brand legitimacy, actual self-congruence and employees' passion
Carsana and Jolibert, 2018	integrity, credibility, symbolism, continuity
Tran and Keng, 2018	realism, aesthetics, control, originality, connection, virtue
Davis, Sheriff and Owen, 2019	iconic/time of origin, self-identification
Shirdastian, Laroche and Richard, 2019	commitment to quality, heritage, uniqueness, symbolism
Hernandez-Fernandez and Lewis, 2019	individuality, consistency, continuity
Becker, Wiegand and Reinartz, 2019	preserving the brand essence, honouring brand heritage, showing a realistic plot, presenting a credible message
Nunes, Ordanini and Giambastiani, 2021	accuracy, connection, integrity, legitimacy, originality, proficiency

Authors	Dimensions
Campagna, Donthu and Yoo, 2023	conscious, longevity, self-empowerment

Source: own elaboration

The importance of brand authenticity is indicated by the fact that it is analysed in different variants regarding various industries and companies. For example, brand authenticity is a mediating variable in inferring trust in family businesses. Consumers perceive brands that communicate family nature as more authentic, which leads to greater trust in the brand (Lude and Prügl, 2018). In tourism, authenticity is considered from the perspective of enjoyment and the perceived authenticity of tourists' experiences. Cultural motivation, object authenticity, existential authenticity, and loyalty are analysed as dimensions of authenticity (Kolar and Zabkar, 2010). In this view, authenticity is a social construct that can change due to different perceptions and interpretations of a place, situation, person, or object (Liang, Choi and Joppe, 2017). In the case of games, on the other hand, authenticity is based on the player's perception of the genuineness of things (virtual items), rituals, and traditions in the game world (Wu and Hsu, 2018).

1.2. Brand consistency, continuity, individuality, and credibility as dimensions of brand authenticity

Brand consistency, brand continuity, and brand individuality are among the dimensions of brand authenticity. This is based on the premise that to improve brand authenticity, companies should strive for a unified brand perception using all communication sources. This means a consistent presentation of the brand name, logo, and slogan through all communication tools (Bruhn et al., 2012).

Consistency measures the attributes expressed by the repeatability of current brand

behaviour and image. Thus, a high level of consistency is perceived if the brand promise is fulfilled at every brand touchpoint. This is coherence (Schallehn, Burmann and Riley, 2014) and stylistic consistency as a dimension of brand authenticity (Alexander, 2009). Perceived brand consistency can also refer to a brand's behaviour that reflects its core values and norms, according to which it is perceived to be true to itself. This perceptual process includes two types of authenticity (indexical and iconic) (Fritz, Schoenmueller and Bruhn, 2017).

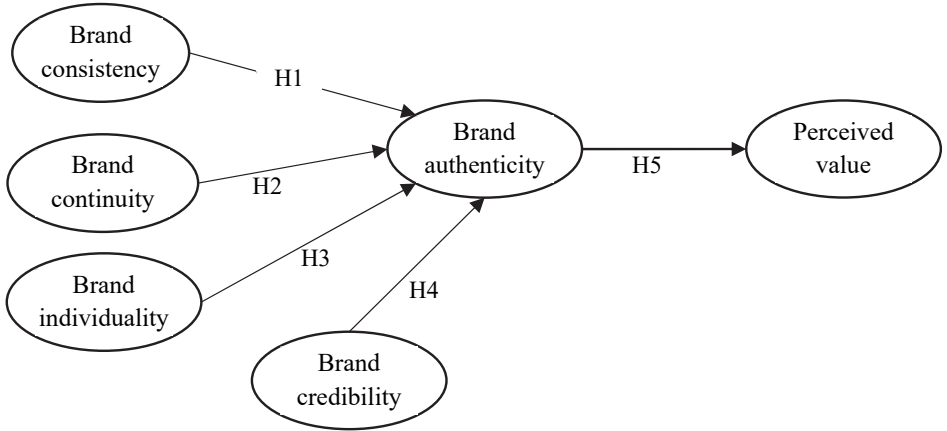
Previous studies have confirmed the positive impact of brand consistency on brand authenticity. This was concluded in the luxury segment with the example of ultra-premium wine brands. Using the case study method and interviews, six attributes of authenticity were analysed. The importance of consistency was proven in the context of receiving the same product repeatedly, with the same quality, without any variation or deviation (Beverland, 2006). Analogous determinants, including brand consistency, were analysed through the case study method in the mass-market context, indicating the influence of this variable on brand authenticity (Alexander, 2009). In turn, a study of four beer brands and five fast-food chain brands proved the positive effect of brand consistency on brand authenticity. For beer brands the positive effect was confirmed at $p < 0.01$, while for fast-food chain brands it was confirmed at $p < 0.1$. In structural modelling, the highest path coefficient value of 0.47 was obtained for beer, with 0.17 for fast-food chain brands and 0.36 for the entire study sample (Schallehn, Burmann and Riley, 2014). Also, a study of 48 craft beer

brands in the U.S. market confirmed the positive impact of brand consistency on brand authenticity, indicating that current brand actions affect the perception of the brand as authentic (Hernandez-Fernandez and Lewis, 2019).

Based on these arguments and empirical findings, the first research hypothesis was formulated (Figure 1):

H1: Brand consistency positively influences brand authenticity.

Figure 1. Research model of brand authenticity



Source: own elaboration

Continuity indicates whether a brand is stable over time and remains true to itself. It also identifies whether the brand has a clear concept that it follows (Bruhn et al., 2012). At the same time, brand reliability and naturalness are important for brand continuity. Brand reliability indicates whether a brand keeps and delivers on its promises, as well as whether the brand’s promises are credible and reliable. Naturalness, on the other hand, means that the brand does not seem artificial (Bruhn et al., 2012). Since continuity refers to stability over a long period of time, consumers rate it highly if the current brand promise reflects past brand behaviour. In this sense of brand continuity, the positive impact of this variable on brand authenticity was confirmed for beer brands and major fast-food chains. The highest path coefficient value of 0.53 (with $p<0.01$) was obtained for fast-food brands, with the path coefficient for beer at 0.27 ($p<0.01$) and the entire population at 0.37 ($p<0.01$). This strong relationship

between brand continuity and brand authenticity is due to fast-food chains adjusting their markets to changing consumer preferences (Schallehn, Burmann and Riley, 2014). Also, in the case of craft beer brands, the positive impact of brand continuity on brand authenticity has been confirmed, indicating the importance of previous brand activities on current consumer perceptions of brand authenticity (Hernandez-Fernandez and Lewis, 2019). Brand continuity was also confirmed as a dimension of brand authenticity in other empirical studies. These studies looked at 27 brands recognised as authentic, for example, Lacoste, Nike, Levi’s, Tommy Hilfiger, Vittel, Gucci, and Zara (Bruhn et al., 2012), and 22 brands such as Coca-Cola, Harley-Davidson, McDonald’s, IKEA, and Microsoft (Morhart et al., 2015). Also, in a study of private labels belonging to the Carrefour retail chain, brand continuity was proven to be a dimension of brand authenticity. Standard and premium private label brands (Carrefour and Reflets de

France) were analysed, differentiated by quality-price positioning and the occurrence of brand alliances (Carsana and Jolibert, 2018).

In the context of the empirical results, the following hypothesis was formulated:

H2: Brand continuity positively influences brand authenticity.

Individuality is defined as the unique way in which a brand fulfils its promise (Schallehn, Burmann and Riley, 2014). Uniqueness, analysed in the context of originality, is also one of the dimensions of brand authenticity (Liao and Ma, 2009; Nunes, Ordanini and Giambastiani, 2021). Originality also indicates commitments relating to offer quality (Alexander, 2009) and user perception (Tran and Keng, 2018) as well as uniqueness and differentiation from others (Bruhn et al., 2012).

The empirical study confirmed the positive effect of brand individuality on brand authenticity. This was confirmed for beer brands and brands of major food chains, obtaining path coefficient values of 0.15 for fast-food brands, 0.17 for beer brands, and 0.15 for the entire study population, each time at $p < 0.01$. It was indicated that for food chain brands and beer brands, brand individuality plays a smaller role in the context of perceived brand authenticity compared to brand continuity (Schallehn, Burmann and Riley, 2014). A study of craft beer brands found results indicating that brand individuality had a positive impact on brand authenticity which was greater than that of brand consistency and brand continuity (Hernandez-Fernandez and Lewis, 2019).

Based on these arguments, the following hypothesis was formulated:

H3: Brand individuality positively influences brand authenticity.

Brand credibility is analysed in the literature as a determinant of brand authenticity

(Liao and Ma, 2009), including the context of reliability and being true and honest (Tran and Keng, 2018). In this aspect, brand credibility is defined as the believability of the product information contained in the brand, which causes consumers to perceive the brand as having the ability (i.e. expertise) and willingness (i.e. trustworthiness) to continuously deliver what has been promised (Erdem and Swait, 2004). Brand credibility is also analysed as a determinant of brand equity (Adnan, Naveed and Ahmad, 2006; Ng et al., 2014; Delafrooz and Goli, 2015; Esmaeli et al., 2017; Akturan, 2018).

In addition, brand credibility is essential to consumer trust. A decline in trust occurs when brands' activities differ from the promises and values they communicate. Brand authenticity is believed to have a positive impact on brand trust (Portal, Abratt and Bendixen, 2019). Creating an impression of authenticity requires the creation of a sincere story consisting of a creative combination of multiple attributes. Sincerity can be achieved in a number of ways, such as by publicly declaring handcrafted techniques, uniqueness, connection to place, passion, and using modern marketing techniques (Beverland, 2005).

Brand credibility as a dimension of brand authenticity was confirmed in authenticity studies of 20 brands, including Apple, Coca-Cola, Harley-Davidson, McDonald's, IKEA, and Microsoft (Morhart et al., 2015). Similar results were obtained in a study of standard and premium private label brands owned by international retailer Carrefour (Carsana and Jolibert, 2018).

In this context, the following hypothesis was proposed:

H4: Brand credibility positively influences brand authenticity.

1.3. Brand authenticity as a dimension of perceived value

The concept of value has been widely studied in exploratory and empirical studies

(Zeithaml, 1988; Woodruff, 1997; Rajh, 2012; Tabaku and Kushi, 2013), including the context of brand authenticity (Kovács, Carroll and Lehman, 2014; Hernandez-Fernandez and Lewis, 2019). Perceived value is based on the consumer's evaluation of product quality and perceived costs (Zeithaml, 1988). Definitions of this concept address these two issues (Rajh, 2012), but the most commonly perceived value is defined as the consumer's overall assessment of a product's utility based on perceptions of what is received in the exchange process (Zeithaml, 1988). Value formation derives from the assumption that the consumer buys the product that has the highest perceived value to him (Rajh, 2012). From this perspective, perceived value can be viewed as the ratio of perceived quality to perceived cost (Suri and Monroe, 2003). Perceived value, then, is the result or benefit that customers receive in relation to the price paid for the product or service (Woodruff, 1997).

The literature also points to the relationship between brand heritage and authenticity while identifying the impact of brand heritage on four dimensions of perceived value: economic, functional, affective, and social. Some elements that characterise brand heritage are included in brand continuity and differentiation (Wuestefeld et al., 2012). In addition, the relationship between customers and brands, particularly the experience of brand authenticity, can also be a critical determinant for generating perceived value (Hernandez-Fernandez and Lewis, 2019).

Two empirical studies by Kovacs (2019) have proven the relationship between post-registration brand authenticity and brand value. The first study analysed online reviews and ratings of restaurants by consumers. It proved that restaurants perceived as authentic were rated higher. Such ratings were influenced by the type of restaurant, chain affiliation, and specialisation. Specialty, family, and non-network restaurants were rated as more authentic and thus higher. The second

study confirmed the results obtained in an experiment involving the presentation of photos of fictitious restaurants. Findings from both studies indicated a positive impact of brand authenticity on consumers' perceived value (Kovács, Carroll and Lehman, 2013).

A study of craft beer brands confirmed the positive effect of brand authenticity on their perceived value; that is, higher perceived brand authenticity determines higher perceived value, understood as the price/quality ratio. The purchase of such a brand is perceived as more favourable and acceptable in terms of price and value level (Hernandez-Fernandez and Lewis, 2019).

In this context, the following hypothesis was formulated:

H5: Brand authenticity positively influences perceived brand value.

2. Methodology

2.1. Study design

This study was conducted as a quantitative study using partial least squares structural equation modelling (PLS-SEM) to support the conceptual framework and proposed hypotheses. This study examines the influence of brand authenticity on perceived value and the influence of brand consistency, continuity, individuality, and credibility on brand authenticity. The 20 most valuable Polish brands, according to a published ranking, were analysed (Forbes, 2022). These brands were as follows: Biedronka (food retailing), Orlen (fuel sector), PKO BP (banking sector), Santander Bank Polska (banking sector), mBank (banking sector), ING Bank (banking sector), Allegro (retailing), Bank Millennium (banking sector), Lotos (fuel sector), PZU (insurance), Play (telecommunication), Bank Pekao (banking sector), Alior Bank (banking sector), Plus (telecommunications), Żabka (food retailing), Dino (food retailing), WARTA (insurance), Żywiec (beer), Reserved (clothes), and Tyskie (beer).

The survey was conducted in the first quarter of 2023 using an online questionnaire. The criteria for inclusion in the survey was to list at least five brands that are among the most valuable Polish brands. 670 completed records were obtained, 175 of which were eliminated due to their incompleteness and the failure to list five brands belonging to the 20 most valuable Polish brands. The survey was anonymous; no data that could identify the respondents was collected.

The questionnaire consisted of two parts. The first part included questions about gender, age, household type, and household income, while the second part included statements to evaluate the variables studied, such as brand consistency, continuity, individuality, authenticity, credibility, and perceived value. A total of 32 items were used in the study: five items each for brand consistency, brand credibility, and perceived value; seven items each for brand continuity and brand authenticity; and three items for brand individuality. The scales for assessing brand consistency, continuity, individuality, and authenticity were adapted from a study conducted by Schallehn et al. (2014), which was subjected to replication research (Hernandez-Fernandez and Lewis, 2019). This study also included the scales used by Eggers et al. (2013) for brand consistency, by Morhart et al. (2015) for brand continuity, and by Moulard et al. (2016) for brand authenticity. Scales for brand credibility were adapted from studies by Morhart et al. (2015) and Akturan et al. (2018). Perceived value was examined using a scale introduced by Rajh (2012). The items were rated on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree).

2.2. Data analysis

PLS-SEM modelling, known as Partial Least Squares Path Modelling, was used to test the research model. This modelling method uses the partial least squares method and

is categorised as 'soft' or 'light' modelling (Sarstedt, Ringle and Hair, 2014). Cronbach's alpha index was used to assess the internal consistency of the test. Composite reliability was calculated using Dijkstra-Henseler's ρ_a and Dillon-Goldstein's ρ_c indices. In contrast, average variance extracted (AVE) was used to validate the constructs.

2.3. Sample population

The survey included 495 people from Warsaw, 53.7% of whom were women and 46.3% of whom were men. In terms of age, the largest group was 30–39 years old (27.5%), followed by groups of respondents aged 18–29 (22.8%) and 40–49 (20.6%). In terms of household type, 66.1% came from family households, and the remainder from single households. More than two-thirds of the surveyed population were employed. However, in the structure of the surveyed population in view of income, the largest groups were those with an income of PLN 5001 – PLN 6500 (26.1%) and PLN 3501 – PLN 5000 (23.2%).

3. Research results

3.1. Measurement model

Table 2 presents the factor loadings, construct reliability, and validity for the measurement model. Factor loadings ranged from 0.675 to 0.810 for brand consistency, from 0.674 to 0.830 for brand continuity, from 0.813 to 0.850 for brand individuality, from 0.669 to 0.844 for brand credibility, from 0.679 to 0.775 for brand authenticity, and from 0.774 to 0.834 for perceived value.

Cronbach's alpha index was used to assess construct reliability as an indicator that determines internal consistency. It indicates the degree to which test items are related to each other. Cronbach's alpha index took values ranging from 0.784 for the construct denoting brand individuality (BI) to 0.855 for perceived value (PV) and 0.856 for brand authenticity (BA). A reliability between 0.7

and 0.95 is accepted as satisfactory (Tavakol and Dennick, 2011).

Composite reliability was calculated using Dijkstra-Henseler's rho_a and Dillon-Goldstein's rho_c indices. The reliability indices rho_a and rho_a reached satisfactory values above 0.7, with rho_a ranging from 0.799 for brand individuality (BI) to 0.886 for brand credibility (BCr). The rho_c index ranged from 0.871 for brand individuality (BI) to 0.913 for brand credibility (BCr).

The average variance extracted (AVE) was used to validate constructs as a measure of the amount of variance that is captured by a construct in relation to the amount of variance due to measurement error (dos Santos and Cirillo, 2021). In this study, AVE ranged from 0.538 for brand authenticity to 0.726 for brand credibility. A satisfactory value for this indicator is above 0.5.

Table 2. Factor loadings, construct reliability and validity

Constructs	Items	Factor loadings	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Brand consistency (BC)	BC-1	0.675	0.802	0.804	0.863	0.558
	BC-2	0.757				
	BC-3	0.679				
	BC-4	0.803				
	BC-5	0.810				
Brand continuity (BCC)	BCC-1	0.812	0.872	0.879	0.901	0.567
	BCC-2	0.785				
	BCC-3	0.830				
	BCC-4	0.730				
	BCC-5	0.731				
	BCC-6	0.698				
	BCC-7	0.674				
Brand individuality (BI)	BI-1	0.813	0.784	0.799	0.871	0.693
	BI-2	0.834				
	BI-3	0.850				
Brand credibility (BCr)	BCr-1	0.748	0.873	0.886	0.913	0.726
	BCr-2	0.834				
	BCr-3	0.844				
	BCr-4	0.741				
	BCr-5	0.669				
Brand authenticity (BA)	BA-1	0.759	0.856	0.858	0.890	0.538
	BA-2	0.725				
	BA-3	0.769				
	BA-4	0.714				
	BA-5	0.705				
	BA-6	0.679				
	BA-7	0.775				
Perceived	PV-1	0.789	0.855	0.857	0.896	0.634

Constructs	Items	Factor loadings	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
value	PV-2	0.774				
(PV)	PV-3	0.777				
	PV-4	0.805				
	PV-5	0.834				

Source: own elaboration

3.2. Discriminant validity

In analysing the discriminant validity (Table 3), the Fornell-Larcker criterion (Fornell and Larcker, 1981) was applied, and the values of the AVE square root and the inter-construct correlations were compared. Each time, the value of the square root of AVE was greater

than the coefficients between constructs. The heterotrait-monotrait ratios of correlations (HTMT) were calculated (Table 4), obtaining a satisfactory value of less than 0.85 each time (HTMT85 (HTMT<0.85)) (Henseler, Ringle and Sarstedt, 2015).

Table 3. Discriminant validity – Fornell-Larcker criterion

	BA	BC	BCC	BCr	BI	PV
BA	0.733					
BC	0.626	0.747				
BCC	0.693	0.644	0.753			
BCr	0.460	0.361	0.374	0.852		
BI	0.540	0.500	0.509	0.337	0.833	
PV	0.580	0.478	0.498	0.708	0.431	0.796

Source: own elaboration

Table 4. Discriminant validity – Heterotrait-monotrait ratios (HTMT)

	BA	BC	BCC	BCr	BI	PV
BA						
BC	0.730					
BCC	0.790	0.755				
BCr	0.527	0.414	0.431			
BI	0.636	0.604	0.600	0.394		
PV	0.676	0.556	0.569	0.814	0.514	

Source: own elaboration

3.3. Variance inflation factor

Collinearity was checked with the variance inflation factor (VIF), which should achieve a value of less than 5.00 (Hair, Ringle and Sarstedt, 2013). Table 5 shows

the VIF results for the study variables BC, BCC, BCr, BI, and PV with VIF coefficients below 5.00. This means no collinearity. The tested constructs can be subjected to further analysis.

Table 5. Collinearity statistics – Variance inflation factor (VIF)

	BA	BC	BCC	BCr	BI	PV
BA						1.000
BC	1.866					
BCC	1.903					
BCr	1.223					
BI	1.481					
PV						

Source: own elaboration

3.4. Hypothesis testing

Table 6 shows the statistical results for the five proposed hypotheses. The results show that the five hypotheses were accepted,

obtaining β ranging from 0.137 for H4 to 0.580 for H5, with T-values ranging from 3.347 for H4 to 16.143 for H5, and p values of 0.000 or 0.001.

Table 6. Path coefficients – bias-corrected confidence intervals

Hypotheses		Beta	SE	T-value	Bias-corrected confidence intervals		P values	Supported
					2.5%	97.5%		
H1	BC -> BA	0.193	0.043	5.211	0.137	0.303	0.000	Yes
H2	BCC -> BA	0.354	0.051	7.838	0.299	0.498	0.000	Yes
H3	BCr -> BA	0.305	0.044	3.991	0.086	0.258	0.000	Yes
H4	BI -> BA	0.137	0.050	3.347	0.065	0.261	0.001	Yes
H5	BA -> PV	0.580	0.036	16.143	0.502	0.643	0.000	Yes

Source: own elaboration

3.5. Mediating estimation

When testing specific indirect effects, four paths were identified with p values of 0.000 or 0.000 (Table 7). The largest β value was

obtained for the BCC -> BA -> PV path ($\beta = 0.232$, $p = 0.000$), and the smallest for the BI -> BA -> PV path ($\beta = 0.097$, $p = 0.001$).

Table 7. Specific indirect effects – bias-corrected confidence intervals

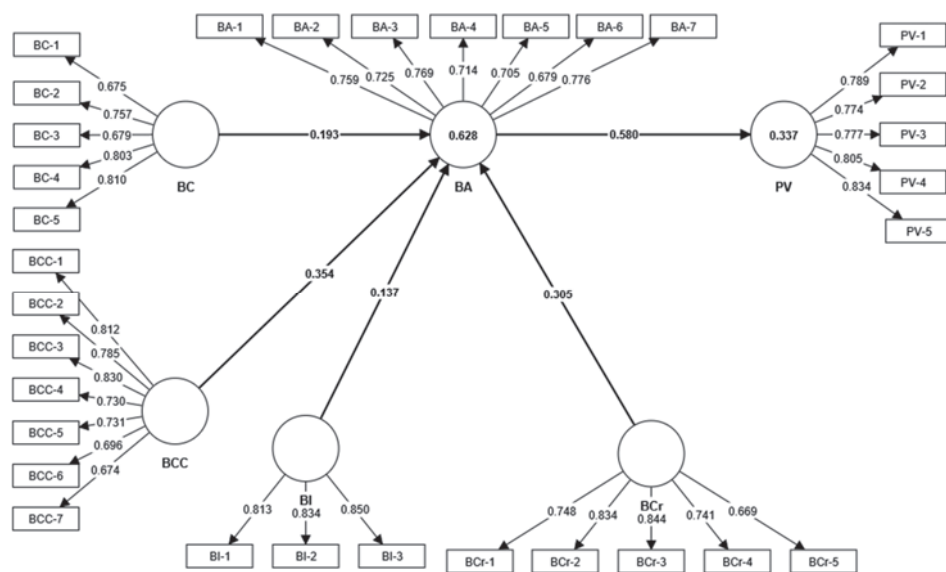
Paths	Beta	SE	T-value	Bias-corrected confidence intervals		P values
				2.5%	97.5%	
BI -> BA -> PV	0.097	0.029	3.291	0.038	0.153	0.001
BC -> BA -> PV	0.129	0.025	5.122	0.081	0.179	0.000
BCr -> BA -> PV	0.101	0.028	3.561	0.047	0.159	0.000
BCC -> BA -> PV	0.232	0.033	7.100	0.169	0.296	0.000

Source: own elaboration

Based on the relationships found and specific indirect effects, a structural model was developed, as shown in Figure 2. Based

on the figure, brand consistency, continuity, individuality, and credibility have a direct impact on brand authenticity.

Figure 2. Structural model of brand authenticity



Source: own elaboration

Figure 2 indicates that all five hypotheses proposed in this study were accepted. In addition, it was proven that there are four relationships regarding the indirect effect of brand authenticity on the perceived value of brands.

4. Discussion

The purpose of this study was to determine the relationship between the authenticity of the most valuable Polish brands and their perceived value and the impact of brand consistency, continuity, individuality, and credibility on brand authenticity. Five hypotheses were formulated and confirmed in this study. The discussion of the results is guided by these hypotheses.

This study proved that brand consistency, continuity, and individuality influence brand authenticity. The results confirm previous studies published in the literature

on the importance of brand consistency, continuity, and individuality in the formation of brand authenticity in the context of beer brands (Becks, Corona, Erdinger, Schöfferhofer, and Desperados) and fast-food restaurants (McDonalds, Burger King, Subway, Pizza Hut, and Kentucky Fried Chicken (KFC)) (Schallehn, Burmann and Riley, 2014). It was pointed out that a brand's fulfilment of its promise in an individual, consistent, and continuous manner could be considered the key to building brand authenticity. Brand individuality was found to be the least important factor, while consistency and continuity were found to be crucial for building brand authenticity. As an explanation, it was pointed out that brands are currently adjusting their product offerings to meet growing demand and changing consumer needs (Schallehn, Burmann and Riley, 2014). Similar results were obtained in another study, indicating that individuality,

consistency, and continuity positively influence consumer perceptions of brand authenticity. In addition, higher consumer perceptions of brand authenticity result in higher perceived value and trust in the brand (Hernandez-Fernandez and Lewis, 2019).

This study proved that the authenticity of the most valuable Polish brands is also determined by brand credibility in terms of honesty, trust, and delivering on value promises. This study is supported by the literature, indicating that high brand credibility is associated with high levels of brand trust (Kashif et al., 2018), brand loyalty (Rosli, Che-Ha and Ghazali, 2020), and corporate social responsibility (Wang et al., 2021). Brand credibility influences the retention of existing customers and the attraction of new ones by properly managing long-term customer satisfaction relationships. At the same time, it reduces brand-switching behaviour among customers (Sweeney and Swait, 2008), perceived uncertainty, and thus consumer vulnerability to the marketing efforts of other companies (Haryanto, Moutinho and Coelho, 2016).

This study proved that brand authenticity influences perceived value for the most valuable Polish brands. Authenticity was analysed in the context of fulfilling promises in accordance with the approved assumptions, character, and essence. These aspects are relevant from the perspective of the most valuable Polish brands, pointing to certain characteristics that characterise the management of the authenticity of these brands. The items consider that these brands 'know exactly what they represent' and 'do not promise anything that contradicts their essence and character'. In addition, these brands 'have a genuine passion for their business' and 'are willing to give their best by providing their products and services'. Moreover, they are 'dedicated to what they do' (Schallehn, Burmann and Riley, 2014; Moulard, Raggio and Folse, 2016; Hernandez-Fernandez and Lewis, 2019).

The literature points to the importance of perceived value as a determinant of brand equity (Callarisa et al., 2012; So et al., 2013; Suhartanto, Clemes and Dean, 2013; Pechyiam and Jaroenwanit, 2014; Delafrooz and Goli, 2015; Dolatabadi, Tabaeian and Tavakoli, 2016; Tiwari, Tiwari and Yaseen, 2016; Esmaeli et al., 2017; Gupta, Dash and Mishra, 2019) and consumer loyalty (So et al., 2013; Suhartanto, Clemes and Dean, 2013). Understanding brand equity refers to two main definitions that have been the subject of many replication studies. The first points to the set of brand assets and liabilities associated with a company's name and symbol that add or subtract from the value provided by a product or service (Aaker, 1991). Another approach relating to consumer-based brand equity points to the differential impact of brand knowledge on consumer responses to the marketing of the brand (Keller, 1993). The importance of loyalty is increasingly being analysed by companies in the context of improving and maintaining quality and high customer satisfaction (Salegna and Farzaneh, 2011). Consumer loyalty should be treated as the basis of strategic planning and an element of a company's competitive advantage (Kotler and Keller, 2016). Loyalty is a complex construct (Huang, Cheng and Chen, 2017; Unurlu and Uca, 2017; Rather, 2018; Nastasoïu and Vandenbosch, 2019) depicting the relationship between an individual's attitude and repeated purchases (Noyan and Şimşek, 2014) in relation to certain social norms and situational factors (Dick and Basu, 1994; Noyan and Şimşek, 2014).

In addition, perceived value influences brand reputation (Lai, 2019) and corporate reputation (Caruana and Ewing, 2010). This relationship is particularly important for brands that are among the most valuable Polish brands. Corporate reputation has been widely analysed in the literature from the point of view of management processes. For example, several attributes of corporate

reputation have been distinguished, including stakeholder perception, collective perception, permanence and stability, relativity, and positive or negative dimension (Walker, 2010). From a management perspective, perceived value is important in building brand reputation. A brand with a good reputation suits the predictability of consumers and satisfies their needs. Reputation can be analysed on the basis of past experiences regarding the credibility, integrity, and honesty of the company and its employees (Afzal et al., 2010). The literature cites such distinguishing characteristics of reputable brands as good image, honesty, and reliability (Waddington, 2012; Agmek, Wathoni and Santoso, 2019), as well as the ability to inspire consumer confidence (Waddington, 2012; Lingavel, 2015; Agmek, Wathoni and Santoso, 2019).

Conclusions

The present research proved the influence of brand authenticity on the perceived value of the most valuable Polish brands. In addition, the positive influence of brand consistency, continuity, individuality, and credibility on perceived brand quality was identified.

The results of this study have several management implications. First, four factors were selected from previous literature on brand authenticity, and their positive impact on brand authenticity was determined. Brand managers should make consistent efforts to increase brand authenticity by increasing their credibility, consistency, continuity, and individuality. It is necessary to continuously monitor the perception of brands in terms of fulfilling the promises offered, consistency of actions taken, and being trustworthy. Second, the positive impact of the authenticity of the most valuable Polish brands on their perceived value has been proven. For management processes, this implies the need to monitor perceived brand value in the context of the

price-quality and price-value relationship and the perception that the choice of these brands is beneficial.

The survey has contributed to management's knowledge of brand authenticity and perceived value, but has some limitations. First, the survey was conducted in Warsaw without considering people living in other cities. Second, the most valuable brands published in the ranking were analysed. They were from different areas of economic activity such as manufacturing, trade, and services, which meant that the model studied and the relationships identified did not take industry specifics into account.

Analysing management factors relating to the authenticity of the world's most valuable brands should be identified as directions for future research. In addition, it would be worth studying other management factors affecting the perceived value of brands, including brand heritage, brand personality, management strategies, leadership, and others. It would also be interesting to consider industry specifics, as well as corporate and non-profit brands.

References

- Aaker, D. (1991) *Managing brand equity: capitalizing on the value of a brand name*. New York: Free Press; ew York: Free Press; Toronto: Maxwell Macmillan Canada; New York: Maxwell Macmillan International, ©1991.
- Abdellatif, R. and Elsayed, A. (2023) 'The effect of investment in the brand value chain on profitability and market value of the firm: lesson of success taken from Amazon', *Future Business Journal* 2023 9:1. SpringerOpen, 9(1), pp. 1–17. doi: 10.1186/S43093-023-00196-2.
- Adnan, M., Naveed, R. T. and Ahmad, N. (2006) 'Predicting Green Brand Equity Through Green Brand Credibility', *Journal of Managerial Sciences*, 13(2), pp. 144–157.

- Afzal, H. *et al.* (2010) 'Consumer's Trust in the Brand: Can it Be Built through Brand Reputation, Brand Competence and Brand Predictability', *International Business Research*, 3(1), pp. 43–51.
- Agmeka, F., Wathoni, R. N. and Santoso, A. S. (2019) 'The Influence of Discount Framing towards Brand Reputation and The Influence of Discount Framing towards Brand Reputation and Brand Image on Purchase Intention and Actual Behaviour in e-Brand Image on Purchase Intention and Actual Behaviour in e-commerce', *Procedia Computer Science The Fifth Information Systems International Conference 2019*. Elsevier, 161, pp. 851–858. doi: 10.1016/J.PROCS.2019.11.192.
- Akkaya, M. (2021) 'Understanding the impacts of lifestyle segmentation & perceived value on brand purchase intention: An empirical study in different product categories', *European Research on Management and Business Economics*. Elsevier Doyma, 27(3), p. 100155. doi: 10.1016/J.IEDEEN.2021.100155.
- Akturan, U. (2018) 'How does greenwashing affect green branding equity and purchase intention? An empirical research', *Marketing Intelligence and Planning*, 36(7), pp. 809–824. doi: 10.1108/MIP-12-2017-0339.
- Alexander, N. (2009) 'Brand authentication: Creating and maintaining brand auras', *European Journal of Marketing*, 43(3–4), pp. 551–562. doi: 10.1108/03090560910935578.
- Becker, M., Wiegand, N. and Reinartz, W. J. (2019) 'Does It Pay to Be Real? Understanding Authenticity in TV Advertising', *Journal of Marketing*. SAGE Publications Ltd, 83(1), pp. 24–50. doi: 10.1177/0022242918815880/ASSET/IMAGES/LARGE/10.1177_0022242918815880-FIG7.JPEG.
- Beverland, M. (2006) 'The "real thing": Branding authenticity in the luxury wine trade', *Journal of Business Research*, 59(2), pp. 251–258. doi: 10.1016/j.jbusres.2005.04.007.
- Beverland, M. B. (2005) 'Crafting Brand Authenticity: The Case of Luxury Wines*', *Journal of Management Studies*. John Wiley & Sons, Ltd, 42(5), pp. 1003–1029. doi: 10.1111/J.1467-6486.2005.00530.X.
- Beverland, M. B. and Farrelly, F. J. (2010) 'The quest for authenticity in consumption: Consumers' purposive choice of authentic cues to shape experienced outcomes', *Journal of Consumer Research*. Oxford Academic, 36(5), pp. 838–856. doi: 10.1086/615047/2/M_36-5-838-FG1.JPEG.
- Bruhn, M. *et al.* (2012) 'Brand authenticity: Towards a deeper understanding of its conceptualization and measurement', *Advances in Consumer Research*, 40, pp. 567–576.
- Callarisa, L. *et al.* (2012) 'Harnessing social media platforms to measure customer-based hotel brand equity', *Tourism Management Perspectives*, 4, pp. 73–79. doi: <https://doi.org/10.1016/j.tmp.2012.04.005>.
- Campagna, C. L., Donthu, N. and Yoo, B. (2023) 'Brand authenticity: literature review, comprehensive definition, and an amalgamated scale', *Journal of Marketing Theory and Practice*. Routledge, 31(2), pp. 129–145. doi: 10.1080/10696679.2021.2018937.
- Carsana, L. and Jolibert, A. (2018) 'Influence of iconic, indexical cues, and brand schematicity on perceived authenticity dimensions of private-label brands', *Journal of Retailing and Consumer Services*. Elsevier Ltd, 40(June 2017), pp. 213–220. doi: 10.1016/j.jretconser.2017.10.006.
- Caruana, A. and Ewing, M. T. (2010) 'How corporate reputation, quality, and value influence online loyalty', *Journal of Business Research*. Elsevier Inc., 63(9–10), pp. 1103–1110. doi: 10.1016/j.jbusres.2009.04.030.
- Choi, H. *et al.* (2015) 'The Role of Fashion Brand Authenticity in Product Management: A Holistic Marketing Approach', *Journal of Product Innovation Management*. John Wiley & Sons, Ltd, 32(2), pp. 233–242. doi: 10.1111/JPIM.12175.
- Davis, R., Sheriff, K. and Owen, K. (2019) 'Conceptualising and measuring consumer authenticity online', *Journal of Retailing and Consumer Services*. Pergamon, 47, pp. 17–31. doi: 10.1016/J.JRETCONSER.2018.10.002.
- Delafoz, N. and Goli, A. (2015) 'The factors affecting the green brand equity of electronic products: Green marketing', *Cogent Business and Management*. Cogent, 2(1). doi: 10.1080/23311975.2015.1079351.

- Dick, A. S. and Basu, K. (1994) 'Customer loyalty: Toward an integrated conceptual framework', *Journal of the Academy of Marketing Science*. Springer-Verlag, 22(2), pp. 99–113. doi: 10.1177/0092070394222001.
- Dolatabadi, H. R., Tabaeian, R. A. and Tavakoli, H. (2016) 'Integral model of green brand equity: a study among customers of online shopping websites', *EuroMed J. of Management*, 1(2), p. 185. doi: 10.1504/emjm.2016.078854.
- Erdem, T. and Swait, J. (2004) 'Brand credibility, brand consideration, and choice', *Journal of Consumer Research*, 31(1), pp. 191–198. doi: 10.1086/383434.
- Esmaeli, A. *et al.* (2017) 'Effect of Integration of Green Constructs and Traditional Constructs of Brand on Green Purchase Intention of Customers', *Marketing and Trade*, 20(3), pp. 219–237. doi: 10.15240/tul/001/2017-3-015.
- Forbes (2022) 'TOP Polskie Marki. Siłą przedsiębiorstwa jest marka', 10. Available at: <https://www.forbes.pl/rankingi/top-polskie-marki-sila-przedsiębiorstwa-jest-marka/08qrqft> (Accessed: 22 October 2022).
- Fornell, C. and Larcker, D. F. (1981) 'Evaluating Structural Equation Models with Unobservable Variables and Measurement Error', *Journal of Marketing Research*. JSTOR, 18(1), p. 39. doi: 10.2307/3151312.
- Fritz, K., Schoenmueller, V. and Bruhn, M. (2017) 'Authenticity in branding – exploring antecedents and consequences of brand authenticity', *European Journal of Marketing*. Emerald Group Publishing Ltd., 51(2), pp. 324–348. doi: 10.1108/EJM-10-2014-0633/FULL/XML.
- Goulding, C. and Derbaix, M. (2019) 'Consuming material authenticity in the age of digital reproduction', *European Journal of Marketing*. Emerald Group Holdings Ltd., 53(3), pp. 545–564. doi: 10.1108/EJM-10-2017-0717/FULL/XML.
- Grayson, K. and Martinec, R. (2004) 'Consumer Perceptions of Iconicity and Indexicality and Their Influence on Assessments of Authentic Market Offerings', *Journal of Consumer Research*. Oxford Academic, 31(2), pp. 296–312. doi: 10.1086/422109.
- Gupta, A., Dash, S. and Mishra, A. (2019) 'Self-other oriented green experiential values: Measurement and impact on hotel-consumer relationship', *International Journal Of Hospitality Management*, 83, pp. 159–168. doi: 10.1016/j.ijhm.2019.05.010.
- Gupta, S. *et al.* (2020) 'The impact of brand value on brand competitiveness', *Journal of Business Research*. Elsevier, 112, pp. 210–222. doi: 10.1016/J.JBUSRES.2020.02.033.
- Hair, J. F., Ringle, C. M. and Sarstedt, M. (2013) 'Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance', *Long Range Planning*, 46(1–2), pp. 1–12. doi: 10.1016/j.lrp.2013.01.001.
- Haryanto, J. O., Moutinho, L. and Coelho, A. (2016) 'Is brand loyalty really present in the children's market? A comparative study from Indonesia, Portugal, and Brazil', *Journal of Business Research*. Elsevier Inc., 69(10), pp. 4020–4032. doi: 10.1016/j.jbusres.2016.06.013.
- Henseler, J., Ringle, C. M. and Sarstedt, M. (2015) 'A new criterion for assessing discriminant validity in variance-based structural equation modeling', *Journal of the Academy of Marketing Science*. Springer Science and Business Media, LLC, 43(1), pp. 115–135. doi: 10.1007/S11747-014-0403-8/FIGURES/8.
- Hernandez-Fernandez, A. and Lewis, M. C. (2019) 'Brand authenticity leads to perceived value and brand trust', *European Journal of Management and Business Economics*, 28(3), pp. 222–238. doi: 10.1108/EJMBE-10-2017-0027.
- Huang, M.-H., Cheng, Z.-H. and Chen, I.-C. (2017) 'The importance of CSR in forming customer-company identification and long-term loyalty', *Journal of Services Marketing*. Emerald Group Publishing Ltd., 31(1), pp. 63–72. doi: 10.1108/JSM-01-2016-0046.
- Interbrand (2022) *Best Global Brands Report*. Available at: <https://www.meaningful-brands.com/>.
- Kadirov, D. (2010) 'Brand Authenticity: Scale Development and Validation', in *ANZMAC2010 Proceedings*, pp. 1–7.

- Kashif, M. *et al.* (2018) 'Finding greener grass on the other side of hill: Examining donor perceived brand equity in a moderating role of brand credibility', *Asia Pacific Journal of Marketing and Logistics*. Emerald Group Holdings Ltd., 30(4), pp. 988–1012. doi: 10.1108/APJML-10-2017-0231/FULL/XML.
- Keller, K. L. (1993) 'Conceptualizing, Measuring, and Managing Customer-Based Brand Equity', *Journal of Marketing*. SAGE Publications, 57(1), p. 1. doi: 10.2307/1252054.
- Kolar, T. and Zabkar, V. (2010) 'A consumer-based model of authenticity: An oxymoron or the foundation of cultural heritage marketing?', *Tourism Management*. Pergamon, 31(5), pp. 652–664. doi: 10.1016/J.TOURMAN.2009.07.010.
- Kotler, P. and Keller, K. L. (2016) *Marketing Management*. Pearson Limited Edition.
- Kovács, B., Carroll, G. R. and Lehman, D. W. (2013) 'Authenticity and Consumer Value Ratings: Empirical Tests from the Restaurant Domain', *Organization Science*. INFORMS, 25(2), pp. 458–478. doi: 10.1287/ORSC.2013.0843.
- Kovács, B., Carroll, G. R. and Lehman, D. W. (2014) 'Authenticity and consumer value ratings: Empirical tests from the restaurant domain', *Organization Science*, 25(2), pp. 458–478. doi: 10.1287/orsc.2013.0843.
- Lai, I. K. W. (2019) 'Hotel image and reputation on building customer loyalty: An empirical study in Macau', *Journal of Hospitality and Tourism Management*, 38, pp. 111–121. doi: 10.1016/j.jhtm.2019.01.003.
- Liang, L. J., Choi, H. C. and Joppe, M. (2017) 'Understanding repurchase intention of Airbnb consumers: perceived authenticity, electronic word-of-mouth, and price sensitivity', *Journal of Travel and Tourism Marketing*. Routledge, 35(1), pp. 73–89. doi: 10.1080/10548408.2016.1224750.
- Liao, S. and Ma, Y.-Y. (2009) 'Conceptualizing Consumer Need for Product Authenticity', *The International Journal of Business and Information*. doi: 10.6702/IJBI.2009.4.1.5.
- Lingavel, D. (2015) 'Impact of Customer Relationship Management on Brand Equity: Private Hospitals in Jaffna', *European Journal of Business and Management*, 7(4), pp. 2222–2839.
- Lu, A. C. C., Gursoy, D. and Lu, C. Y. (2015) 'Authenticity perceptions, brand equity and brand choice intention: The case of ethnic restaurants', *International Journal of Hospitality Management*. Elsevier Ltd, 50, pp. 36–45. doi: 10.1016/j.ijhm.2015.07.008.
- Lude, M. and Prügl, R. (2018) 'Why the family business brand matters: Brand authenticity and the family firm trust inference', *Journal of Business Research*. Elsevier Inc., 89, pp. 121–134. doi: 10.1016/j.jbusres.2018.03.040.
- Manthiou, A. *et al.* (2018) 'The impact of brand authenticity on building brand love: An investigation of impression in memory and lifestyle-congruence', *International Journal of Hospitality Management*. Pergamon, 75, pp. 38–47. doi: 10.1016/J.IJHM.2018.03.005.
- Mazutis, D. D. and Slawinski, N. (2015) 'Reconnecting Business and Society: Perceptions of Authenticity in Corporate Social Responsibility', *Journal of Business Ethics*. Kluwer Academic Publishers, 131(1), pp. 137–150. doi: 10.1007/S10551-014-2253-1/METRICS.
- Merz, M. A., Zarantonello, L. and Grappi, S. (2018) 'How valuable are your customers in the brand value co-creation process? The development of a Customer Co-Creation Value (CCCV) scale', *Journal of Business Research*. Elsevier, 82, pp. 79–89. doi: 10.1016/J.JBUSRES.2017.08.018.
- Morhart, F. *et al.* (2015) 'Brand authenticity: An integrative framework and measurement scale', *Journal of Consumer Psychology*. John Wiley & Sons, Ltd, 25(2), pp. 200–218. doi: 10.1016/J.JCPS.2014.11.006.
- Moulard, J. G., Raggio, R. and Folse, J. (2016) 'Brand Authenticity: Testing the Antecedents and Outcomes of Brand Management's Passion for its Products', *Psychology & Marketing*, 33(6), pp. 421–436. doi: 10.1002/mar.
- Napoli, J. *et al.* (2014) 'Measuring consumer-based brand authenticity', *Journal of Business Research*. Elsevier, 67(6), pp. 1090–1098. doi: 10.1016/J.JBUSRES.2013.06.001.
- Nastasoiu, A. and Vandenbosch, M. (2019) 'Competing with loyalty: How to design successful customer loyalty reward programs', *Business Horizons*, 62(2), pp. 207–214. doi: 10.1016/j.bushor.2018.11.002.

- Newman, G. E. and Dhar, R. (2014) 'Authenticity is Contagious: Brand Essence and the Original Source of Production', <https://doi.org/10.1509/jmr.11.0022>. Sage Publications CA: Los Angeles, CA, 51(3), pp. 371–386. doi: 10.1509/JMR.11.0022.
- Ng, P. F. *et al.* (2014) 'Antecedents of Green Brand Equity: An Integrated Approach', *Journal of Business Ethics*, 121(2), pp. 203–215. doi: 10.1007/s10551-013-1689-z.
- Noyan, F. and Şimşek, G. (2014) 'The antecedents of customer loyalty Selection and peer review under responsibility of Organizing Committee of BEM 2013', *Procedia – Social and Behavioral Sciences*, 109, pp. 1220–1224. doi: 10.1016/j.sbspro.2013.12.615.
- Nunes, J. C., Ordanini, A. and Giambastiani, G. (2021) 'The Concept of Authenticity: What It Means to Consumers', *Journal of Marketing*. Sage Publications CA: Los Angeles, CA, 85(4), pp. 1–20. doi: 10.1177/0022242921997081.
- Oh, H. *et al.* (2019) 'The effect of brand authenticity on consumer–brand relationships', *Journal of Product and Brand Management*. Emerald Group Holdings Ltd., 28(2), pp. 231–241. doi: 10.1108/JPBM-09-2017-1567/FULL/XML.
- Pechyiam, C. and Jaroenwanit, P. (2014) 'The Macrotheme Review A multidisciplinary journal of global macro trends The Factors Affecting Green Brand Equity of Electronic Products in Thailand', *The Macrotheme Review*, 3(9), pp. 1–12.
- Peterson, R. A. (2005) 'In search of authenticity', *Journal of Management Studies*. Blackwell Publishing Ltd, 42(5), pp. 1083–1098. doi: 10.1111/J.1467-6486.2005.00533.X.
- Portal, S., Abratt, R. and Bendixen, M. (2019) 'The role of brand authenticity in developing brand trust', *Journal of Strategic Marketing*. Routledge, 27(8), pp. 714–729. doi: 10.1080/0965254X.2018.1466828.
- Rajh, S. (2012) 'Comparison of perceived value structural models', *Market-Trziste*, (1), pp. 117–133. doi: 10.1007/978-3-7908-1904-5_7.
- Rather, R. A. (2018) 'Investigating the Impact of Customer Brand Identification on Hospitality Brand Loyalty: A Social Identity Perspective', *Journal of Hospitality Marketing and Management*. Routledge, 27(5), pp. 487–513. doi: 10.1080/19368623.2018.1404539.
- Rosli, N., Che-Ha, N. and Ghazali, E. M. (2020) 'The Influence of Hotel Attributes on Brand Attachment and Post-Consumption Outcomes: The Mediating Effects of Brand Credibility', *International Journal of Business and Society*. UNIMAS Publisher, 21(1), pp. 313–333. doi: 10.33736/IJBS.3255.2020.
- Salegna, G. and Farzaneh, F. (2011) 'Consumer Loyalty to Service Providers: An Integrated Conceptual Model | Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior', *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior*, 24. Available at: <https://jcsdcb.com/index.php/JCSDCB/article/view/55> (Accessed: 29 April 2020).
- Salehzadeh, R. and Pool, J. K. (2017) 'Brand Attitude and Perceived Value and Purchase Intention toward Global Luxury Brands', *Journal of International Consumer Marketing*. Routledge, 29(2), pp. 74–82. doi: 10.1080/08961530.2016.1236311.
- dos Santos, P. M. and Cirillo, M. Â. (2021) 'Construction of the average variance extracted index for construct validation in structural equation models with adaptive regressions', *Communications in Statistics: Simulation and Computation*. Bellwether Publishing, Ltd. doi: 10.1080/03610918.2021.1888122.
- Sarstedt, M., Ringle, C. M. and Hair, J. (2014) 'PLS-SEM: Looking Back and Moving Forward', *Long Range Planning*. Pergamon, 47(3), pp. 132–137. doi: 10.1016/j.LRP.2014.02.008.
- Schallehn, M., Burmann, C. and Riley, N. (2014) 'Brand authenticity: Model development and empirical testing', *Journal of Product and Brand Management*, 23(3), pp. 192–199. doi: 10.1108/JPBM-06-2013-0339.

- Shirdastian, H., Laroche, M. and Richard, M. O. (2019) 'Using big data analytics to study brand authenticity sentiments: The case of Starbucks on Twitter', *International Journal of Information Management*, Pergamon, 48, pp. 291–307. doi: 10.1016/j.IJINFOMGT.2017.09.007.
- So, K. K. F. *et al.* (2013) 'The influence of customer brand identification on hotel brand evaluation and loyalty development', *International Journal of Hospitality Management*, 34(1), pp. 31–41. doi: 10.1016/j.ijhm.2013.02.002.
- Södergren, J. (2021) 'Brand authenticity: 25 Years of research', *International Journal of Consumer Studies*, 45(4), pp. 645–663. doi: 10.1111/ijcs.12651.
- Suhartanto, D., Clemes, M. and Dean, D. (2013) 'Analyzing the Complex and Dynamic Nature of Brand Loyalty in the Hotel Industry', *Tourism Review International*, 17(1), pp. 47–61. doi: 10.3727/154427213x13649094288106.
- Suri, R. and Monroe, K. B. (2003) 'The Effects of Time Constraints on Consumers' Judgments of Prices and Products', *Journal of Consumer Research*, 30(1), pp. 92–104. doi: 10.1086/374696/0.
- Sweeney, J. and Swait, J. (2008) 'The effects of brand credibility on customer loyalty', *Journal of Retailing and Consumer Services*, 15(3), pp. 179–193. doi: <https://doi.org/10.1016/j.jretconser.2007.04.001>.
- Tabaku, E. and Kushi, E. (2013) 'Service Quality, Customer Satisfaction, Perceived Value and Brand Loyalty: A Critical Review of the Literature', *Academic Journal of Interdisciplinary Studies*, 2(9), pp. 223–228. doi: 10.5901/ajis.2013.v2n9p223.
- Tavakol, M. and Dennick, R. (2011) 'Making sense of Cronbach's alpha', *International Journal of Medical Education*. IJME, 2, p. 53. doi: 10.5116/IJME.4DFB.8DFD.
- Tiwari, Ankita, Tiwari, Apurva and Yaseen, M. (2016) 'Study of Brand Equity & its components in a Tertiary Care Super Specialty Teaching Hospital', 18(2), pp. 15–21. doi: 10.9790/487X-18211521.
- Tran, V. D. and Keng, C. J. (2018) 'The brand authenticity scale: development and validation', *Contemporary Management Research*, 14(4), pp. 277–291. doi: 10.7903/cm.r18581.
- Unurlu, C. and Uca, S. (2017) 'The effect of culture on brand loyalty through brand performance and brand personality', *International Journal of Tourism Research*, 19(6), pp. 672–681. doi: 10.1002/jtr.2139.
- Valsesia, F., Nunes, J. C. and Ordanini, A. (2016) 'What Wins Awards Is Not Always What I Buy: How Creative Control Affects Authenticity and Thus Recognition (But Not Liking)', *Journal of Consumer Research*. Oxford Academic, 42(6), pp. 897–914. doi: 10.1093/JCR/UCV093.
- Vredenburg, J. *et al.* (2020) 'Brands Taking a Stand: Authentic Brand Activism or Woke Washing?', *Journal of Public Policy & Marketing*. Sage Publications CA: Los Angeles, CA, 39(4), pp. 444–460. doi: 10.1177/0743915620947359.
- Waddington, A. J. (2012) *Investigating the impact of brand reputation on brand architecture strategies: a study on a South African automotive company*. Rhodes University. Available at: http://vital.seals.ac.za:8080/vital/access/manager/Repository/vital:1179?site_name=GlobalView (Accessed: 14 May 2022).
- Walker, K. (2010) 'A systematic review of the corporate reputation literature: Definition, measurement, and theory', *Corporate Reputation Review*. SPRINGER NATURE, 12(4), pp. 357–387. doi: 10.1057/CRR.2009.26/REFERENCES.
- Wang, S. *et al.* (2021) 'The Role of Corporate Social Responsibility Perceptions in Brand Equity, Brand Credibility, Brand Reputation, and Purchase Intentions', *Sustainability* 2021, Vol. 13, Page 11975. Multidisciplinary Digital Publishing Institute, 13(21), p. 11975. doi: 10.3390/SU132111975.
- Wang, X. *et al.* (2020) 'Towards an Ethical and Trustworthy Social Commerce Community for Brand Value Co-creation: A trust-Commitment Perspective', *Journal of Business Ethics*. Springer Science and Business Media B.V., 167(1), pp. 137–152. doi: 10.1007/S10551-019-04182-Z/METRICS.

- Woodruff, R. B. (1997) 'Customer value: The next source for competitive advantage', *Journal of the Academy of Marketing Science*. Springer New York LLC, 25(2), pp. 139–153. doi: 10.1007/BF02894350/METRICS.
- Wu, S. L. and Hsu, C. P. (2018) 'Role of authenticity in massively multiplayer online role playing games (MMORPGs): Determinants of virtual item purchase intention', *Journal of Business Research*. Elsevier, 92, pp. 242–249. doi: 10.1016/J.JBUSRES.2018.07.035.
- Wuestefeld, T. et al. (2012) 'The impact of brand heritage on customer perceived value', *der markt*. Springer Science and Business Media LLC, 51(2–3), pp. 51–61. doi: 10.1007/S12642-012-0074-2.
- Yuan, R. et al. (2014) 'A critical review of the literature on authenticity: Evolution and future research agenda', *International Journal of Services, Economics and Management*, 6(4), pp. 339–356. doi: 10.1504/IJSEM.2014.068270.
- Zeithaml, V. A. (1988) 'Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence', *Journal of Marketing*. Sage Publications, 52(3), p. 2. doi: 10.2307/1251446.

Hanna Górska-Warsewicz, Associate Professor at the Warsaw University of Life Sciences, Head of Department of Food Market and Consumption Research. Habilitated at the Faculty of Management, University of Warsaw. Hanna has cooperated with foreign and domestic institutions and participated in international and domestic projects. She specializes in the subject of brands, brand equity, consumer-based brand equity and brand management in production, service, and trade companies. She works with the business community as a brand management consultant, especially in food sector. She is an author or co-author of over 240 publications in this field, including 29 scientific publications indexed in Scopus (31 publications indexed in Web of Science). In addition, she is the author or co-author of 11 books. She cooperates with foreign and domestic institutions. ORCID no. <https://orcid.org/0000-0002-5110-7583>



WSB University

Dąbrowa Górnicza, Ciepłaka 1c, tel.: +48 32295 93 59, e-mail: wydawnictwo@wsb.edu.pl

