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FROM THE EDITORIAL COMMITTEE

We are giving you the next 32nd 1 (2025) issue of the Scientific Journal of the Faculty of Management at the Rzeszow University of Technology entitled „Humanities and Social Sciences".

The aim of the Publisher is to raise the merits and the international position of the quarterly published by the Faculty of Management, that is why we are still developing the cooperation with foreign team of reviewers, as well as an international Scientific Council. The Editors have also attempted to apply for international databases; currently the quarterly HSS is indexed in **Index Copernicus Journal Master List, The Central European Journal of Social Sciences and Humanities (CEJSH) ERIH PLUS, DOAJ and EBSCO**.

The journal „Humanities and Social Sciences" participated in the „Support for scientific journals" program in 2019-2020, and in the „Development of scientific journals" program in 2023-2024, organized by the Ministry of Science and Higher Education.

The articles published in this publication are devoted to the broader issues of the humanities and social sciences. They are the result both of theoretical and empirical research. The subjects covered vary considerably and reflect the interdisciplinary nature of the Journal. We do hope that the papers published will meet your kind interest and will be an inspiration to further research and fruitful discussions.

On behalf of the Editorial Board of „Humanities and Social Sciences" we would like to thank the Authors for sending the outcomes of their research. We would like to express particular gratitude to the Reviewers for their valuable feedback that greatly contributed to increasing values of the scientific publications.

With compliments
Editorial Committee

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FUTURE OF THE CHINA-PAKISTAN ECONOMIC CORRIDOR (CPEC) AFTER THE TALIBAN TAKEOVER AND THE GEOPOLITICAL IMPLICATIONS FOR INDIA

The China-Pakistan Economic Corridor, also termed the CPEC, is a set of infrastructural projects that focus on building an enhanced transportation system and infrastructures focusing on railways and maritime ports in Pakistan. This research focuses on the shifting power dynamics in the region, taking China-Pakistan-India as the predominant actors in the region, and aims to answer the question of what the geopolitical implications of CPEC can have on India. During the analysis of its implications for India, a special focus will be placed on the Taliban takeover and the possible extension of CPEC in Afghanistan. We aim to shed light on the ever-changing power dynamics in the region, as well as address the recent developments of Afghan involvement in CPEC and the implications it can have on the region. It is concluded that CPEC can be detrimental to Indian interests in the region.

Keywords: CPEC, India, geopolitics, South Asia, Taliban takeover.

1. INTRODUCTION

China-Pakistan Economic Corridor (CPEC), is an ambitious project and one of China's most essential projects for the implementation of its Belt and Road initiative (BRI). China's increasing interest in Pakistan dates back to 1998, when Pakistan's Gwadar port first caught China's eye (Khan and Liu, 2018). The construction of the port by the Chinese began in 2002 and completed in 2006. However, it was not operational due to various reasons including the fall of General Musharraf. After the initial signing of several agreements and memoranda of understanding by former President Asif Ali Zardari and Chinese Premier Li Keqiang that initiated the CPEC in 2013 (Ramachandran, 2015), CPEC was officially launched in 2015 when the Pakistani Prime Minister Nawaz Sharif and the Chinese President Xi Jinping signed 51 agreements and Memorandums of Understanding (MoU) with a combined value of $46 billion (Harris, 2019).

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Pakistan benefits generously through the Chinese investment into the CPEC projects. Major proportion of investments under CPEC goes into the energy sector. With most of the CPEC projects being power projects under the energy sector, the country aims to eliminate its ongoing energy crisis (Aziz, Ahmad, 2015). Transport Infrastructure development and Industrial cooperation are also some of the main priorities of CPEC projects. The Gwadar Port project is the signature project of CPEC. With the construction of Gwadar port and the implementation of Special Economic zone, CPEC has the potential to make Pakistan a regional hub of trade (Farwa, Siddiqa, 2017). Moreover, unlike western nations China markets CPEC as a win-win cooperative initiative unlike the unequal treaties China had to put up with during the colonial period (Weidong, 2017).

Ever since the initiation of CPEC, India has opposed the strategic plan. India has blamed CPEC of violating its sovereignty due to the plan passing through disputed territories of Jammu & Kashmir and Ladakh (Economic Times, 2018). Moreover, with an increasing Chinese footprint in South Asia, India's hegemonic goals in the region are challenged by China. India has reacted by investing in Iran's Chabahar port which has the potential to directly compete with Pakistan's Gwadar port (Kumar, Verma, 2021). India has also been actively participating in building alliances with other nations bilaterally and through regional strategic agreements such as the Indo Pacific Strategy to mitigate the rise of China in the region. Likewise, China aims to expand CPEC beyond Pakistan.

CPEC was first proposed to Afghanistan by China and Pakistan in 2017 (Hindustan Times, 2017). After the Taliban takeover of Afghanistan, Pakistan resumed the discussion of an extension of CPEC to include Afghanistan. Mansoor Ahmed Khan, Pakistan's envoy to Kabul stated "This important project – China Pakistan Economic Corridor ... provides good opportunities, good potential for providing infrastructure and energy connectivity between Afghanistan and Pakistan ... (and) also connecting South Asia to the Central Asian region". (Greenfield, 2021). Due to its landlocked nature, Afghanistan is highly dependent on Pakistan for its trading (Bhatnagar, Ahmed, 2020). Afghanistan joining the CPEC will connect its economy with Pakistan, China and the rest of the world via Gwadar which will open the wide array of economic opportunities for Afghanistan.

Pakistan has always been wary of the previous pro Indian Afghan government. However, currently the Indian influence in Afghanistan is minimal considering it does not recognize the Afghan government (Ramachandran, 2021). Pakistan although reluctant to recognize the newly formed Afghan government, is closer to recognizing it compared to India. Pakistan considers India's role in Afghanistan to be one of its chief security concerns. Even though China is silent about India's role in Afghanistan, analysing Sino-Indo-Pakistan trilateral security concerns, their goals are not too far off from each other. The June 2020 deadly brawls between China and India at Ladakh and their subsequent measures against each other serves us as a reminder of Indo-Chinese rivalry. Pakistan and China have always shared similar goals to eradicate the Indian influence in Afghanistan (Ghulam, 2020). Thus, the possible extension of CPEC to Taliban led Afghanistan can be detrimental for Indian influence in the region.

This research has utilised primary and secondary resources. Primary resources include statistics published by the government, agreements, policy statements, books written about the subject by academicians and newspapers. The secondary resources include research articles published by scholars.

This paper has been divided into four sections. The first part goes into detail about the statistics of Chinese investment in Pakistan as well as the main projects under CPEC in Pakistan. It also covers the opportunities CPEC offers to both China and Pakistan. The next

section attempts to shine some light on the implications CPEC can have on India. The third section elaborates on India's response towards an enhanced Sino-Pakistan cooperation in the region. Finally, this is followed by a conclusion where the authors discuss the potential outcomes of the ongoing struggle for power in the region.

2. UNDERSTANDING CPEC

The China-Pakistan Economic Corridor is marketed to benefit not only China and Pakistan, but also other regional neighbors like Iran, Afghanistan and Central Asian region. The scheme focuses on improving regional connectivity, diverse investment opportunities, industrial cooperation, agricultural cooperation, finance cooperation, cultural exchange, socio-economic development, tourism industry and security (*CPEC Authority*, 2015). The Chinese companies has pledged to build US$ 45.6 billion (increased to US$ 62 million) worth of energy and infrastructure projects in Pakistan funded by the Chinese government and banks. China has approximately agreed to invest about US$11.8 billion in infrastructure projects, US$622 million for Gwadar port, up-gradation of Pakistan's major transport infrastructure that includes: Karakorum Highway, Karachi-Lahore Motorway, the Gwadar port, East Bay Expressway Project and Gwadar International Airport (Khan, M. Z. U., Khan, M. M., 2019).

Table 1. Summary of China Pakistan Economic Corridor's Major Project

SN	Major Categories	No of Projects	Estimated Cost (US $ million)	Estimated Cost (US $ million)	Direct Job Opportunities
1	Energy	21	26,370 for 13,810 MW	33,000 for 17,045 MW	71,959
2	Infrastructure (Road)	5	5,341	5,341	31,474
3	Infrastructure (Rail)	3	8,237	8,237	14,400
4	Infrastructure (Optical Fiber)	1	44	44	1,294
5	Gwadar	12	793	10,000–14,000	77,700
	Total	42	40,784	58,622	196,827

Source: (Hussain 2018).

CPEC has three corridors with a northern extension, the first one (Eastern Alignment) passing through Punjab and Sindh, connecting the cities Thakot-Mansehra-Islamabad-Lahore and Multan (Rana, 2015a). The second route (Central Route) passes through Khyber-Pakhtunkhwa (KPK), and unconnected parts of Punjab and Sindh. The third route (Western Alignment) passes through the relatively underdeveloped areas of Khyber Pakhtunkhwa and Balochistan (Rana, 2015b). Finally, all of the three Pakistani alignments are connected with the Northern route with the Pakistani-China border at Kunjarab and continues on Chinese territory.

Pakistan aims to attract foreign capital with CPEC and intends to use it for developing its infrastructure, for improving regional connectivity and enhancing its communications infrastructure. The Chinese investment in Pakistan is said to produce more than 2 million direct and indirect jobs and boost Pakistan's economic growth (Government of Pakistan, 2016).

The energy component is one of the sector's where Pakistan gains a lot with the implementation of CPEC. Pakistan has been suffering from acute energy shortfall especially after 2006. This is mainly due to 'inadequate capacity addition, limited exploration and ineffective exploitation of hydro, coal and renewable potential and inefficient use of energy resources' (Government of Pakistan, 2016). According to the Government of Pakistan Annual Plan 2016 – 17,74% of the total China-Pakistan Economic Corridor (CPEC) projects are energy projects which include coal, hydro and wind' (Government of Pakistan, 2016).

Table 2. CPEC Energy Priority Projects

CPEC Energy Priority Projects								
Project Name	Estima-ted cost (*million $*)	Financing Companies/ Sponsors	Capacity in MW	Supervising Agency	Type of Energy /Techno-logy	Debt/ Equity Ratio	Expec-ted Commer-cial Opera-tion Date (COD)	Direct Job Opportu-nities
2×660 MW Coal-Fired Power Plants at Port Qasim Karachi	1,980	Port Qasim Electric Power Company (Private) Limited	1,320	Private Power and Infrastruc-ture Board (PBIB)	Coal (Imported) / Super Critical	75/25	June 2018	6,500
Suki Kinari Hydro Power Station, Naran, KPK	1,802	Suki Kinari Hydro (Pvt) Ltd	870	PPIB	Hydel	70/30	2020/21	6,250
Sahiwal 2x660 MW Coal-fired Power Plant, Punjab	1,600	Huaneng Shandong Rui Group, China	1,320	Punjab Power Develop-ment Board (PPDB)	Coal (Imported) / Super Critical	75/25	May 17	8,278
Engro Thar Block ll 2*330 MW Coal-Fired Power Plant,TEL 1*330 MW Mine Mouth Lignite Fird Power Project at Thar Block ll, Sindh, ThalNova 1*330 MW Mine Mouth Lignite Fired Power Project at Thar Block-ll, Sindh.	2,000	Engro Power Gen Thar LTd. / China Machinery Engineering Corporation (CMEC)	1,320	PPIB	Coal (Local)/ Sub Critical	75/25	Jun 19	4,100

Table 2 (cont.). CPEC Energy Priority Projects

CPEC Energy Priority Projects								
Project Name	Estima-ted cost (*million $*)	Financing Companies/ Sponsors	Capacity in MW	Supervising Agency	Type of Energy /Techno-logy	Debt/ Equity Ratio	Expec-ted Commer-cial Opera-tion Date (COD)	Direct Job Opportu-nities
Surface Mine In Block II Of Thar Coal Field, 6.5 Metric Ton Per Annum (Mtpa), Thar Sindh	1,470	China Machinery Engineering Corporation (CMEC) / Sindh Engro Coal Mining Company (SECMC)		Thar Coal Energy Board (TCEB)	Coal/Open Pit Mining		December 2018	
Hydro China Dawood 50 MW Wind Farm (Gharo, Thatta)	125	M/s Hydrochina Dawood Power Pvt. Limited (HDPPL)	50	Alternative Energy Develop-ment Board (AEDB)	Wind/ Wind Turbine	80/20	Apr-17	325
300 MW Imported Coal Based Power Project at Gwadar	600	China Communi-cations Construc-tion Company (CCCC)	300	Gwadar Port Authority (GPA) / Gwadar Develop-ment Authority (GDA)	Coal (Imported)			2,500
Quaid-e-Azam 1000 MW Solar Park (Bahawal-pur)	1,302	Zonergy	1000	PPDB/ AEDB	Solar	72/28	COD of 3 x 100 MW attained in August 2016	1,600

Source (Hussain, 2018).

Numerous other energy related projects such as Sachal 50 MW Wind Farm, Jhimpir, Thatta, Sindh and Karot Hydropower Station, AJK & Punjab are also amongst the priority list of energy related projects.

Another important sector CPEC focuses on is the infrastructure factor. This includes improving existing communication facilities as well as establishing new ones. An estimate of US$12 billion has been allocated for numerous infrastructure projects in Gwadar and other areas along the CPEC route. According to an official in the Ministry of Planning, Development and Reform, 'various roads planned under CPEC would enhance inter-provincial connectivity and would connect less developed areas of Baluchistan, Khyber Pakhtunkhwa and Azad Jammu and Kashmir with the main corridor, and would help in bringing a new era of development to these parts of the country' (Murad, 2019).

Table 3. Connectivity Projects under CPEC

SN	Project Name	Estimated Cost	Mode of Financing	Length (KM)	Expected Commercial Operation	Job Opportu- nities
Roads Projects in CPEC						
1	KKH Phase II (Thakot - Havelian Section)	1,366	Chinese Government Concessional Loan (GCL)	120	Mar-20	7,800
2	Peshawar-Karachi Motorway (Multan- Sukkur Section)	2,980	GCL	392	Aug-19	15,174
3	Khuzdar-Basima Road N-30 (110 km)	80	TBD	110		800
4	Upgradation of D.I.Khan (Yarik) - Zhob, N-50 Phase-I	195		210		6,700
5	KKH Thakot-Raikot N35 remaining	719.8	TBD	136		1,000
	Total	**5,341**		**968**		**31,474**
Railways Projects of CPEC						
1	Expansion and reconstruction of existing line ML-1	8,172	GCL	1,872	2022	14,400
2	Havelian Dry port (450 M. Twenty- foot equivalent units)	25	GCL			
3	Capacity Development of Pakistan Railways					
	Total	8,197				14,400
CPEC Optical Fiber *(Kunjarab to Islamabad)*						
1	Cross Border Optical Fiber Cable	44	GCL	835	Dec-18	1,294
Total						
		13,622		3,675		47,168

Source: (Hussain, 2018).

Another key component of CPEC is establishing various industrial zones or Special Economic Zones (SEZs) along its different routes. CPEC's goal is to be a transit route for

commodities and raw materials while promoting industrialisation and development of manufacturing hubs. These hubs boost Pakistan's underperforming economy and create opportunities for entrepreneurs (Wolf, 2016). A government policy document states, 'the two sides agreed to set up nine SEZs which will serve as centres of industrial activity' (Government of Pakistan, 2017).

The key factor that aligns CPEC with China's BRI strategy are the projects connecting Kashgar in China's Xinjiang Uygur Autonomous Region with Gwadar port on the Baluchistan coast in Pakistan's south-western region. The Gwadar port is crucial for China because it is the only exit to the Indian Ocean for China. Increasing tensions in South China Sea has motivated China to find an alternative route to continue its trading through the Indian Ocean, Arabian Gulf and Persian Gulf and the answer to this is the Gwadar Port.

Table 4. Gwadar Project

SN	Project Name	Estimated Cost ($ Millions)	Financing	Commercial Operation Date	Direct Job Opportu- nities
1	Development of Free Zone	32	Chinese GCL	2018	1,100
2	New Gwadar International Airport	230	Chinese Government Grant		
3	Construction of Breakwaters	123	Chinese GCL & Grant		
4	Dredging of berthing areas & channels	27	GCL & Grant		
5	Gwadar East-Bay Expressway	41	GCL & Grant	2018	
6	Necessary facilities of fresh water treatment, supply and distribution	130	CGG	2018	
7	Pak China Friendship Hospital	100	CGG		
8	Technical and Vocational Institute at Gwadar	10	CGG		
9	Gwadar Smart Port City Master Plan			2018	76,600
10	Bao Steel Park, petrochemicals, stainless steel and other industries in Gwadar				
11	Development of Gwadar University (Social Sector Development)				
12	Upgradation and development of fishing, boat making and maintenance services to protect and promote livelihoods of local population				

Source: (Hussain, 2018).

CPEC enables Pakistan to develop in the presence of its arch rival India. CPEC plays a key role in China's strategy for South and Central Asia. Its geostrategic position is crucial as it serves as a gateway to the Middle East, where China seeks access to the energy-rich Persian Gulf region. Moreover, CPEC also gives an opportunity for integration to countries such as Afghanistan and Iran which will connect the whole region together. This will have a major impact on Indian interests in the region.

3. IMPLICATION OF CPEC TO INDIA

India's position towards the CPEC is an outcome of deteriorating Indo-China relations. Countries in the Asia-Pacific region are threatened by the rise of China and have taken countermeasures to limit the influence of China, India being one of them. Although China is one of India's largest trading partners (World Integrated Trade Solutions, 2022), the relations between the two countries contain various dynamics such as cooperation, containment, conflict, and competition (Joshi, 2017). India, being an aspirant of hegemonic power in the region, has rejected the Belt and Road Initiative and wishes to limit the growing Chinese influence in the region. CPEC, which is one of China's flagship investments under the Belt and Road Initiative in South Asia, has allowed China to exert its influence in South Asia through India's arch rival Pakistan. India has several concerns regarding the implications CPEC can have on India.

India's first issue with the CPEC is regarding its sovereignty. China has invested significantly in Pakistan Occupied Kashmir, especially in developing the Karakoram Highway. India has claimed a violation of its sovereignty due to the project passing through the Pakistan-occupied Azad Kashmir which is an Indian territory illegally occupied by Pakistan (Chansoria, 2018). China has rejected India's claims of a violation of sovereignty. China defends itself by saying that the CPEC is an economic project that does not involve any third country. India and Pakistan have not yet to recognize the Line of Control (LOC) as an international border and the approval of CPEC would internationalize the Kashmir dispute in Pakistan's favour. Furthermore, there is also a chance that the presence of China in the region will encourage Pakistan to challenge India on the ongoing border dispute (Schwemlein, 2019). However, the best-case scenario would result in a settlement of the Kashmir dispute (Wagner, 2016).

India is also concerned about China's investment in the Gwadar port. China is interested in Pakistan's Gwadar port to keep an eye on the growing Indian naval power in the Indian Ocean, Persian Gulf, and the Arabian Sea (Conrad, Portia, 2017). India is concerned that the Chinese state-owned company (SOE) that owns the port would be transformed into a permanent military facility that could threaten Indian navy from subcontinent bases (Akber, 2015). Furthermore, Chinese investment in Gwadar is a threat to India's geo-economic goals in the region as Gwadar being a trade hub in the region will limit India's economic growth (Mishra 2021). The Gwadar port will provide China direct access to the Indian Ocean through the Arabian Sea. Moreover, other landlocked states in the region also see the Gwadar port as an opportunity to transport their resources to the rest of the world (Rahman, Khan, Lifang, Hussain, 2021). Jay Ranade, a former additional secretary in the government, said: 'Having control of Gwadar, China is basically getting an entry into the Arabian Sea and the Gulf' (Kotoky, Ananthalakshmi, 2013).

India is concerned with the lack of transparency of CPEC projects. US diplomat Alice Wells has stated that there is no transparency in CPEC projects, and firms blacklisted by the World Bank have received projects that will increase the Pakistan's debt (PTI, 2020).

If China takes control of the Gwadar port through debt trapping, India could face a huge security dilemma. China has been accused of debt trapping Colombo and its Hambantota port (Abi-Habib, 2018) and the possibility of acquiring the Gwadar port in a similar manner cannot be ignored.

China's diplomatic ventures have also been largely successful in the region. India is threatened by China's increasing diplomatic leverage in the region (Aryal, Nair, 2021). China is currently trying to fill the void created after the US forces left Afghanistan economically and is launching its Belt and Road (BRI) initiatives. A CPEC extension that includes Afghanistan can undermine India's investments in the region and its investments in Iran's Chabahar port. China has also signed a 25-year strategic partnership agreement with Iran (Reuters, 2021). A possible extension of the CPEC to Iran is also being discussed, although Iran has to meet various conditions to be fully integrated into the CPEC (Goulard, 2020). So far India has been the largest aid provider to Afghanistan in the region, committing more than US$2 billion (Hindustan Times, 2011) for the developmental work that includes construction of roads, power plants, dams, parliament building, rural development, education, infrastructure, and much more. However, after the recent Taliban takeover, China, being one of the first countries to recognize the Taliban regime, showed its willingness to be in good terms with the new Afghan government, while India has remained adamant about not recognizing the Taliban regime. China's ongoing attempts to provide for Afghanistan aim to undermine India in the region. China has supported the new Afghan government by providing 31 million dollars of emergency aid during the ongoing Afghan winter crisis. Furthermore, China has proposed an extension of CPEC to Afghanistan through the construction of the Peshawar-Kabul Highway. China will play a key role in overpowering India's economic influence in Afghanistan after the extension of the CPEC. China's growing footprint in Afghanistan makes India cautious of undermining the India-Iran-Afghanistan trilateral agreement that gives Afghanistan access to the sea. Furthermore, Afghanistan's possible inclusion in the CPEC will also help Pakistan gain strategic advantage and the upper hand over Indian influence in Afghanistan, resulting in a huge security threat for India (Manish, Kaushik, 2019).

A CPEC extension to Afghanistan makes it easier for China to access Afghanistan's minerals and rare earth materials such as gold, copper, zinc etc. India has already declared its interest in minerals in Afghanistan, especially Hajgak iron ore deposits. India planned to invest $ 10 billion in the construction of the Hajgak mine and a direct railway to Chabahar. The mining project was stopped due to Afghanistan's instability and is now on hold, while the port is now operational (Silk Road Briefing, 2021). A deterioration of Indian influence in Afghanistan due to the China factor will limit India from achieving natural resources in Afghanistan and is going to jeopardize India's investments in Afghanistan.

China has been active in securing and strengthening its relations with countries in the South Asian region. With CPEC undermining India's territorial boundaries and India questioning the transparency of the project, the country has not been silent. India has collaborated with regional and extra-regional partners in order to compete with China and Pakistan's CPEC through various multilateral and bilateral agreements.

4. INDIA'S RESPONSE TO CPEC

India has taken several steps to contain the growing Chinese footprint in the Asia-Pacific region and most importantly to have reversal measures against the CPEC. India has

invested more than $ 500 million to the development of the Chabahar harbour. The Chabahar port is India's initiative to counter China's investments in Pakistan's Gwadar Port. The Chabahar port is India's gateway to Central Asia and Afghanistan. India sent its first wheat through Chabahar to Afghanistan in October 2017. Chabahar Port is also crucial for Indian ocean and sea surveillance (Khetran, 2018).

India is also a member of the Quadrilateral Security Dialogue (QUAD). It has four members including Australia, India, Japan, and United States of America. Indo-US ties bolstered after the US adopted a policy of reconciliation after the 1998 Indian nuclear tests. The tsunami in the Indian Ocean in 2004, which killed some 225,000 people in Indonesia, Sri Lanka, Thailand and India was resulted in further strengthening of Indo-US ties (Joshi, 2021). This led to the formation of a coalition between the United States, Australia, India and Japan to provide immediate assistance to those affected. This shaped the basis of the Quad. The group attempted to formalize the Quad at the initiation of the former Japanese Prime Minister Shinzo Abe, but was not successful. Today, with China's influence increasing in the Indo-Pacific, the Quad's main aim is to contain the growth of Chinese influence. Quad is not a formal military alliance; it is rather an informal diplomatic alliance. In terms of military alliances, Indo-US relations have amplified under the Modi administration, making United States the largest partner in military exercises. India and the United States have also entered into several technology sharing agreements (Grady, 2021).

Prime Minister Modi also initiated a concept focused on security in the Indian Ocean called Security and Growth for All in the Region (SAGAR). The main principles of SAGAR are: (1) safeguard the mainland and islands and the defense of the nation's interests focusing on improving security and prosperity for the region; (2) deepen economic and security cooperation between neighboring countries and island states; (3) promote collective action and cooperation through existing regional institutions such as the Indian Ocean Rim Association (IORA), Indian Ocean Naval Symposium (IONS) and Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and other regional mechanisms for maritime cooperation; (4) Working towards sustainable regional development through enhanced collaboration; and, (5) to work together with extra-regional actors with the aim of building greater trust and promoting respect for maritime rules, norms, and peaceful resolution of disputes (Schöttli, 2019). Furthermore, PM Modi initiated the operation of an Indian Ocean University (IOU), co-supported by Mauritius and prepared by the Indian Ocean Rim Association (IORA) Secretariat for preliminary research (Swaraj, 2017).

India has also invested immensely in its neighboring Indian Ocean islands. India signed several memoranda with Seychelles understanding renewable energy, hydrography, a protocol agreement on the sale of navigational charts, and the development of facilities on Assumption Island. However, this was met with domestic political opposition due to the vague nature of the document in Seychelles (Revi, 2020). In 2018, the two countries signed a revised version of the memoranda that provided further clarity in response to domestic opposition (Mitra, 2018). However, after a YouTube video surfaced alleging that the island was sold to India, Linyon Demokratik Seselwa (LDS) rejected the agreement. In a press conference on 5 June 2018, the President announced that the deal was no longer up for discussion, not at home or with India in his upcoming state visit (Lawrence, 2018). India's relations with Sri Lanka and Maritius are also not stable as well. However, India has committed to assist Sri Lanka and has recently extended the 500 million USD line of Credit (LOC) to Sri Lanka for urgent fuel imports (Srinivasan, 2022). India must maintain good

relations with the islands of the Indian Ocean islands to counter China's Maritime Silk Road strategy.

On 17 May, Prime Minister Modi stated that both India and Japan aim to achieve closer developmental cooperation in Africa. Both countries initiated an agenda for an Asian African Growth Corridor (AAGC) to improve Asian-African growth and linkage, focusing on areas such areas as development cooperation projects, quality infrastructure and institutional connectivity, and skilful improvement in India and Japan, at the 52nd Annual Meeting of the African Development Bank (PM-INDIA, 2017). It aims to synergize the East Policy Act of India with Japan's extended quality infrastructure collaboration to boost growth and the links between Asia and Africa (Singh, 2017).

India has also tried to gain cultural leverage over China through Project Mausam. Project Mausam aims to reconnect and re-establish communications between countries of the Indian Ocean world, which would lead to an enhanced understanding of cultural values and concerns. It also aims to understand national cultures in their regional maritime background (Ministry of Culture, 2015). Despite the cultural element, India also has strategic gains. The project as this project will provide an opportunity for India to re-establish its ties with its ancient trade partners and re-establish an "Indian Ocean world' along the littoral of the Indian Ocean, stretching from East Africa, along the Arabian Peninsula, past southern Iran to the main countries of South Asia and then to Sri Lanka and Southeast Asia (Kumar, 2019).

India's Connect Central Asia policy (2012) also plays a role in countering CPEC while expanding India's political, security, and cultural connections with the region, especially after the Taliban takeover. Central Asia's importance has heightened after the Taliban takeover of Afghanistan due to a variety of factors. Firstly, due to the threat of terrorism and drug trafficking that spreads from Afghanistan into Central Asian regions, India and Central Asian countries have a common ground to cooperate. Second, Russia and China are potential victims of a spill over from Afghanistan. Therefore, big players like Russia and China are focusing on achieving stability in the Central Asian Region and as a result Central Asian regions are likely to remain in the focus at multilateral forums regarding Afghanistan, which makes improving relations with India crucial (Mishra, 2021).

5. CONCLUSION

Over the years, Sino-Pak cooperation has enhanced, and their goals have been getting more aligned. With the implementation of CPEC, China has gained significant influence in the region. The impact of CPEC on Pakistan has been positive. With China's approach to non-interference in domestic politics, both China and Pakistan have established a stable relationship. Although China and Pakistan have been improving their relations, India does not have stable relations with most of its neighboring states. Thus, CPEC puts India in a vulnerable position.

India is losing its regional power status with the rise of China in the region. China, with its non -interference rule and ample amount of investment in the region, attracts the smaller states in South Asia. With China entering the South Asian regional power struggle, there is also a lesser room for India and Pakistan making peace with each other regarding their border conflicts and security dilemmas. Furthermore, with the undermining of India's sovereignty, China has expressed how little it values international norms and only values it if China's sovereignty is questioned. This can be a problem in the future even for Pakistan's sovereignty and also for the sovereignty of other states in the region.

Similarly, the deterioration of Indian leverage in Afghanistan signifies the rapid pace with which geopolitical dynamics are changing in the region. China's approach to Afghanistan has been empathetic and diplomatic, while India's approach lacks diplomacy and relies more on accusations like its western allies. India needs to understand that its western allies have much less to lose compared to India with China taking over in the region. India cannot afford to lose its potential regional allies while trying to please its western allies. Being in good terms with Afghanistan can benefit India with its Central Asia policy and can show the other states in the region of India's diplomatic capabilities. CPEC extended to Afghanistan is going to make Afghanistan highly dependent on China and limit the possibility of thriving relations between India and Afghanistan.

India is focusing too much on strengthening relations with countries that are far from its geographical proximity. India should instead focus on its immediate neighbors and aim to improve and strengthen its relations with regional countries. Currently, India lacks the power to counter the influence in the region on its own. Therefore, the country needs to use institutional bodies such as SAARC (South Asian Association for Regional Cooperation) to limit Chinese influence in the region. Finally, being the most affected country, India needs to take the initiative to resume all of its stalled and slow-paced projects that can help the country gain more leverage in the region, which is needed to maintain the balance of power in the region.

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MEMORY IN ADVERTISING – A BIBLIOMETRIC ANALYSIS

This article explores the relationship that exists between concepts such as memory and advertising. For this purpose, we perform a literature review based on database resources such as Scopus and Web of Science. Links between the terms in question are identified by exploring the content of the selected databases. In turn, VOSviewer software enables the extraction of patterns for keyword popularity in publications dedicated to memory and advertising, which is included in a discussion on the most critical research areas. The examined publications indicate a relationship between memory and advertising effectiveness. The literature indicates that various factors influence the processes of memory encoding, consolidation, and retrieval. Understanding these mechanisms allows brands to design strategies that maximize the likelihood of message retention in memory.

Keywords: memory, advertising, bibliometric analysis, VOSviewer, purchase decision.

1. INTRODUCTION

Currently, advertising is a fundamental element of marketing communication that continues to dynamically develop and transform to effectively influence increasingly demanding and diverse audiences (Arens, Weigold, 2021; Alsharif et al., 2023). In this context, it seems particularly important to identify thematic areas that broaden the research optics within the social sciences. An example of such an area is the exploration of the issue of advertising about memory. After all, memory shapes how individuals encode, store and retrieve information in the mind (Squire, 2009), including that contained in advertising messages.

This article explores the relationship between concepts such as memory and advertising. The authors carried out a review of the literature on the subject. The resources

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of the Scopus and Web of Science databases were analysed. The article outlines the links identified by exploring the content of the selected databases. In addition, using the VOSviewer software, the authors developed patterns of keyword popularity in publications on memory and advertising and discussed the most critical research areas. The authors formulated answers to the research questions adopted earlier based on the analyses conducted.

2. MEMORY VERSUS ADVERTISING EFFECTIVENESS

The issue of measuring the effectiveness of advertising campaigns remains a challenge for those representing business practice and academia (Otamendi, Martin, 2020). Importantly, research in this area began as early as the 1960s (Ladvige, Steiner, 1961). Attempts were made to identify the factors that act as underlying determinants to understand how advertising influences consumer decision-making (Ansari, Riasi, 2016; Chernenko, Yakovlev, 2019). The developed models of advertising influence were applied in undertakings dedicated to creating communication strategies, as well as providing a reference point in designing the research process and estimating the impact of advertising on consumer behaviour (Kozlowska, 2014).

The appearance of marketing messages in the consciousness of consumers has the hallmarks of a complex process. It requires attention to issues such as (Maison, 2004):

- whether the advertising message has reached the target group,
- were the advertisements appealing and remembered by the recipients,
- have the addressees adequately understood the message?

According to researchers, the memorisation and evaluation of advertising depend, among other things, on the context of its reception (Falkowski, Grochowska, 2008). This process is also conditioned by the reduced perceptual abilities of the senses and the limited capacity of memory (Taranko, 2015). For the present considerations, it was assumed that perception is an example of a process that involves the active reception, analysis and interpretation of sensory phenomena, including the reception of information processed based on knowledge from the individual's environment registered in memory (Michalik, 2018). The phenomenon refers to the basic cognitive activities contributing to noticing and remembering advertising messages. Several types of perception can be distinguished (Kotler, 1994):

- selective attention – consumers mainly notice content related to their needs,
- selective distortion – recipients adapt the information they receive to their thought patterns,
- selective memorisation – respondents primarily perceive information that confirms the validity of their beliefs and attitudes.

Selective attention indicates consumers' appreciation of messages corresponding to their current needs (Barasz, Kim, 2022). The term is also understood as „a mental process that engages a portion of cognitive resources, allowing a slice of reality to be perceived while other cognitive resources remain dormant" (Lipka, 2015). The selective distortion indicates switching on a kind of „filter". Consumers only perceive content consistent with their beliefs and expectations (Światowy, 2004). Consequently, the human mind interprets the information presented in advertising messages according to the recipient's beliefs, which have already been fixed (Keller, Kotler, 2012). Selective memorisation, on the other hand, should be linked to memory (Światowy, 2004). This type of perception indicates the relevance of messages that primarily coincide with the individual's pre-conceptions about

the content presented in the advertising message. The distinguished types of perception outline coping mechanisms for dealing with the complex surrounding environment that influences the decisions made by individuals. Sometimes, they may be considered helpful, but their use also leads to cognitive errors (Sanak-Kosmowska, 2023).

The purchasing decision-making process is determined by thought processes, in which memory plays an important role. The memory can be divided into sensory, short-term and long-term memory. The first distinguished type of memory involves the temporary, raw retention of sensory stimuli such as vision, hearing, smell, taste or touch (Jarodzka et al., 2012; Hultén, 2020). This memory allows an individual to temporarily store sensory information before it is interpreted and transformed into a more permanent form of memory (Crowder, 1976). Short-term memory, on the other hand, is essential for performing specific tasks, such as learning, understanding instructions or logical thinking (Hultén, 2020). In contrast to sensory memory, it does not necessarily reflect the stimulus that affects the perceiver. Instead, it represents an interpretation of what happened (Nairne, Neath, 2012). Long-term memory, in contrast, encompasses a body of knowledge about all previous events and a set of long-term memories, which is only partially error-free and complete (Cowan, 2008).

According to Atkinson and Shiffrin (1968), retaining information in memory involves its passage through the sensory register and short-term memory, while all omitted data is lost in the process. In business practice, memorable advertisements can have a long-lasting impact on consumers (Pieters et al., 2020). Furthermore, they become helpful in creating strong brand associations, increasing brand awareness and building brand loyalty (Abideen, Saleem, 2011; Amendeep, Syed, 2017). In this area, mental shortcuts and cognitive heuristics will play an important role (Nadler, McGuigan, 2018). At different stages of the purchase path, the consumer more or less consciously makes decisions to make a purchase (Bajak, Spendel, 2022). In doing so, he or she often relies on educated and developed neural pathways shaped by his or her own experiences and memories (Nicks, Carriou, 2016). Information from advertising, for example, can be recalled in the consumer's mind as a result of an emerging stimulus or need (Sutherland, 2020). In this case, the brand acts as a mental shortcut that facilitates decision-making through existing knowledge and associations (Nicks, Carriou, 2016).

In light of the available literature, the authors concluded that despite an increasing understanding of the importance of memory, there are still many research gaps and thematic areas for further exploration to detail its role in advertising.

3. PURPOSE AND RESEARCH METHOD USED

For the discussion presented here, the authors conducted a bibliometric analysis to identify the links occurring in the literature between the categories of memory and advertising. These terms appear in researchers' studies representing various scientific disciplines (e.g. management and quality sciences, psychology, social communication sciences and media). The primary task of bibliometrics is to explore the content of databases and scientific citation indexes (Theus, 2016). This type of research is used when there are numerous publication items in a given field, making it challenging to capture mainstream research and identify relationships between them (Olczyk, 2016). Conducting bibliometric research can aim to (Ejdys, 2016):
- anticipate future research directions in a given area,
- identify areas requiring further exploration (search for research gaps),

- establish links between research areas,
- penetrating areas characterised by a pretty high saturation of ongoing research,
- analysing trends in a given subject area.

The authors examined the resources of the Scopus and Web of Science databases as part of the bibliometric analysis. It was decided to indicate the links that were identified by exploring the selected databases, focusing on the following research questions:

- what links exist in the literature between the topics of memory and advertising?
- what are the interests of the researchers discussing memory in advertising?

The answers to the questions outlined above were developed based on a discussion of the results obtained.

4. ADVERTISING AND MEMORY – AVAILABLE PUBLICATIONS

In order to identify the connections existing in the literature between advertising and memory, the authors conducted a bibliometric analysis. Publications containing both the terms advertising (advertising) and memory (memory) [in the title, keywords or abstract – status at: 31.11.2023] were searched for. The Scopus database identified 1284 publications meeting the criterion adopted for the analyses. In contrast, the Web of Science database contained 1651 such papers. In the Scopus database, they most often represent the topics of Business, Management and Accounting (20.5%), Social Sciences (17.3%) and Computer Sciences (13.4%) (drawing 1). Similarly, in the Web of Sciences database, they are mainly classified in the Business (46%) and Communication (23.9%) categories.
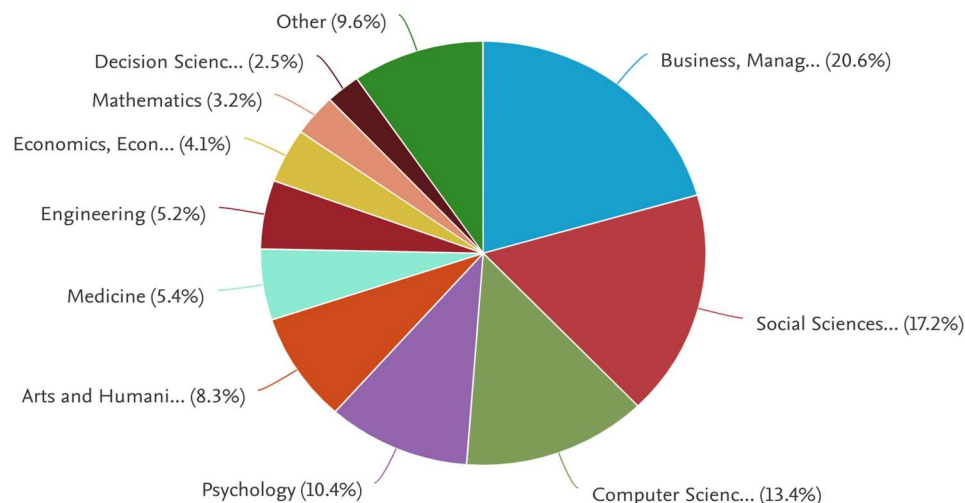
Drawing 1. Categories of articles on advertising and memory in the Scopus database

Source: (Scopus, 2023).

According to the data available in the Scopus database, these publications were cited 30126 times. It means that the average number of references per paper was 23.46. On the other hand, in the Web of Science database, the number of citations was 43968, which, after averaging, is 26.63. As the most cited publication in Scopus on this topic, the article

by T. Brown (2008) should be mentioned as a cited author 2450 times. This paper is also the most cited in Web of Science, scoring 1682 citations.

The oldest publication surveyed is from 1912 (Yerkes, 1912). This study is available in the Scopus database. It concerned an experiment to classify advertisements in terms of their decreasing excellence and to compare them systematically in terms of overall impression, attention value, perception value, feeling value, judgement value and memory value. The oldest article in the Web of Science database dates back to 1916 (Franz, 1916) and is classified as a book review. Notably, there has been a continuous increase in interest in the topic of memory in advertising over time (drawing 2). The authors with the most publications related to the topic should be identified in the Scopus database as A. Furnham. He has published 16 papers. On the other hand, the Web of Science database identifies 12 papers by Van Reijmersdal as the most active author on the topic under study.
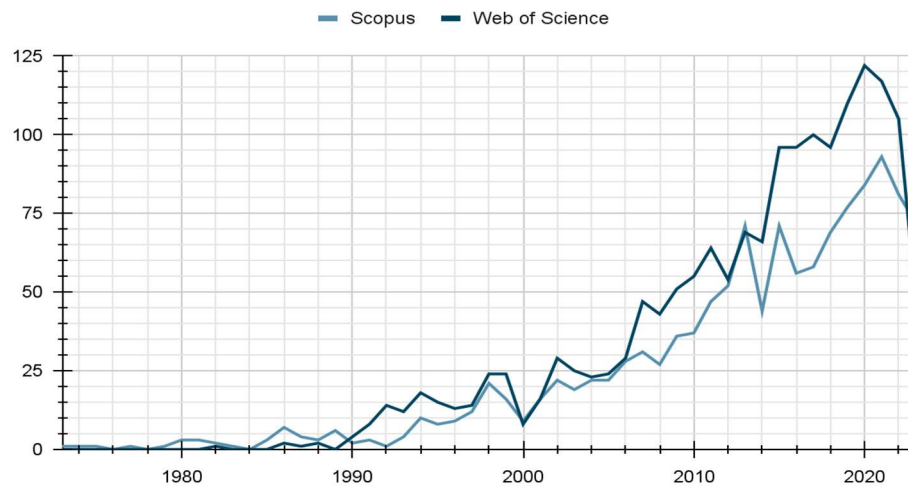
Drawing 2. Increase in publications on memory and advertising in Scopus and Web of Science databases from 1973 to 2023

Source: Own research.

5. IDENTIFIED RESEARCH AREAS

Publications on the subject of memory in advertising form an extensive list. Moreover, there has been a significant increase in such studies in recent years. It indicates that researchers are very interested in this type of issue. It was, therefore, decided to analyse the subject matter of the scientific papers quantitatively and using the VOSviewer software. The bibliographic data of all papers with topics covering both memory (memory) and advertising (advertising) were downloaded from the Scopus database. All indexed keywords (4373 in total) were then exported; those repeated a minimum of 20 times were separated and visualised using VOSviewer software (drawing 3).

The undertaken activities made it possible to create a cluster map consisting of 43 elements included in 3 thematic clusters:
- red cluster (19 elements) mainly related to the methodology of the research conducted, where the word human was used most frequently, appearing 216 times,

- green cluster (13 elements) focused on the broadly defined topic of memory in advertising, where the phrase advertising appeared the most often, used 116 times,
- the blue cluster (11 elements) was associated mainly with supporting purchase decisions through digital means and traditional promotional tools; the most frequently occurring word was marketing, occurring 123 times.
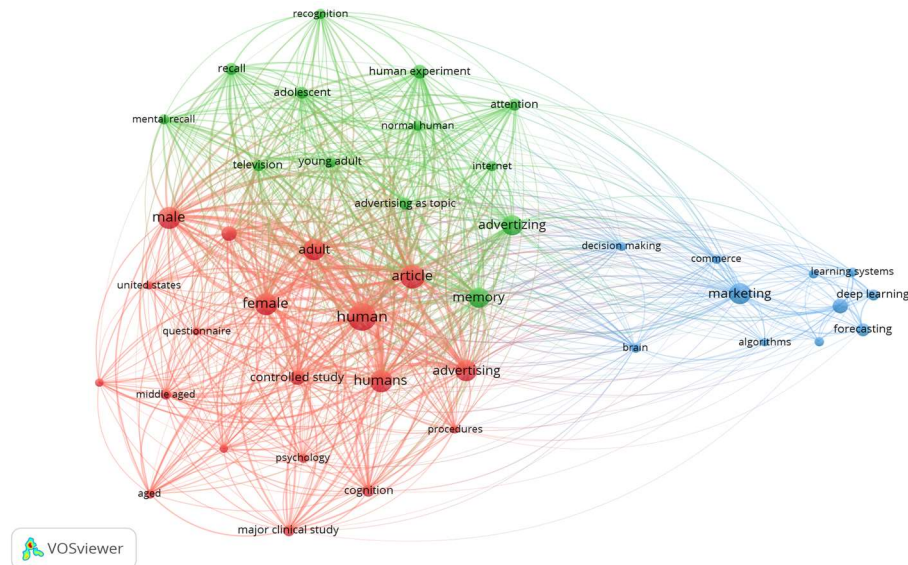
Drawing 3. Map of keyword associations in publications on the subject of memory and advertising

Source: own research using VOSviewer software.

Based on the bibliometric analysis, three main research sub-areas can be identified, which are exemplary research directions for the issue of memory in relation to advertising (Table 1). The initial number of 4,373 indexed keywords indicates the extensive thematic scope of research relating to memory and advertising. Moreover, in more than half of the cases, the keywords were not repeated, indicating many still poorly penetrated research directions.

From the point of view of further studies, two thematic clusters are particularly relevant: memory in advertising and purchase decision support. These delineate two main research directions. On the one hand, the response of human memory to advertising content, and on the other, the use of learning systems to influence customers' purchasing decisions through various marketing-mix tools. Within the green cluster, issues such as advertising, memory, recognition transmission channels and stimuli can be identified. The blue cluster, in turn, illustrates issues such as learning systems, the online space, algorithms, purchase decisions and marketing tools.

Table 1. Main research sub-areas for the topic of memory in relation to advertising with example references

Research sub-area	Example issues	Most popular keywords	Example references
Research methodology (red cluster)	gender of respondents, age of respondents, research method, research procedures	human (216); article (166); humans (140); female (139); male (133)	(Bell, Mieth, Buchner, 2022) (Casado-Aranda, Sánchez-Fernández, García, 2022) (Ashford et al., 2023) (Ciuvat, Furnham, McClelland, 2023) (Ning et al., 2023)
Memory in advertising (green cluster)	advertising, memory, recognition; transmission channels; stimuli	advertizing (116); memory (112); human experiment (56); recall (43); advertising as topic (42)	(Campbell et al., 2021) (Han, 2023) (Paredes, Bautist, Dui, 2023) (Vroegrijk, 2023) (Santos, Santo, Ferreira, 2024)
Purchase decision support (blue cluster)	learning systems, online space, algorithms, purchasing decisions; marketing tools	marketing (123); long short-term memory (61); forecasting (50); deep learning (35); decision making (27); learning systems (27)	(Rohilla, Chakraborty, Kumar, 2022) (Souissi, Ghorbel, 2022) (Zhao et al., 2022) (Ajaykrishna et al., 2023) (Göker, 2023)

Source: own research.

6. DISCUSSION OF THE RESULTS RECEIVED

The publications examined indicate a relationship between memory and advertising effectiveness. The literature indicates that various factors influence the processes of memory encoding, consolidation, and retrieval. For example, using emotional, repetition, and creative elements in advertisements can enhance memory processes (Pham, Johar, 2001; Huang, Jang, 2017; Jin et al., 2022). Understanding these mechanisms allows brands to design strategies that maximise the likelihood of message retention in memory. One feature that enhances ad recall and consequently improves ad effectiveness is emotional content. Higher affective content promotes recognition and recall of messages (Ambler, Burne, 1999; Utkutug Bozokluk, Alkibay, 2016). It is because emotional arousal is elicited in this way, activating brain areas such as the amygdala and superior temporal sulcus, which are involved in memory formation and social cognition (Bakalash, Riemer, 2013). Furthermore, a neurological study by Khan and co-authors (2023) suggests that emotion and memory are the earliest predictors of the response to liking an advertisement.

The reception of advertising is influenced not only by the emotional appeal of its content but also by using reward mechanisms and consumers' perceptions and motivations (Alsharif et al., 2022). In this regard, the personalisation of marketing efforts can be

identified as an effective intervention (Abedi, Koslow, 2022; Wei et al., 2020). Personalising the approach to the consumer fosters an emotional bond with the chosen brand, which translates into increased attentiveness and sensitivity to its messages (Diehl, Terlutter, 2022). Brand familiarity contributes to ad recall and reduces competitive distractions (Kent, Allen, 1993).

Another beneficial practice is to take a creative advertising approach, as the more unusual ones are later better recognised by the audience (Alsharif et al., 2023; Shen et al., 2020). Additionally, social influence theory suggests that advertising messages accepted or appreciated by an individual's social environment are more likely to be remembered (Spasova, 2022). Factors such as the reactions of reference groups, the popularity of the advertisement, and the promotion of essential values for the individual may ultimately translate into the consumer's assimilation of marketing messages.

It is worth analysing the given factors in terms of short-term and long-term sensory memory (drawing 4). In advertising, sensory memory is vital to the viewer's first contact with a message, brand, or product (Hutlen, 2020). Advertisements must effectively engage the different senses to attract attention (Köster, Mojet, 2017). In turn, attracting attention through sensory stimuli (e.g. visual: light, colour, shape, movement) can help activate the cognitive response of short-term memory and ultimately direct brainwave signals towards decision-making (Yazid et al., 2020). However, which information is ultimately processed in short-term memory and is missed depends mainly on the individual's attentional control process. This information selected by the mind will then merge with previous experiences recorded throughout life in long-term memory, influencing how consumers ultimately react to the brand and respond to its messages (Sanchez, Alley, 2016). It should be noted that when the recipient is favourably disposed to a given message from the outset, they are likely to accept it once they have assimilated additional arguments reinforcing their positive experience. Consequently, the processed information will automatically be incorporated into long-term memory (Światowy, 2004). However, market practice shows it can be significantly delayed relative to the first stimulus intended to induce the consumer to buy.

Sensory memory		Short-term memory		Long-term memory
temporary, raw retention of sensory stimuli, for example: • sight, • hearing, • smell, • taste, • touch.	→ Attracting attention →	interpretation of events that have taken place, such as: • learning, • reasoning, • logical thinking.	— Experience — →	possessed knowledge of all previous events and a set of long-term memories.
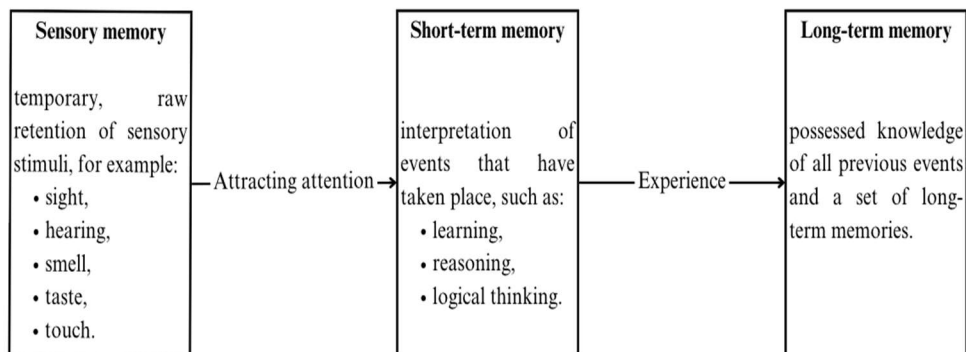
Drawing 4. Factors influencing selected memory types

Source: own elaboration based on (Jansson-Boyd, 2019).

Differentiated cognitive processes in sensory and short-term memory precede the consolidation of messages in long-term memory. The final embedding of a message in

memory is influenced by how attention is attracted and the experience of receiving the message. The issues outlined signal an exciting area from the point of view of research into the links between advertising and memory. It also has a practical dimension, which should be of interest to brands taking action to assess the effectiveness of their advertising campaigns.

7. CONSLUSIONS

In the presented article, the authors attempted to highlight the main research topics and the publications in which the issues covered by the analysis were addressed. To summarise the discussion, selected research areas devoted to memory have been identified about advertising in such databases as Scopus and Web of Science. The bibliometric analysis determined that the available publications present research results on issues such as memory in advertising and purchase decision support. Their subject matter mainly falls within the scope of social sciences (business, management, accounting, sociology, communication) and computer science.

Various factors influence the processes of encoding, consolidation, and retrieval of memory. Understanding these can be useful in designing marketing strategies that contribute to retaining messages in the audience's memory. The authors formulated the following conclusions from these considerations:

- the process of remembering advertising messages is influenced by the emotional and creative elements used and by repetition,
- the affective content of messages contributes to their recognition and recall by recipients,
- the individual perception and motivation of consumers influence the reception of advertising and its memorisation,
- individualising the approach to the consumer fosters an emotional connection with the chosen brand, resulting in increased attentiveness and sensitivity to the advertising message,
- prior knowledge of the brand makes it easier to remember the advertisement and also reduces distortions related to competition,
- the reactions of reference groups, the popularity of the advertisement, and the promotion of essential values for the individual are also factors conducive to remembering messages.

The considerations presented were also treated as contributions to further analyses dedicated to deepening the results obtained. During the research, it was also observed that, despite an increasing understanding of the importance of memory issues, many research gaps and thematic areas for further exploration could still be identified to detail their role in advertising.

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INVESTMENT INCENTIVES
IN THE CZECH REPUBLIC

This study examines the effectiveness of investment incentives in the Czech Republic in reducing regional unemployment. Using correlation analysis, it investigates the relationship between job creation and unemployment rates across various Czech regions. The results reveal notable regional disparities: in the Central Bohemian Region, job creation is associated with lower unemployment while, in structurally affected areas such as Moravia-Silesia and Ústí, high job creation does not translate into lower unemployment due to factors such as skill mismatches and industrial decline. The Karlovy Vary Region shows particularly deep-rooted labor market challenges. The main contribution of this paper lies in demonstrating that investment incentives have inconsistent impacts and that their effectiveness is highly context dependent. These findings underscore the need for region-specific policy approaches that go beyond general job creation and directly address structural labor market weaknesses.

Keywords: government incentives, regional development, unemployment, Czech Republic.

1. INTRODUCTION

Investment incentives are a key tool in economic policy, aimed at attracting domestic and foreign investment, fostering economic growth, and enhancing regional development. In the Czech Republic, investment incentives play a crucial role in shaping the business environment and stimulating innovation. Over the years, the government has implemented various forms of incentives, including tax relief, subsidies, and grants, to support both local and international investors.

Despite their widespread use, the effectiveness of investment incentives remains a subject of debate. While some argue that they contribute significantly to economic expansion, others question their long-term sustainability and fiscal impact. This study examines the role of investment incentives in the Czech Republic, analyzing their influence on foreign direct investment (FDI), job creation, and technological advancement. By

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assessing their strengths and limitations, this research seeks to provide recommendations for optimizing incentive policies to ensure a balanced and sustainable economic strategy.

2. LITERATURE REVIEW

Investment incentives, as instruments of public policy, are primarily designed to mitigate the concentration of investments in economically developed regions and to promote growth in lagging or underdeveloped areas. Numerous scholars have explored this topic, revealing both the strengths and shortcomings of such incentives.

Damborský (2023) found that the structure of investment incentives in place was insufficient to effectively support weaker regions. Belkhodja et al. (2017) emphasized that the impact of incentives varies depending on the investor's background and the surrounding environment. Similarly, Schalk & Untiedt (2000) observed that while incentives may generate short-term benefits, they do not significantly enhance long-term productivity or regional competitiveness—an assessment echoed by Garibaldi et al. (2001). The timing of incentive implementation is also crucial for determining effectiveness.

In Central and Eastern Europe, various determinants of investment have been widely studied. These include production costs, market size, and trade openness, as well as broader macroeconomic conditions (Bobenič-Hintošová et al., 2018). Another branch of literature focuses on institutional factors like infrastructure, government spending, corruption, and the rule of law (Chanegriha et al., 2017; Bilan et al., 2019).

In Slovakia, investment incentives are considered a foundational tool for attracting foreign capital (Fabuš, Csabay, 2018). In the Czech Republic, incentives are generally deemed effective but only in certain regions (Cedidlová, 2013; Hlaváček, Janáček, 2019). Johnson & Toledano (2022) point out that within the EU, some incentives qualify as "State Aid", which is defined by specific legal criteria and may risk distorting competition and affecting trade between member states.

Musil & Hedija (2020) argue that investment incentives are procyclical, responding to economic conditions. Hlaváček & Janáček (2019) examined their impact in the Czech Republic, concluding that incentives influence firm location decisions, albeit with uneven geographical outcomes. Táncošová (2019) highlighted the persistent issue of disproportionate investment in already strong regions.

Fabuš & Csabay (2018) still regard incentives as a necessary means for job creation. However, Bolcha & Zemplinerová (2012) pointed to their low efficiency, and Dinga (2011) found that despite more incentives being allocated to high-unemployment districts, their actual impact was marginal. Viturka (2007) noted the strongest benefit of investment incentives lies in employment growth, especially when linked to job creation conditions.

Blaschke (2022) concluded that the influence of incentives on economic development is positive, though not statistically significant. Johnson & Toledano (2022) emphasized the difficulty in quantifying their economic effects. Yanikkaya & Karaboga (2017) even found negative macroeconomic implications. Yet, the positive impact on employment has been affirmed by Schalk & Untiedt (2000) which confirm incentives' role in supporting underdeveloped regions through foreign investment.

Schwarz et al. (2007) determined that the maturity of a region does not significantly influence the distribution of incentives, indicating a lack of targeted support for less developed areas. Moreover, the volume of incentives often does not match the number of jobs promised. This suggests that incentives tend to support specific economic segments rather than driving comprehensive regional development.

Many studies argue that incentives have limited influence on location decisions, particularly when investment environments are unattractive. The World Bank's investment climate surveys show that investors rarely rank incentives among their top decision-making factors (Jensen, 2018; Johnson, Toledano, 2022). Similar conclusions were drawn by Antaloczy & Sass (2001), Bevan & Estrin (2000), and others. Morisset (2003), studying investment promotion agencies, even found that incentives can sometimes have negative consequences in transitional and developing countries.

3. METHODOLOGY

This study analyzes investment incentives at the territorial level, focusing on the districts and regions of NUTS III in the Czech Republic. Prague was excluded from the dataset due to its unique economic structure, which significantly differs from other regions. The dataset comprises information on regions that received investment incentives between 2000 and 2022, including the number of supported projects and the number of newly created jobs. These data were sourced from project databases maintained by the Ministry of Industry and Trade of the Czech Republic, in collaboration with the Agency for Business and Investment Support – CzechInvest. These variables represent the independent factors in the analysis. For dependent variables, macroeconomic data at the regional level were obtained from the Czech Statistical Office. The primary statistical method employed was correlation analysis to examine the relationships between investment incentives and unemployment trends. Correlation analysis is a statistical technique used to assess the strength and direction of the relationship between variables. In this study, we performed a correlation analysis to identify the degree of association between unemployment (U) and Job created (J). To determine the strength and direction of the relationships, we used the Pearson correlation coefficient, which ranges from -1 to 1. A coefficient close to 1 indicates a strong positive relationship, while a value close to -1 suggests a strong negative relationship. A value around 0 suggests no linear correlation.

The study aimed to answer the central research question: *Does the development of unemployment depend on the number of newly created jobs?*

In order to investigate this question, the following hypotheses were tested:
H1: An increase in the number of newly created jobs leads to a decrease in the unemployment rate.

The findings of this study contribute to understanding the impact of investment incentives on regional labor markets, providing valuable insights for policymakers and economic strategists.

4. RESULTS

The data presented in the table (Table 1) reveals regional variations in the number of new jobs created and unemployment rates across different regions. Central Bohemia leads with the highest number of new jobs created (7,904) and maintains a relatively low unemployment rate of 4%. South Bohemia, while contributing fewer jobs (2,224), shares the same unemployment rate of 4%. On the other hand, regions such as Ústí and Moravia--Silesia experience both high unemployment rates (9.1%) and significant job creation (6,502 and 9,524, respectively), indicating potential challenges in job absorption despite the creation of employment opportunities. Karlovy Vary stands out with the highest unemployment rate (7.5%) despite having only 819 new jobs created, suggesting

difficulties in the region's labor market. Most regions have an unemployment rate below 5%, reflecting overall positive employment trends, with the exception of some regions like Ústí, Olomouc, and MoraviaSilesia, where higher unemployment levels persist. This regional disparity in both job creation and unemployment rates indicates a need for targeted interventions to address labor market challenges in certain areas.

Table 1. New Job Creation and Labor Market Dynamics

	NEW JOBS CREATED	UNEMPLOYMENT RATE (%)
CENTRAL BOHEMIA	7904	4.0
SOUTH BOHEMIA	2224	4.0
PLZEŇ	6576	4.2
KARLOVY VARY	819	7.5
ÚSTÍ	6502	9.1
LIBEREC	3482	5.5
HRADEC KRÁLOVÉ	7356	4.9
PARDUBICE	6133	5.1
VYSOČINA	4742	4.7
SOUTH MORAVIA	4576	5.8
OLOMOUC	4500	7.0
ZLÍN	3283	5.7
MORAVIA-SILESIA	9524	9.1

Source: Own processing based on data from CzechInvest and the Czech Statistical Office.

The graph (Figure 1) illustrates significant fluctuations and regional variation in job creation across the Czech Republic from 2000 to 2022. There is a notable peak in job creation in 2014, particularly in regions like Central Bohemia and Moravia-Silesia, while other regions show comparatively lower levels. The overall trend indicates lower job creation in the early 2000s, a rise and peak around 2014, and a decline in recent years, possibly influenced by economic events such as the 2008 financial crisis and the COVID-19 pandemic. This pattern highlights the uneven impact of factors influencing job creation and suggests the need for policies that address regional disparities and promote economic resilience.

The analysis reveals a complex and geographically varied relationship between unemployment rates and the creation of new jobs across the regions (Table 2). Overall, when considering all regions together, there is a moderately strong positive correlation (0.6126). In the Karlovy Vary region (0.7286) shows a very strong positive link. Moderate positive correlations also exist in Central Bohemia (0.2342) and Hradec Králové (0.2046). Conversely, many regions, including South Bohemia, Liberec, Pardubice, Vysočina, South Moravia, Olomouc, and Zlín, show virtually no linear relationship (coefficients near zero), indicating that changes in unemployment and new job creation are largely independent there. The Ústí region (-0.1805) displays a weak negative correlation, aligning slightly more with the conventional expectation that higher unemployment might correspond with

fewer new job openings, though the link is tenuous. This highlights that the dynamic between job losses/unemployment and job creation is not uniform and exhibits significant regional specificities, with some areas possibly experiencing economic restructuring where job losses and gains occur concurrently.
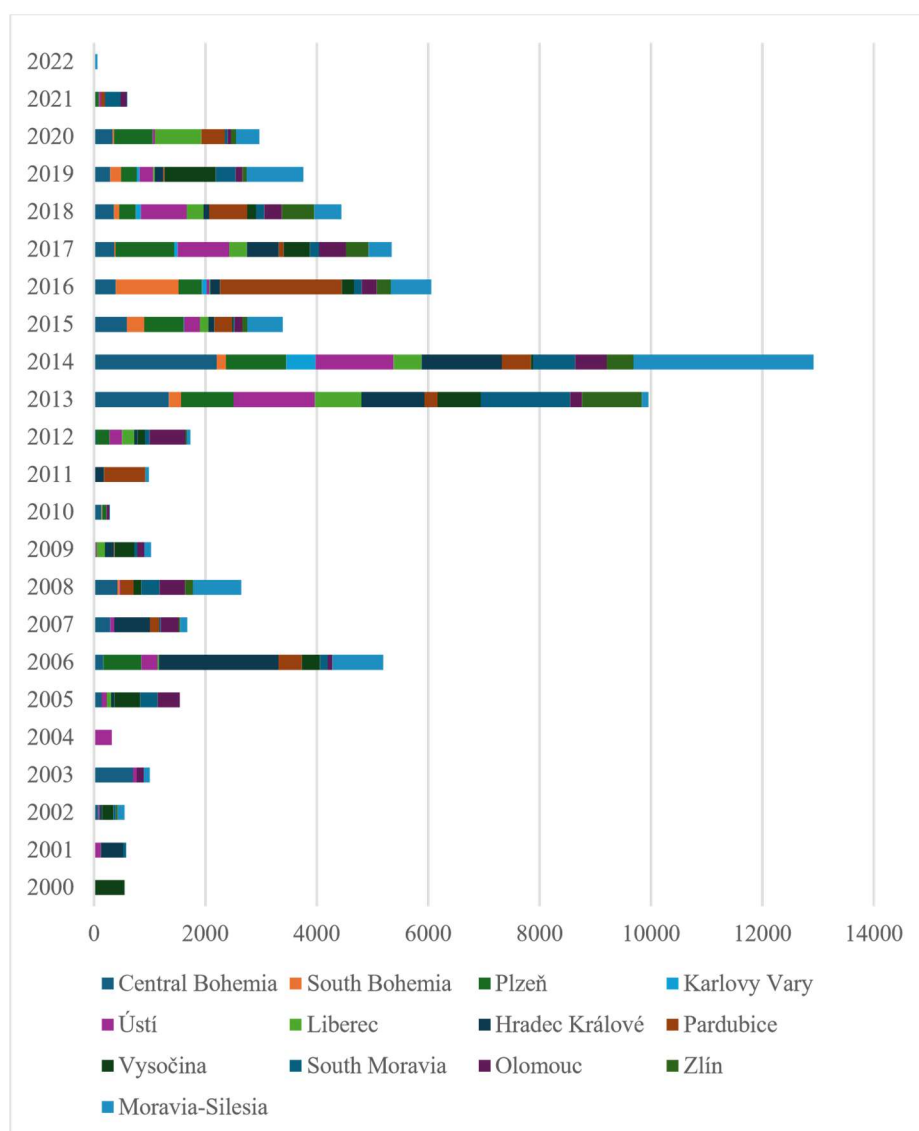
Figure 1. Jobs created from 2000 to 2022

Source: Own processing based on data from CzechInvest.

Table 2. Correlation Analysis of Unemployment rate and Newly Created Jobs

REGION	CORRELATION COEFFICIENTS
CENTRAL BOHEMIA	0.2342
SOUTH BOHEMIA	-0.0144
PLZEŇ	-0.1099
KARLOVY VARY	0.7286
ÚSTÍ	-0.1805
LIBEREC	-0.0424
HRADEC KRÁLOVÉ	0.2046
PARDUBICE	-0.0253
VYSOČINA	-0.0396
SOUTH MORAVIA	0.0833
OLOMOUC	0.0649
ZLÍN	-0.0332
MORAVIA-SILESIA	-0.0819
ALL REGIONS	0.6126

Source: Own processing.

5. DISCUSSION

The results of this study underscore the regional disparities in the relationship between job creation and unemployment rates across the Czech Republic. While the general expectation is that an increase in newly created jobs should lead to a decrease in unemployment, the findings reveal a more nuanced and region-specific dynamic. Central Bohemia, which has the highest number of newly created jobs, maintains a relatively low unemployment rate, supporting the hypothesis that job creation contributes to employment growth. However, the situation in Moravia-Silesia and Ústí presents a more complex picture. Despite high numbers of newly created jobs, these regions continue to experience elevated unemployment rates, suggesting that job absorption in these areas may be hindered by structural economic factors such as skill mismatches, industrial decline, or demographic challenges. The Karlovy Vary region, in particular, stands out with a significantly high unemployment rate despite a low number of newly created jobs, indicating deeper labor market issues that require targeted policy interventions.

The correlation analysis further supports the notion that the relationship between job creation and unemployment is not uniform across regions. At a broad level, regions with more job creation tend to have higher unemployment, potentially reflecting economic restructuring rather than a straightforward causal link. The strong positive correlation in Karlovy Vary suggests that new jobs have not significantly reduced unemployment, possibly due to local labor market inefficiencies or a higher prevalence of long-term unemployment. Conversely, some regions such as South Bohemia, Liberec, and South Moravia exhibit little to no correlation, implying that job creation and unemployment trends operate independently in these areas. This could be due to factors such as labor mobility, commuting patterns, or variations in local economic structures. The Ústí region

shows a weak negative correlation, aligning slightly with conventional economic theory, suggesting that in this area, job creation may have a small but discernible effect on reducing unemployment.

Overall, the findings suggest that while investment incentives play a role in job creation, their effectiveness in reducing unemployment varies significantly by region. This underscores the importance of region-specific policies that address local economic structures, workforce skills, and industrial composition rather than a one-size-fits-all approach. Future research should further explore causal relationships by incorporating additional economic indicators, labor market mobility data, and qualitative insights from policymakers and businesses.

6. CONCLUSSION

This study highlights the complex and regionally diverse relationship between job creation and unemployment in the Czech Republic. While investment incentives have contributed to employment growth in some regions, their impact on reducing unemployment is inconsistent. Structural factors such as industrial composition, workforce mobility, and skill mismatches play a crucial role in shaping these dynamics. The findings indicate that policies aimed at reducing unemployment should not rely solely on job creation initiatives but should also address underlying labor market challenges unique to each region. In areas where job creation does not correspond to lower unemployment, targeted strategies such as workforce training, education reforms, and infrastructure improvements may be necessary to enhance labor market efficiency.

Our findings align with previous research (Damborský, 2023; Yanikkaya, Karaboga, 2017), which also highlighted the limited efficiency of investment incentives in reducing unemployment in targeted regions. The study by Damborský (2023) particularly supports the argument that the current system of investment incentives in the Czech Republic does not sufficiently protect or uplift economically weaker regions.

Ultimately, a more tailored approach to investment incentives and employment policies is needed to ensure balanced economic development across all regions. Future studies should incorporate additional socioeconomic variables and longitudinal data to provide a deeper understanding of the causal mechanisms behind these trends.

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AN EVALUATION OF THE IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOAL 7 IN EUROPEAN UNION COUNTRIES IN 2013 AND 2022 USING THE WARD'S METHOD

The aim of this article is to assess the implementation of Sustainable Development Goal 7 by European Union countries in 2013 and 2022. This objective is achieved by grouping EU countries using one of the methods belonging to hierarchical agglomeration – the Ward method. The results of this study show that, in 2022, compared with 2013, the gap between the EU countries in terms of meeting Sustainable Development Goal 7 narrowed. Northern European countries are the best performers in the implementation of SDG7, and their situation continues to improve. In contrast, the southern and eastern European countries, despite the progress made, are still far behind in the implementation of this goal. Separated by the Ward method, the groups of countries with similar levels of SDG7 implementation have certain characteristics that are useful in monitoring the progress of individual countries and in implementing appropriate policies.

Keywords: SDG7, European Union countries, Ward's method.

1. INTRODUCTION

Sustainable development has been the subject of scientific research, economic analysis or public debate for many years and the issue is still relevant today. Sustainable development is currently the most popular development concept, broadly accepted worldwide.

The concept of sustainable development is very complex and is therefore defined differently in the literature. The most common assumption is that sustainable development

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implies the management of natural resources, taking into account their depletion and bringing them into use according to social and economic needs (Roszkowska et.al., 2014).

It is important to stress the great importance of sustainable development for the economies of individual countries as well as societies. Sustainable development is development that meets the needs of people today without compromising the ability of future generations to satisfy their. It is based on a comprehensive approach that combines economic, social and environmental issues in a way that ensures that they reinforce each other (Raczkowska et.al., 2021).

The concept of sustainable development has evolved over the years and the current 2030 Agenda for Sustainable Development (Transforming Our World: the 2030 Agenda for Sustainable Development) is a programme of action that sets out a model for sustainable development at a global level. The Agenda contains 17 Sustainable Development Goals (SDGs), divided into 169 targets and 304 indicators, to make people's lives better, healthier and safer in 2030, both socially, environmentally and economically (Grzebyk, Stec, 2015). These goals can be implemented worldwide, taking into account the different conditions of individual countries, their capacities and levels of development, and their compatibility with national strategies and priorities.

It is emphasised that the individual Sustainable Development Goals are closely interlinked. The achievement of one of the Sustainable Development Goals may hinder or even prevent the achievement of the others (Raczkowska et.al., 2021).

Despite the fact that the 2030 Agenda is more expansive than the previous Millennium Development Goals, it is sometimes seen as a utopian, ambitious declaration that does not take into account many of the problems facing the world today: refugees, religious fundamentalism or the system of the global economy supporting the growth of inequality (Szymczak, 2018).

The European Union is therefore working to implement the Sustainable Development Goals in its Member States, as reflected in the directives it adopts.

Energy plays a significant role in sustainable development initiatives, hence the aim of this article is to assess the implementation of Sustainable Development Goal 7 by EU countries in selected years, i.e. 2013 and 2022. This objective was attempted by grouping EU countries into similar groups using Ward's method.

The article poses the following research questions:

- Which EU countries have similar levels of achievement of Sustainable Development Goal 7 in the years under review?
- What are the characteristics of groups of countries with similar levels of achievement of Sustainable Development Goal 7?
- What is the consistency of the grouping results in the years studied?

2. LITERATURE REVIEW

The 2030 Agenda implies the active involvement of the European Union in its implementation, including usage of analytical and scientific capacities to forecast future risks and challenges. It is also a declaration of commitment to a Europe that is ready to share its experience and knowledge with other parts of the world, supporting other countries on the road to sustainable development, to develop or adapt technology to their needs taking into account the specificities of their economy, society and culture, involving all stakeholders in the process (Latoszek, 2017).

The Agenda's sustainable development goals are intended to prevent climate change, poverty, inequality, discrimination, lack of access to natural resources and war (Sachs,et.al., 2022).

Among the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda, SDG 7 occupies an important position. Under Goal 7, the European Union has adopted the following tasks (United Nations. Goal 7., 2022):

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services.

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix.

7.3 By 2030, double the global rate of improvement in energy efficiency.

7.A By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.

7.B By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed ones, small island developing States and landlocked developing countries, in accordance with their respective programmes of support.

SDG7 emphasises the importance of energy security to guarantee affordable and reliable energy access for everyone.

Energy security is defined as the accessibility and availability of energy at affordable prices for everyone (Luty et.al., 2023).

As the world's population grows, the demand for energy is increasing rapidly, and with it the importance of ensuring that energy production and consumption are sustainable.

The energy sector is responsible for more than 75% of greenhouse gas emissions, covering a wide range of sources from traditional fossil fuels to renewable energy sources. Therefore, the energy transition should be inextricably linked to reducing GHG emissions by phasing out fossil fuels and replacing them with renewable energy sources on a global scale (Diaconescu et.al., 2024).

The intersection of energy and sustainable development has become a key arena in the global pursuit of the Sustainable Development Goals. In a world marked by growing concerns about environmental degradation, climate change and socio-economic inequality, understanding the multifaceted contribution of the energy sector to sustainable development has become imperative (Carvalho, Santos, 2024).

Energy is an essential element not only for sustaining economic growth and the survival of humanity, but also in terms of contributing to the stability of political, economic and social processes of individual countries (Luty et.al., 2023).

The implementation of SDG7 should cover three aspects: environmental, economic and social.

In the environmental aspect, achieving Goal 7 will enable consumers to have access to clean energy without emitting harmful substances that negatively affect the environment. The economic aspect is primarily about ensuring an uninterrupted supply of energy in the required quantity, time, place and at an affordable price. Without this, economic development is impossible. In the social aspect, the achievement of SDG7 is to ensure the elimination of energy poverty. Access to energy affects the quality of life of society and access to education and healthcare (Rybak et.al., 2024).

Fitting into the current research on SDG7 and analysing the literature on the subject, one notices a continuous increased interest in this issue. In recent years (2019–2024),

several hundred articles have been written on this topic[4]. Research directions revolve around several main issues, which include: assessing the level of progress in the implementation of this target in the EU using various statistical methods (Bączkiewicz, Wątróbski, 2022; Czerwińska et.al., 2023; Dmytrów et.al, 2022), determining the relationship between SDG7 and renewable energy consumption in EU countries (Firlej, Stanuch, 2023), the importance of effective economic policies in achieving this target (Zarghami, 2025), assessing energy efficiency (Zhang et.al., 2024) and productivity within a circular economy (Campoli, 2024), exploring the role of green innovation technologies, economic progress and urbanisation on energy demand (Xing, 2024).

The research results presented show that the scope is quite broad, but there is a lack of analysis on the usage of country grouping methods to assess progress in SDG7 implementation.

3. SELECTION OF DIAGNOSTIC VARIABLES AND ASSUMPTIONS OF THE RESEARCH METHOD

Ward's method was used to assess the achievement of the EU countries' Sustainable Development Goal 7 in 2013 and 2022.

The initial step in the application of clustering methods is to adequately prepare the variables used in the study by checking their level of variability and correlation. The assessment of variability usually adopts the classic coefficient of variation based on the arithmetic mean and standard deviation. Variables for which the coefficient of variation is lower or equal to 0.10 are removed from the set of potential diagnostic variables, while the correlation of variables can be assessed using, for example, the inverse correlation matrix method of Malina and Zelias (1998). After statistical verification of the variables, the so-called diagnostic variables remain in the set of variables.

As the diagnostic variables are expressed in different units, their normalisation is carried out using formulas:

For stimulants

$$z_{ij} = \frac{x_{ij} - \min_i\{x_{ij}\}}{R_j} \qquad (1)$$

For destimulants

$$z_{ij} = \frac{\max_i\{x_{ij}\} - x_{ij}}{R_j} \qquad (2)$$

It should be added that the minimum value, maximum value and spread were calculated simultaneously for both years under study.

Ward's method, among others, can be used to group countries with similar levels of implementation of Sustainable Development Goal 7. It is characterised by high efficiency, understood as the ability to correctly identify the real structure of objects in a multidimensional classification space (Sokolowski, 1992).

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[4] Data based on bibliometric analysis of the Scopus database conducted 11.11.2024 considering keyword: SDG 7.

Ward's method is one of the hierarchical agglomerative methods. All such procedures can be described by the so-called central agglomerative procedure (Grabinski, 2003; Lance, Williams, 1967; Ward, 1963).

The starting point is a matrix D of distances d_{ij} between classified objects O_1, O_2,...,O_n. A taxonomic distance is the distance between points in a multidimensional space. In order to measure the distance between points, a specific metric must first be adopted. In practice, the Euclidean distance of the form (Nowak, 1990) is most commonly used:

$$d_{ik} = \sqrt{\sum_{j=1}^{m}(z_{ij} - z_{kj})^2} \quad (i,k = 1,2,...,n). \tag{3}$$

By calculating the distances between the highlighted objects, a distance matrix is obtained

$$D = \begin{bmatrix} 0 & d_{12} & \ldots & d_{1n} \\ d_{21} & 0 & \ldots & d_{2n} \\ . & . & . & . \\ d_{n1} & d_{n2} & \ldots & 0 \end{bmatrix}. \tag{4}$$

The algorithm for the central agglomeration procedure is as follows (Nowak 1990):
1. each object O_i $(i = 1,2,...,n)$ is treated as a one-element group,
2. a minimum value is searched for in the distance matrix:

$$d_{pq} = \min_{i,j} \{d_{ij}\} (i, j = 1,...,n), \tag{5}$$

where:

n – is the number of groups currently present (in the first step, n equals the number of objects).
3. O_p and O_q objects are treated as one-element groups.
4. The clusters A_p and A_q are combined into one two-element group A_r:

$$A_r = A_p \cup A_q$$

5. The row and column numbered q are removed from the matrix D and n:=n−1, is substituted,
6. The distances d_{ir} of the newly created group A r from all other groups A_i are determined according to the method chosen. The values of d_{ir} are inserted into the matrix D in place of the p-th row (in place of the *p-th* column the elements of d_{ir}),
7. steps 2 - 5 are repeated until all objects form one group.

The general formula for transforming the distance matrix, when combining groups A_p and A_q into a new group A_r for hierarchical agglomerative methods operating according to the principle of the central agglomerative procedure has the following form (Nowak, 1990):

$$d_{ir} = a_p d_{ip} + a_q d_{iq} + b d_{pq} + c|d_{ip} - d_{iq}| \tag{6}$$

where:
d_{ir} – distance between groups A_i and A_r,
d_{ip} – distance between groups A_i and A_p,
d_{iq} – distance between groups A_i and A_q,

d_{pq} – distance between groups A_p and A_q,
ap, aq, b, c – transformation parameters specific to different grouping methods,
N_i, N_p, N_q, N_r – number of group elements A_i, A_p, A_q, A_r.

Ward's method consists in combining such clusters of A_p and A_q that, as a whole, provide the minimum of the sum of squares of the distances from the centre of gravity of the new cluster they form. The transformation of the elements of the distance matrix is performed as follows (Nowak, 1990):

$$d_{ir} = \frac{N_i + N_p}{N_i + N_r} d_{ip} + \frac{N_i + N_q}{N_i + N_r} d_{iq} - \frac{N_i}{N_i + N_r} d_{pq} \tag{7}$$

An important step in the clustering process is to determine the number of classes. One way to do this is to analyse an agglomeration flow chart. This graph shows the distances between clusters when they were combined. The best cut-off point is a clear flattening (longer vertical line), indicating distant clusters.

In the next stage of the object grouping process, the obtained classification results are verified. An interesting proposal for comparing classification results was proposed by Pociecha, Podolec, Sokołowski and Zając (1988). In this method, an assignment consistency matrix is introduced:

$$P = P_A + P_B \tag{8}$$

where:
P_A, P_B – assignment matrices in classifications A and B.

In the assignment matrix P_A, an element (i, j) is equal to 1 if objects numbered i and j are in the same subset, and 0 when they are in different subsets.
For the second division, an assignment matrix P_B.

The matrix P is a square matrix of dimension (n x n) in which the elements 0, 1, 2, denote respectively that the pair of objects in the two divisions being compared do not form a common subgroup, have been differently or equally assigned.

If classification A yields k1 subsets and classification B yields k2 subsets, then the measure of compatibility between the two classifications (W_Z) is given by the formula (Pociecha et.al., 1988):

$$W_Z = \frac{2(z_2 - n)}{\sum\limits_{i=1}^{k_1} \left(n_i^2 - n_i\right) + \sum\limits_{j=1}^{k_2} \left(n_j^2 - n_j\right)}, \tag{9}$$

where:
z_2 – the number of twos in the P matrix,
n_i – abundance of the i-th subgroup in classification A,
n_j – abundance j of this subgroup in the B classification,
n – number of objects.

W_Z – it is a measure that is normalised in the interval [0, 1]. The concordance between two classifications is better the higher the value of the measure. With identical classifications, $W_Z = 1$, while $W_Z = 0$, if one classification includes n one-element

subgroups and the other classification is a single group containing all elements of a set of objects.

4. AN ANALYSIS OF RESEARCH RESULTS

The following variables were taken into account in the research on SDG7 in the European Union countries:

X1 – Primary energy consumption [sdg_07_10],
X2 – Final energy consumption [sdg_07_11],
X3 – Final energy consumption in households per capita [sdg_07_20],
X4 – Energy productivity [sdg_07_30],
X5 – Share of renewable energy in gross final energy consumption by sector [sdg_07_40],
X6 – Energy import dependency by products [sdg_07_50],
X7 – Population unable to keep home adequately warm by poverty status [sdg_07_60].

Variables X4 and X5 are stimulants, the other variables are destimulants. The values of variables X1-X7 for 2013 and 2022 were downloaded from the Eurostat website (https://ec.europa.eu/eurostat/data/database). Calculations were performed using Excel, Python and Statistica 13.

The variables defining the 7th Sustainable Development Goal in 2022 were subjected to statistical verification. After calculating the coefficients of variation, it was found that values higher than 0.10 were obtained for all variables.

The inverse correlation matrix method of Malina and Zelias (1998) was used to assess the correlation of the variables. Only variable X1- Primary energy consumption showed too high a correlation, which was removed from the initial set of variables. The diagnostic variables thus remained variables X2–X7. The same set of diagnostic variables was adopted for 2013.

In the next stage of the research, using the normalised values of the variables, Ward's clustering method was applied.

The results of the grouping of EU countries in terms of the level of achievement of Sustainable Development Goal 7 in 2013 are presented in Figure 1.

Analysing the dendrogram presented in Figure 1, the EU countries were divided into 5 groups similar in terms of the implementation of Sustainable Development Goal 7 in 2013. It also seems interesting to indicate the characteristics of the groups formed. To this end, Table 1 lists the countries included in each group and the arithmetic averages of the baseline variables for the countries included in the group. The most favourable values of the output variables are indicated in bold font.

It should be noted that group I, comprising the 3 countries Belgium, Luxembourg and Ireland, has the most favourable situation in terms of variable X4 – Energy productivity. In contrast, Germany, France, Spain and Italy included in group II do not stand out in terms of the variables defining the 7th Sustainable Development Goal. The most numerous group III containing 10 countries (Czech Republic, Netherlands, Poland, Estonia, Romania, Croatia, Slovenia, Hungary, Slovakia, Latvia) had the lowest value of variable X6 – Energy import dependency by products. Countries included in group IV (Denmark, Austria, Finland, Sweden) had the most favourable values of two variables: X5 – Share of renewable energy in gross final energy consumption by sector and X7 – Population unable to keep home adequately warm by poverty status. In contrast, countries forming group V (Bulgaria, Greece, Portugal, Lithuania, Cyprus, Malta) were characterised by the lowest

values of the variables: X2 – Final energy consumption, X3 – Final energy consumption in households per capita.

Figure 1. Grouping of EU countries by level of achievement of Sustainable Development Goal 7 using the Ward method in 2013

Source: own elaboration.

Table 1. Average values of output variables across EU country groups in 2013

Groups	X2	X3	X4	X5	X6	X7
I: Belgium, Luxembourg, Ireland	17.23	791.67	**9.69**	6.23	88.81	5.80
II: Germany, France, Spain, Italy	144.15	590.50	8.33	14.86	64.28	9.68
III: Czech Republic, Netherlands, Poland, Estonia, Romania, Croatia, Slovenia, Hungary, Slovakia, Latvia	20.73	597.40	4.45	19.39	**36.97**	9.40
IV: Denmark, Austria, Finland, Sweden	24.68	841.50	8.83	**36.66**	39.01	**2.15**
V: Bulgaria, Greece, Portugal, Lithuania, Cyprus, Malta	**7.80**	**322.00**	5.32	15.80	74.86	30.98

Source: own elaboration.

In order to answer the question: has there been a change in the composition of the different groups of EU countries in terms of the implementation of Sustainable Development Goal 7, the Ward method was also applied to the 2022 data. The results are presented in Figure 2 and Table 2.
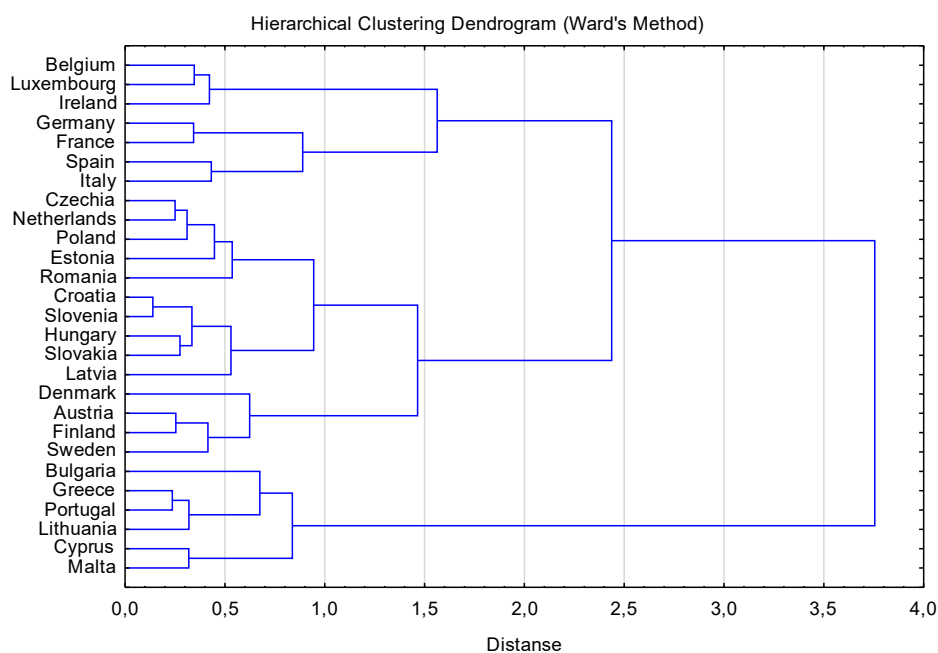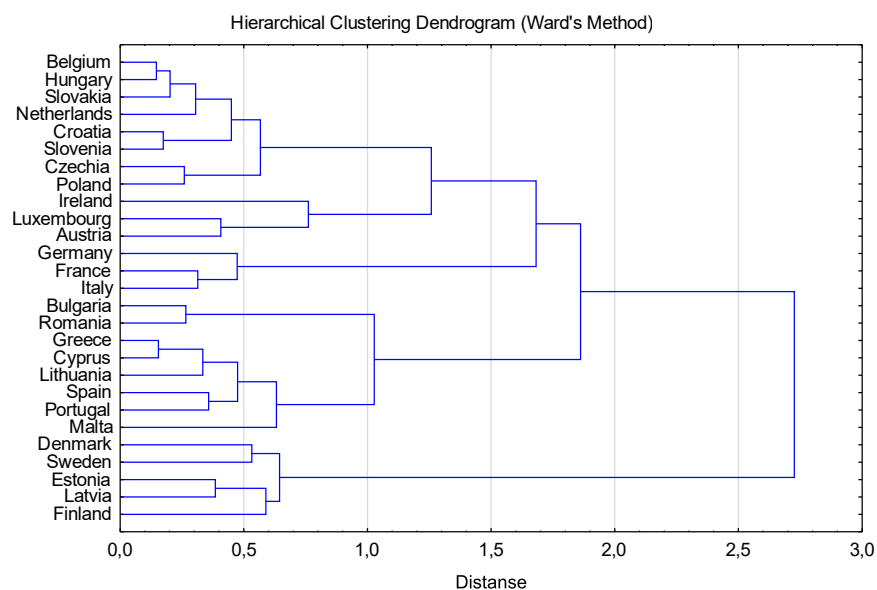
Figure 2. Grouping of EU countries in terms of their level of achievement of Sustainable Development Goal 7 using the Ward method in 2022

Source: own elaboration.

Table 2. Average values of output variables across EU country groups in 2022

Groups	X2	X3	X4	X5	X6	X7
I: Belgium, Hungary, Slovakia, Netherlands, Croatia, Slovenia, Czech Republic, Poland, Ireland, Luxembourg, Austria	23.90	590.91	9.28	18.47	68.24	5.10
II: Germany, France, Italy	151.13	580.33	**10.67**	20.02	66.63	8.70
III: Bulgaria, Romania, Greece, Cyprus, Lithuania, Spain, Portugal, Malta	19.48	**362.88**	6.70	23.14	69.78	16.91
IV: Denmark, Sweden, Estonia, Latvia, Finland	**14.90**	735.80	8.80	**47.46**	**31.10**	**4.06**

Source: own elaboration.

For the 2022 data, 4 groups of EU countries with similar levels of achievement of the 7th Sustainable Development Goal were created. The largest group I, containing 11 countries, did not stand out in terms of the variables defining Sustainable Development Goal 7.

The special feature of group II (Germany, France, Italy) was the highest level of variable X4 – Energy productivity. Countries classified in group III: Bulgaria, Romania, Greece, Cyprus, Lithuania, Spain, Portugal, Malta, were characterised by the most favourable situation in terms of variable X3 – Final energy consumption in households per capita. Group IV countries (Denmark, Sweden, Estonia, Latvia, Finland) were the leaders in the implementation of Sustainable Development Goal 7, dominating in terms of as many as four variables, i.e. X2 – Final energy consumption, X5 – Share of renewable energy in

gross final energy consumption by sector, X6 – Energy import dependency by products, X7 – Population unable to keep home adequately warm by poverty status.

The conformity of the grouping results of EU countries in terms of the implementation of Sustainable Development Goal 7 in 2013 and 2022 was assessed using the Pociecha, Podolec, Sokolowski and Zając (1988) measure (formula 9). The calculated value of 0.556 determines a moderate conformity of the grouping results, which may indicate that gradual changes in the composition of the different country groups are taking place. It can be noted that in 2022 compared to 2013, the position of the leaders in achieving Sustainable Development Goal 7 (Denmark, Sweden, Estonia, Latvia, Finland) has strengthened. Quite a number of EU countries including Belgium, Hungary, Slovakia, Netherlands, Croatia, Slovenia, Czech Republic, Poland, Ireland, Luxembourg, Austria, have not yet achieved satisfactory results in ensuring access to affordable, reliable, sustainable and modern energy for all. A lot of work still needs to be done by Germany, France, Italy, achieving unfavourable values in relation to other EU countries, especially for the variables: X2 – Final energy consumption and X3 – Final energy consumption in households per capita.

5. DISCUSSION

In order to achieve the goals set out in Agenda 2030, including SDG 7, there is a great need to transform the economies of the EU27. The European Union is very diverse and complex in terms of the energy efficiency of each Member State, but very similar in terms of the challenges: supply shortage, climate change, rising prices and import dependency. By replicating the best examples taken from the leading countries in this field and avoiding the worst practices, the governance of the entire energy system can be improved (Momete, 2023).

The literature highlights the importance of sustainable energy development and how to measure it in individual EU countries or the EU as a whole (Neelawela et al, 2019; Herrero et al, 2020; Elavarasan et al, 2022). However, studies conducted so far show that there is a lack of consistent methods used to group countries similar in terms of their level of SDG7 achievement. There is still a need to identify new approaches to analyse this phenomenon. It should be noted that attempts to assess sustainable development in EU countries using Ward's method were already made by the authors in 2016 and allowed to draw many interesting conclusions (Stec, Grzebyk, 2017).

Summarising the results of the research conducted in this article, it was observed that the level of implementation of Sustainable Development Goal 7 in the European Union was not homogeneous. In terms of individual countries, there was evidence of a higher level characteristic for the northern Member States and a lower level for the southern European countries. Poland is part of the group of central European countries in which none of the analysed variables determining the level of implementation of Sustainable Development Goal 7 was leading. The results are similar to those achieved by other authors despite the use of different research methods.

An example is the study by Firoiu et. al. (2021). The authors focused on the development of clusters (A to D), i.e. a breakdown of countries achieving similar levels of SDG 7 target achievement in 2015 and 2019. In 2015, the best-performing countries were grouped in cluster C and included Denmark, Finland, Romania and Sweden. The worst-performing countries were grouped into cluster D and included Cyprus, Ireland, Lithuania, Luxembourg and Malta. Similar results were achieved in 2019. Countries grouped in cluster C were again found to be the most advanced in meeting SDG target 7, while the

worst performers were countries grouped in cluster D. Through this research, it was possible to distinguish a group of the best countries, as well as those that require increased attention and support. An important element of the research was that the group of best-performing countries has grown, demonstrating a real concern and commitment to SDG Goal 7.

Other findings were carried out by Dmytrów, et.al. (2022). Their aim was to compare selected European countries in terms of the degree of SDG7 implementation using the COPRAS method between 2005 and 2020. The highest ranked countries were Norway, Denmark, Estonia, Croatia, Latvia, Sweden and the UK. In contrast, the least committed countries in the implementation of SDG7 were: Belgium, Bulgaria, Cyprus, Lithuania and Finland.

The main conclusion of the research presented was that the achievements of the most developed countries should be an incentive for those at a lower level of development, and that changes in the positions of these countries should reflect the development pathway for achieving SDG7.

6. CONCLUSIONS

In the perspective of the changes taking place in the modern world, humanity cannot afford to ignore the issue of the environment and social exclusion, therefore sustainable development subject, including the implementation of SDG 7, should not only remain in the consciousness of individual societies, but also be translated into the actions of decision-makers on a national and international scale.

The current turbulent times, with the world still recovering from the COVID-19 pandemic, the invasion of Ukraine underway, energy prices volatile and inflationary pressures threatening political stability, mean that national governments need to address the energy transition.

Each country needs to find the most appropriate combination of measures for itself, which should range from increasing energy intensity, implementing the right mix of renewables, increasing investment in renewables or introducing new regulations (Momete, 2023).

The results of the study show that there was a systematic improvement in the degree of achievement of the EU's SDG 7 target in the years under review (2013 and 2022). The gap between the European Union countries narrowed markedly, although southern and eastern European countries were still furthest away from the 2030 target. They have a lot of backlog in the implementation of this target. It is also noted on the basis of research that the northern European countries are doing best in the implementation of SDG7, and their situation is still improving. However, it should be highlighted that the final ranking of countries was fundamentally influenced not only by the initial choice of diagnostic variables, but also by the research method used.

The grouping of EU Member States on the basis of the criteria identified in this study may contribute to finding targeted solutions for each group of countries, or may lead to the development of more efficient resource allocation models and better alignment of public policies to support the achievement of the desired level of SDG7 implementation.

The presented results of the analysis can provide policy makers, researchers and other stakeholders with useful knowledge, showing the existing development gaps between countries or groups of countries. They also provide constructive information that may

prove useful in the development of future strategic plans related not only to the implementation of SDG7, but also to the implementation of other Agenda 2030 goals.

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HR ONBOARDING: THE IMPACT OF EMPLOYEE ENGAGEMENT ON THE PERFORMANCE OF NEW HIRES IN THE FIRST PERIOD OF WORK

Onboarding, although present in management science for several decades, still requires in-depth research, especially in the context of its impact on economic and personnel indicators. The purpose of this article is to examine the links between the quality of onboarding and employee engagement and economic measures in large Polish companies. A regression analysis conducted on survey results showed that onboarding affects indicators such as absenteeism, productivity, and recruitment costs. The limitations of the study are sample selection and sample size, but the results provide important practical and theoretical conclusions. This article brings new insights into the economic evaluation of adaptation processes, highlighting their potential benefits for organizational efficiency and employee comfort.

Keywords: onboarding, engagement, HRM, HR indicators, correlation.

1. INTRODUCTION

HR onboarding can be defined as "a time-bound, purposeful and concise process of functionally introducing a newly hired person to the organization, socializing him or her as quickly as possible, familiarizing them with the company's mission, vision, culture and history, as well as familiarizing him or her with assigned tasks and expected behaviors, which continues from the moment of the mutual hiring decision, with the goal of building a positive experience associated with the company" (Jankowski, 2024b). As Iwańczuk M. suggests, one of the goals of onboarding is to build commitment and accelerate the achievement of full productivity of new hires (Iwańczuk, 2008). The fact that HR onboarding programs are the basis for building employee commitment from the first days of their work in the organization is also emphasized by more recent English-language academic sources either directly (Davila, Pina-Ramirez, 2018) or indirectly (Bell, 2021; Badshah, Bulut, 2020). In turn, engagement itself has been defined by the Institute for Employment Studies as:

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A positive attitude of employees toward the organization and its values. An engaged employee is aware of the business context, and works with colleagues to improve work performance for the profit of the organization. The organization must work to develop and sustain commitment, which requires a two-way relationship between employer and employee (Szafarska, 2023).

Based on the above, it can be concluded that onboarding plays a moderating role for engagement in human resources (HR) processes in the first stage of a new hire's work. Exploring the topic of engagement in a scientific context, one can reach its component parts, such as vigor, dedication to work and absorption in work (Kinowska, 2021), as well as its positive effects found in organizations. These include higher productivity, satisfaction, increased employee loyalty and lower staff turnover (Kaczkowska-Serafińska, 2022). However, in the context of the employee adaptation and deployment process itself, it is important to emphasize that we are talking about emotional engagement (Ober, Karwot, 2017), as well as cognitive and behavioral engagement (Wach-Kąkolewicz, Shelest, 2014), which are crucial during the first period of work in a new organization. In order to find preliminary links between engagement and quantifiable economic and personnel indicators, a literature search[2] of the subject was performed from 17.03.2024 to 23.03.2024 using the scientific databases Google Scholar, Web of Science and SCOPUS, a summary of which is presented in Table 1.

A review of the literature showed that the majority (73.9%) of sources treating indicators, describing engagement, focus on "soft" (HR), hard to present in numerical form evaluation criteria, such as flexibility, enjoyment of work or relationship with the supervisor. On the other hand, that part of the academic texts that cited "hard", economic metrics[3] tended to show what, rather than how, correlates with employee engagement, and the indicators themselves were repetitive (mainly: productivity, efficiency, turnover, retention, employment costs, absenteeism). It is also worth mentioning that in each of the sources, the topics discussed in this paper were only side threads, not the main area of research. This raises the question of whether the indicators described above are the only

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[2] The study adopted a literature review with six stages (Lenart-Gansiniec, 2021), which can be briefly described as follows:
1. Selection of research questions:
   - What are the main indicators of engagement in the context of the first period of employment?
   - What is the relevance of engagement from work to employee effectiveness and performance?
   - How can HR onboarding affect the engagement of newly hired employees?
2. Defining the purpose of the review: The purpose of the review is to find links between economic HR indicators (such as turnover) and employee engagement.
3. Choosing the type of review: a systematic literature review to find specific links between the variables in question.
4. Selection of keywords: employee, engagement, indicator.
5. Selection of literature eligibility criteria: Due to the need to reach as many texts as possible preserved in the subject matter under discussion, the only exclusions were related to the year of publication of the text (topicality: qualified 2018–2024), form of access (paid texts were excluded), relevancy (the literature should relate directly to the topic of HR processes).
6. Selection of information sources: SCOPUS, Google Scholar and Web of Science databases were selected for their easy accessibility, transparency and high level of scientific texts presented.

[3] An economic indicator [...] is a ratio of two values or a number resulting from a specific mathematical operation used in financial analysis to assess the economic performance of an organization (Jankowski, 2024a).

ones in the context of measuring employee engagement, and to what extent do they correlate with engagement itself, or further, onboarding?

Table 1. Desk research summary

Search term: employee engagement indicator (searched on 17.03.2024)	Google Scholar	Web of Science	SCOPUS	SUM
Number of scientific texts available through the search engine (limitation for 2018–2024)	17 400	275	244	17 919
Number of scientific texts analyzed (free access)	50	30	10	90
Number of indicated "soft" indicators (management field) related to the concept of engagement	13	3	1	17
Number of works containing "hard" (measurable) indicators (economics field) related to the concept of engagement	4	1	1	6

Source: own elaboration.

This line of thinking led to the current text, which poses the research questions:
1. What are the main indicators of engagement in the context of the first period of employment?
2. What is the importance of onboarding engagement for employee effectiveness and productivity?
3. How can HR onboarding affect the engagement of newly hired employees?

In order to find answers to these questions, the author uses research methods, such as a literature review, a survey, and a desk reaserch in the form of an analysis of data available on websites giving opinions to employers. Instead, the scientific hypothesis guiding this study became the statement according to which the commitment built during HR onboarding affects the personnel costs of the organization, which is reflected in the quality of measurable HR indicators.

2. METHODOLOGY

According to the theory outlined in the Introduction and according to the principles of generally accepted logic, high employee engagement should reflect positively on a company's financial performance. From a managerial point of view, however, the question should be asked: how can this be measured, and where will the translation of high engagement to the company's bottom line be seen? Theoretically, this relationship should be reflected in economic HR indicators, which are the result of HR analytics, whose task is to systematically identify and qualify the human factors that affect a company's business performance (Pszczółkowski, Michalczyk, 2020; Van den Heuvel, Bondarouk, 2016). A general theoretical model and a research model were developed to verify the thinking process presented above.

Analyzing the human resource (HR) measures described in the literature, it is possible to identify a dozen or so of the most common ones, which include the indicators listed below[4]:

- employee turnover,
- employee retention,
- admissions and dismissals,
- absenteeism,
- productivity,
- recruitment efficiency,
- recruitment costs per employee,
- job satisfaction,
- talent retention,
- involvement in company initiatives,
- investment in human capital,
- resignation,
- internal promotions,
- average length of service,
- contracts extended after probationary period,
- stability of executives,
- annual leave on request.

THEORETICAL MODEL

ENGAGEMENT

ONBOARDING

HR INDICATORS

Assumption of the model: Onboarding builds employee engagement, and engagement can be measured using HR indicators.

Main hypothesis: Effective onboarding has a positive impact on employee engagement, which is reflected in changes in selected HR indicators.

RESEARCH MODEL

ENGAGEMENT   FACTOR LOADING   **QUESTION CORRELATED WITH HR INDICATORS**   **RESIDUAL**

Figure 1. Framework for the study – theoretical and research model

Source: own elaboration.

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[4] Indicators developed based on: (Pszczółkowski, Michalczyk, 2020; Skowron-Mielnik, Bor, 2015; (Janik, 2017; Zając, 2011), as well as based on data from https://wskaznikihr.pl/, 18.03.2024 and the author's own professional experience.

The indicators indicated were used to construct research questions for a survey conducted among a random sample of employees of various levels, distributed via LinkedIn[5] between 22.04.2024 and 05.05.2024, and 14 questions were drawn up. It should also be noted that the selection of the research sample limits the representativeness of the research results for the entire population. The metric questions asked about the respondent's age, length of service and size of the organization in which he or she currently works. The relevant research questions are presented in Table 2.

Appropriate questions (on a Likert scale): In the next section, respondents were asked how much on a scale of 1 (not at all) to 5 (very much) they agreed with the following statements.

Table 2. Research questions correlated with HR indicators

HR INDICATOR	Likert scale research question:
	If I am committed to working for a particular company:
employee turnover	I am not looking for a new place of employment.
retention of employees	
layoffs	
talent retention	I am able to endure temporary inconveniences without wanting to quit my job or without the so-called "silent resignation" (performing contractual minimum duties).
resignations	
absenteeism	I do not make excessive use of sick leave.
productivity	I try to work as well and as efficiently as possible.
investments in human capital	I am able to wait longer for a potential promotion/position change.
internal promotions	
average length of service (seniority)	I maintain a long tenure with one employer.
contracts extended after the probationary period	
stability of executives	
on-demand leaves per year	I do not overuse leave on demand.

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[5] Link to Linkedin with the survey: https://www.linkedin.com/posts/%C5%82ukasz-jankowski-3547a2159_wp%C5%82yw-zaanga%C5%BCowania-pracownik%C3%B3w-na-wyniki-activity-7188274503615954944-qr6j?utm_source=share&utm_medium=member_desktop, 19.11.2024.

LinkedIn was chosen as the distribution medium for the survey because of the potential ease of reaching professionally credible respondents who meet basic research criteria such as age, or work status (current or past). As a platform that brings together professionals, it allows access to people who are potentially participating or have participated in onboarding processes, while also being a free and easily accessible service. However, potential biases associated with this channel such as the overrepresentation of certain industries or positions cannot be completely ruled out. However, an analysis of possible bias would require additional in-depth comparative research, which, due to the pilot nature of the study, it was decided not to perform.

Table 2 (cont.). Research questions correlated with HR indicators

HR INDICATOR	Likert scale research question:
	If I care about a particular job/would like to work at a particular workplace:
recruitment efficiency	I try to make the best possible impression during a recruitment interview.
recruitment costs per employee	
hiring	I can even apply several times for a position (the same or different) at a given company.
job satisfaction	I am more eager to come to work, and being at the workplace is not a mental burden for me.
involvement in company initiatives	I am more willing to get involved in company initiatives (charitable, social or business).

Source: own elaboration.

By the author's assumption, the questionnaire was intended to contain as few pertinent (precise) questions as possible, in order to encourage respondents to fill it out6 and obtain as many responses as possible, which, after analysis, will point the way for further in-depth scientific research on this topic.

3. RESULTS

The survey included 231 respondents, 83.98% of whom worked in organizations with large teams (Krancher et al., 2018), 61.90% classified as Generation Y, while the statistics of the seniority achieved by the respondents at the time of the survey were relatively evenly distributed among all responses.

Table 3. Compilation of responses to the question about the age of respondents

What age are you currently?	Amount of answers
18 years old – 24 years old	31
25 years old – 44 years old	143
45 years old – 59 years old	53
60 years old – 78 years old	4

Source: own elaboration.

Based on the metrics presented, it can be seen that the survey respondents are mainly aged 25–44 (143 responses) and work in large organizations employing more than 200 people (169 responses). In terms of length of service, most have work experience of more than 20 years (59 responses) or between 5 and 10 years (56 responses). The data above will be used later in the article to develop an in-depth regression analysis.

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6 "Better to have something short that gives acceptable results rather than something that produces better results but which nobody uses. Within this context, short questionnaires that produce reliable measures of usability are a desirable goal" (Cairns, 2013).

Table 4. Compilation of responses to the question on the length of service of respondents

What is your total length of service (regardless of employer)?	Amount of answers
0–5 years	42
5–10 years	56
10–15 years	41
15–20 years	33
Over 20 years	59

Source: own elaboration.

Table 5. Compilation of responses to the question about the size of the respondents' company

How large is the organization do you currently work for?	Amount of answers
Up to 10 people	20
10–50 people	17
50–200 people	25
More than 200 people	169

Source: own elaboration.

Table 6. Compilation of responses to Likert scale questions

Question / Respondents' rating on a Likert scale	1	2	3	4	5	Sum of responses "do not agree at all" and "partially disagree"	Sum of responses "fully agree" and "partially agree"
If I am committed to working for a particular company, then:							
[I am not looking for a new place of employment.]	21	33	5	67	105	54	172
[I am able to endure temporary inconveniences without wanting to resign or without so-called "quiet resignation" (performing the contractual minimum of duties).]	11	28	16	106	70	39	176
[I do not overuse sick leave.]	9	10	2	20	190	19	210
[I try to work as well and as efficiently as possible.]	4	7	7	56	157	11	213
[I am able to wait longer for a potential promotion/position change.]	13	24	24	89	81	37	170
[I maintain a long tenure with one employer.]	13	23	25	61	109	36	170

Table 6 (cont.). Compilation of responses to Likert scale questions

Question / Respondents' rating on a Likert scale	1	2	3	4	5	Sum of responses "do not agree at all" and "partially disagree"	Sum of responses "fully agree" and "partially agree"
[I do not overuse leave on demand.]	8	13	8	27	175	21	202
If I care about a particular job/want to work at a particular workplace, then							
[I try to make the best possible impression during a recruitment interview.]	3	10	4	22	192	13	214
[I can even apply for a position (same or different) at a given company several times.]	38	57	26	63	47	95	110
[I am more willing to come to work, and being in a workplace is not a mental burden for me.]	6	24	18	77	106	30	183
[I am more willing to get involved in company initiatives (charitable, social or business).]	16	30	31	75	79	46	154

Source: own elaboration.

Absolutely the highest number of "fully agree" responses was given to the questions:
- If I care about a particular job/would like to work at a particular job, then: [I try to make the best impression during the recruitment interview] – 192 responses;
- If I am committed to working at a particular company, then: [I don't overuse sick leave] – 190 responses;
- If I am committed to working at a particular company, then: [I do not excessively use leave on demand.] – 175 responses;
- If I am committed to working at a particular company, then: [I try to work as well and as efficiently as possible] – 157 responses.

The highest aggregate ratio of affirmative ("I fully agree" and "I partially agree") to negative ("I do not agree at all" and "I partially disagree") responses to the following questions:
- If I am committed to working for a company, I: [I try to work as well and as efficiently as possible] – Ratio > 19:1;
- If I care about a particular job/would like to work at a particular workplace, then: [I try to make the best impression during the recruitment interview.] – Ratio > 16:1;
- If I am committed to working at a particular company, then: [I do not overuse sick leave.] – Ratio > 11:1;
- If I am committed to working at a particular company, then: [I do not excessively use leave on demand.] – Ratio > 9:1.

While the design of the questions and their alignment with HR metrics presented in Table 2 is accurate, it can be concluded that the HR metrics on which the change in employee engagement should be most strongly reflected are:

- absenteeism,
- productivity,
- leave on demand per year,
- recruitment efficiency,
- recruitment costs per employee.

However, it should be remembered that the study group was relatively small, and the mere association of HR indicators with the proposed questions should be considered more as a proposal than as an unequivocal fact, making the study to be considered a pilot. The minimum group size calculated according to the formula cited by (Jabłońska, Sobieraj, 2013) assuming that:

- the standard error of the estimate is equal to 2%,
- standard value assumed at 1.96 (calculated on the basis of a confidence level equal to 95%),
- population size (working people) assumed at 15,148,500 people[7],

should be no less than 2,400 when examining the issue of all working people. Thus, the obtained results of the survey and their analysis only suggest a general trend and allow us to infer the direction of further research, which, in light of the evolving onboarding process and the increasing emphasis on cost reductions in companies (Neumann, 2017; Panek, 2006; Lesiak, 2014), seems to be a necessity. Regardless notwithstanding the above, in order to obtain the best possible results from the pilot study, it was decided to conduct an in-depth analysis of the results of the survey in question, which are presented in the next subsection.

An in-depth analysis of the survey results required mapping the data i.e., mapping textual data to numerical data. An example mapping table is presented below (Table 7). In each case of data mapping, the logic of assigning alpha-numeric values from the smallest in the logical context to the digit 1, proceeding with a unit step through the logically progressive values.

Table 7. Data mapping

Answer	Mapping
1 (do not agree at all)	1
2 (partially disagree)	2
3 (have no opinion)	3
4 (partially agree)	4
5 (fully agree)	5

Source: own elaboration.

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[7] Data as of 30.04.2023 taken from the publication of the Polish Central Statistical Office: https://stat.gov.pl/obszary-tematyczne/rynek-pracy/pracujacy-zatrudnieni-wynagrodzenia-koszty-pracy/pracujacy-w-gospodarce-narodowej-w-polsce-w-kwietniu-2023-r-,27,5.html, 15.05.2024.

For ease of analysis, each of the research questions described in Table 2. was given one precisely assigned HR indicator, but it should be remembered that the descriptions in Table 2. have not lost their validity, and interpretation of the results should assume a certain multiplicity of the indicators described there. The provisional one-to-one assignment is shown in Table 8.

Table 8. Mapping of HR indicators

HR indicator	Likert scale research question
employee turnover	I am not looking for a new place of employment.
talent retention	I am able to withstand temporary inconvenience [...].
absenteeism	I do not make excessive use of sick leave.
productivity	I try to work as well and as efficiently as possible.
investment in human capital	I am able to wait longer for a potential promotion [...].
seniority	I maintain a long tenure with one employer.
leave on demand	I do not excessively use leave on demand.

Source: own elaboration.

The next step of the analysis became the creation of a correlation matrix based on two different measures of interdependence: the Pearson correlation coefficient and Spearman rank. The first of the latter measures only linear relationships, which can lead to the overlooking of any nonlinear relationships, to which the second coefficient is resistant. In the case of Pearson, linearity of the relationship and normality of the distribution of the variables are required (Walczak, 2015). Here, the correlation results can be distorted by any outliers, and its assumptions may not be met for the data and social phenomena under study.

Therefore, it was decided that it would be right to check the correlation results using two coefficients of Spearman and Pearson (Şahin, Aybek, 2019).

Table 9. Pearson's correlation for explained and explanatory variables

Pearson correlation	What age are you currently at?	What is your total length of service (regardless of employer)?	How large an organization do you currently work for?
employee turnover	0,0926	0,1447	0,0654
talent retention	0,1944	0,2207	0,0866
absenteeism	-0,0969	-0,0829	0,1721
productivity	0,0072	0,0358	0,0929
investment in human capital	0,1375	0,2121	0,0322
seniority	0,1439	0,2556	0,0347
leave on demand	-0,0207	-0,0217	0,055

Source: own elaboration.

There is a clear linear correlation (Peternek, Kośny, 2011) only in the context of pairs of variables: seniority and talent retention, seniority and investment in human capital and seniority and willingness to stay in the organization. For a more complete picture of the analyses, a summary of correlations based on the Spearman rank method was also performed.

Table 10. Spearman's rank correlation for explained and explanatory variables

Pearson correlation	What age are you currently at?	What is your total length of service (regardless of employer)?	How large an organization do you currently work for?
employee turnover	0,0349	0,0144	-0,5368
talent retention	0,2234	0,1374	-0,3305
absenteeism	-0,1201	-0,5559	-0,2122
productivity	-0,0527	-0,2261	-0,5635
investment in human capital	0,1007	0,1186	-0,498
seniority	0,0586	0,0971	-0,6111
leave on demand	-0,1322	-0,4947	-0,5145

Source: own elaboration.

Analyzing Spearman's rank correlation coefficient for the same data, analogous pairs of variables showed a weak correlation (Stanisz, 2006), but in this case the following pairs of variables also showed a weak correlation: age and talent retention, and age and human capital investment.

In order to understand more correlations, a reciprocal correlation matrix of independent variables was also created, as shown in Tables 11 and 12.

Table 11. Pearson cross-correlation for explanatory variables

Pearson correlation	employee turnover	talents' retention	absenteeism	productivity	human capital investment	seniority	leave on demand
employee turnover	1,00	0,53	0,44	0,37	0,4	0,37	0,33
talent retention	0,53	1,00	0,41	0,4	0,38	0,38	0,32
absenteeism	0,44	0,41	1,00	0,60	0,41	0,4	0,69
productivity	0,37	0,40	0,60	1,00	0,52	0,47	0,56
investment in human capital	0,40	0,38	0,41	0,52	1,00	0,56	0,5
seniority	0,37	0,38	0,4	0,47	0,56	1,00	0,45
leave on demand	0,33	0,32	0,69	0,56	0,5	0,45	1,00

Source: own elaboration.

In the context of linear correlation, moderate relationships can be seen between the following pairs of data: turnover and retention, productivity and absenteeism, productivity and human capital investment, productivity and seniority, productivity and leave on

demand, human capital investment and seniority, and human capital investment and leave on demand.

Table 12. Spearman's rank correlation for explanatory variables

Spearman's Rank Correlation	employee turnover	talents' retention	absenteeism	productivity	human capital investment	seniority	leave on demand
employee turnover	1,00	0,38	-0,03	-0,07	0,18	0,14	-0,16
talent retention	0,38	1,00	0,08	0,02	0,22	0,2	-0,12
absenteeism	-0,03	0,08	1,00	0,15	0,01	-0,06	0,37
productivity	-0,07	0,02	0,15	1,00	0,2	0,05	0,07
investment in human capital	0,18	0,22	0,01	0,2	1,00	0,43	0,07
seniority	0,14	0,2	-0,06	0,05	0,43	1,00	-0,01
leave on demand	-0,16	-0,12	0,37	0,07	0,07	-0,01	1,00

Source: own elaboration.

Correlation calculated using Spearman's rank method showed weak correlations only between on-demand leave and absenteeism, human capital investment and tenure, and talent retention and employee turnover. It is worth noting at this point that the survey examined the overall relationship, not its direction and return, but based on the two tables it can be thought that:

- difficulties in retaining talented employees are closely related to employee turnover,
- high absenteeism rates are negatively related to productivity performance,
- greater investment in human capital can lead to higher productivity,
- longer tenure can lead to higher productivity and lower absenteeism.

In the next steps of the study, a regression analysis was performed, resulting in the specification of data such as:

- Regression coefficient – "The directional coefficient of a regression line tells how many units, on average, the level of the dependent characteristic will change (increase or decrease) if the level of the independent characteristic increases by a unit" (Zając, 1974),
- Standard error – "the standard error of a coefficient (the value of 1 standard deviation; for a normal distribution in the mean±1 standard deviation is within 66% of the data value)" (Dmowska, 2024),
- Probability value – "is the probability of obtaining a result at least as contradictory to the null hypothesis as the result we have just obtained" [Sokolowski, 2010]. "Misinterpretation of the value of p (p-value) is to consider it as the probability of the truth of the null hypothesis" (Trzpiot, 2016),
- The z-value (t-student distribution) – "is the probability distribution used when constructing confidence intervals, testing statistical hypotheses and for assessing measurement error. A t-student distribution table is used to determine the value of the distribution" (*Ćwiczenia projektowe* 2020, nr 2),
- A confidence interval "is the realization of a random interval that, with repeated sampling [statistical – author's note] from the same population will cover the value

of the estimated quantity in 100(1-α)% of all samples. The interval is built around the mean value obtained from the sample" (Toczek, 2018),

- The coefficient of determination r2 which is a determination of how much of the variation in the explained variable is explained by the independent variables.

Microsoft Excel, which has a built-in LINEST function, was used for the actual regression analysis. The data were implemented into the function as follows:

- Known y → a single economic indicator from the HR area as described in Table 8 (HR indicator mapping).
- Known x → mapped by key (values from 1 to 5) answers to questions:
  o What is your current age?
  o What is your total length of service (regardless of employer)?
  o How large an organization do you currently work for?
- The value specifying the calculation of the constant b set to the logical value TRUE (calculated normally),
- The value specifying the return of additional regression statistics set to TRUE

The values returned as a result of the function took a regular form, the key of which was defined by the company distributing the program (REGLINP, 2014). The descriptions are shown in the following table:

Table 13. Description of the LINEST (pol.REGLINP) function result labels (REGLINP, 2014)

Statistic	Description
se1,se2,…,sen	The standard error values for the coefficients m1,m2,…,mn.
seb	The standard error value for the constant b (seb = #N/A when const is FALSE).
r^2	The coefficient of determination. Compares estimated and actual y-values, and ranges in value from 0 to 1. If it is 1, there is a perfect correlation in the sample — there is no difference between the estimated y-value and the actual y-value. At the other extreme, if the coefficient of determination is 0, the regression equation is not helpful in predicting a y-value. For information about how r^2 is calculated, see "Remarks," later in this topic.
sey	The standard error for the y estimate.
F	The F statistic, or the F-observed value. Use the F statistic to determine whether the observed relationship between the dependent and independent variables occurs by chance.
df	The degrees of freedom. Use the degrees of freedom to help you find F-critical values in a statistical table. Compare the values you find in the table to the F statistic returned by LINEST to determine a confidence level for the model. For information about how df is calculated, see "Remarks," later in this topic. Example 4 shows use of F and df.
ssreg	The regression sum of squares.
ssresid	The residual sum of squares. For information about how ssreg and ssresid are calculated, see "Remarks," later in this topic.

Source: (REGLINP, 2014).

The distribution of the returned regression statistics, along with the key distribution of the data in each table, took the form presented in the table below.

INDICATOR DISTRIBUTION KEY	m_n	m_{n-1}	...	m_2	m_1	b
	se_n	se_{n-1}	...	se_2	se_1	se_b
	r_2	se_y				
	F	d_f				
	ss_{reg}	ss_{resid}				

INDICATOR: STAFF TURNOVER			
0,0830	0,1774	-0,1265	3,2315
0,0919	0,1013	0,2292	0,5205
0,0259	1,3542		
2,0095	227,0000		
11,0559	416,3034		

INDICATOR: LEAVE ON DEMAND			
0,0595	-0,0130	-0,0107	4,3024
0,0708	0,0780	0,1765	0,4008
0,0036	1,0428		
0,2737	227,0000		
0,8930	246,8473		

INDICATOR: TALENT RETENTION			
0,0923	0,1345	0,0943	2,8243
0,0747	0,0824	0,1864	0,4233
0,0560	1,1014		
4,4880	227,0000		
16,3327	275,3642		

INDICATOR: ABSENCES			
0,1776	-0,0192	-0,1172	4,1227
0,0665	0,0733	0,1659	0,3766
0,0397	0,9798		
3,1254	227,0000		
9,0018	217,9333		

INDICATOR: PRODUCTIVITY			
0,0782	0,0435	-0,0705	4,2041
0,0569	0,0628	0,1420	0,3224
0,0108	0,8388		
0,8232	227,0000		
1,7375	159,6997		

INDICATOR: INVESTMENT IN HUMAN CAPITAL			
0,0278	0,2236	-0,1557	3,3958
0,0779	0,0859	0,1943	0,4410
0,0483	1,1476		
3,8397	227,0000		
15,1693	298,9346		

INDICATOR: LENGTH OF SENIORITY			
0,0285	0,3218	-0,3098	3,5471
0,0802	0,0884	0,2000	0,4542
0,0757	1,1818		
6,2013	227,0000		
25,9811	317,0146		

Figure 2. Results of the regression function for each explanatory variable

Source: own elaboration.

Based on the tables in Figure 1, the following conclusions can be drawn:
- The coefficient of determination (r^2) means that the independent variables explain:
  - 2.6% of the variation in employee turnover,
  - 5.6% of the variation in talent retention,
  - 3.8% of the variation in absenteeism,
  - 1.1% of the variation in productivity,
  - 4.8% variability in human capital investment,
  - 7.6% variability in seniority,
  - 0.4% variability in leave on demand;
- The low r^2 values suggest that the presented results may be influenced by additional factors, such as, among others, the individual characteristics of employees, the quality of the relationship with the supervisor and the team, or the specifics of the onboarding process itself and the degree to which it is tailored to the needs of new hires, which may suggest the need for alternative studies using other analytical models;
- The following relationships proved to be statistically significant or marginally significant (p-values calculated using the originally implemented Microsoft Excel functions: T.DIST.2T and the results of the LINEST function):
  - Absenteeism and organization size (0.0081),
  - Employee turnover and seniority (0.0813),
  - Seniority on willingness to stay in the organization (0.0003).

Reliability statistics performed in IBM SPSS software (variables treated as quasi-quantitative (Wiktorowicz, 2016)) showed a Cronbach's Alpha coefficient of 0.858, indicating high reliability of measurements. Correlation coefficients between different elements should not be lower than 0.3 (Ramadhan et al., 2019) and higher than 0.7 (Merdiana, 2023). In light of this finding, the necessity of removing the question "If I care about a particular job/would like to work in a particular job, then: [I can even apply several times for a position (same or different) in a given company.]", whose strongest correlation is only 0.285. The model built from the data is presented below.
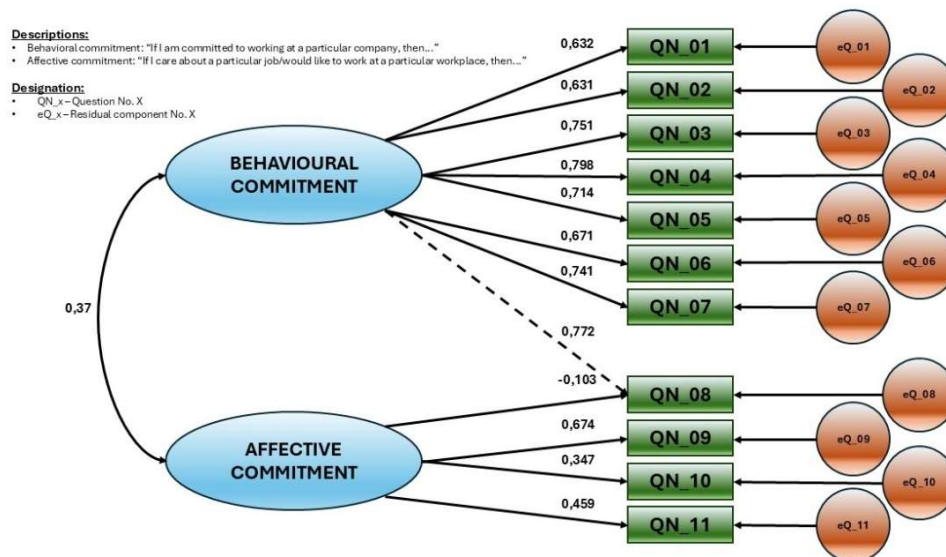
Figure 3. Analysis of the research model

Source: own elaboration.

Despite the correct choice of questions, the residual components are relatively high (all >1) which, with high factor loadings, suggests that the model does not account for all the variability. This means that the model may need to be expanded to include more questions or more factors considered. Nevertheless, the results presented on the basis of the data collected by the described model can be considered correct but incomplete, which leaves room for further research on the described topic.

On the basis of the employee opinion data analyzed in this way, it is potentially it is possible to specify economic indices, subject to change under the influence of changes in engagement caused by the quality of onboarding carried out. The indexes thus described include employee absenteeism, turnover and seniority (dependent on the individual values of the independent variables described earlier in the current subsection). It can also be concluded that relevant in connection with the implementation and adaptation process under study are the indices of retention, leave on demand or productivity. It is worth noting, however, that the conducted research was performed on a statistically small group. due to which, before presenting far-reaching conclusions, it would be necessary to carry out an in-depth survey, based not only on opinion, but also on unambiguous numerical data, obtained from the organization, burdened with renewed regression and correlation analysis.

In the course of interpreting the results, however, one should not forget the potential limitations of the study among which are:

- the significant impact of organizational culture, which affects the level of commitment in parallel with the effects of the onboarding process,
- inter-industry differences affecting the effectiveness and strength of the impact of adaptation and onboarding processes on engagement,
- global economic and political conditions such as the labor market situation or crises that will change perceptions of HR practices among employees and job candidates.

While the study provides valuable findings, further analysis should consider these variables to better understand the context of the relationship between onboarding and HR metrics.

4. CONCLUSION AND DISCUSSION

Recent academic work suggests that employee engagement, as a result of properly executed onboarding, plays a key role in moderating personnel costs and increasing organizational productivity. However, it is worth noting, that there are few precise lists of HR indicators on the basis of which improvements in the quality of onboarding or the resulting increase in employee engagement can be assessed. According to research, the key to increasing employee engagement is leadership, which, in people, satisfies the basic psychological needs of employees, such as autonomy, interpersonal relationships and increased competence. Managers who inspire co-workers positively influence their productivity, activity, bonds with the organization or their passion in performing their daily duties (Mazzetti, Schaufeli, 2022). Engaging leadership can manifest itself in high-quality employee onboarding driven by high-quality executives. New hires who are engaged from their first days on the job reach full effectiveness faster, resulting in higher organizational performance (Walker-Schmidt, 2022), which in turn has a positive impact on the company's financial performance.

Described in the introduction, the purpose of this study was to find preliminary links between engagement and quantifiable economic and personnel indicators. Based on the study, it can be tentatively concluded that increasing engagement of new hires, which is the aftermath of, among other things, a properly conducted HR onboarding process, can affect economic HR indicators such as:

- absenteeism,
- productivity,
- leave on demand per year,
- recruitment efficiency,
- recruitment costs per employee.

This does not mean, however, that the above-mentioned determinants are the only ones that are changed by the operation of onboarding processes. Here, however, the moderating role of commitment built through the onboarding and adaptation processes was significant in the level of indicators, so that some of the indicators naturally moderated by them may not have appeared in the indications of respondents. It is worth noting that employee engagement is not just the result of onboarding, but is the result of many factors. They are influenced by factors such as management style, organizational culture, development opportunities, team relationships and compensation, among others. Adaptation and onboarding processes can provide an important foundation, but their effectiveness depends on the broader organizational context.

In the context of the survey itself, it should be emphasized that it should be considered a pilot survey because:

- it was conducted on a relatively small number of people,
- the linking of HR indicators to the questions should be regarded as suggestions made by the author on the basis of academic and professional experience,
- employees' perceptions of HR practices depend on a number of factors, such as the value system represented, the period of the year in which the survey was performed and previous work experience.

As a practical implication, a conclusion can be made that HR departments should tailor onboarding to organizational needs and the individual needs of specific employee groups. Additionally, onboarding implementation processes should focus on building long-term relationships and commitment, which should translate into employee satisfaction and performance.

All the aforementioned aspects clearly qualify the present work as a prelude to further in-depth research, but they allow us to set an indicative direction for further work and draw the first conclusions, which can be literalized as follows:

- engagement can indeed play a moderating role between employee onboarding and HR economic indicators,
- it is possible to single out a group of HR indicators that is potentially more vulnerable to fluctuations that depend on the quality of the onboarding process,
- it is worth building positive impressions of employees through HR practices, as this can have a significant impact on an organization's financial performance.

However, it is worth remembering that HR practices are most effective when they are perceived by employees[8], and therefore it is important not only to create increasingly effective onboarding programs for employees, but also to build their ongoing awareness of any measures to improve their comfort level and commitment to the organization.

Previous research indicates that engaging new hires leads to faster adaptation and increased efficiency, which is key to achieving company goals (Mazzetti, Schaufeli, 2022). Reducing the turnover rate due to job satisfaction and a sense of belonging to the team translates into lower expenses, related to hiring and implementing new employees (Singh, Sant, 2023).

This text presents the results of our own research, which not only presents the indicators that change under the influence of an increase in engagement resulting from properly conducted onboarding, but also illustrates precisely what part of this relationship the various explanatory variables are responsible for. On the basis of the research conducted and compiled here, it can also be concluded that the current text can make a significant contribution to science in areas such as: taking away new, accurate empirical data; developing engagement theory in the context of employee adaptation and deployment; providing practical guidance for HR practitioners and university faculty; enriching the literature on the subject and filling the existing research gap at the interface of management science and economics in the area of employee onboarding, and highlighting the role of this process as one of the most important for new hires in their first period of work. Practical implications include the need to implement engagement strategies in the onboarding process, which can lead to significant benefits in terms of higher productivity, better quality of work and lower turnover rates. Management attention should also be focused in spheres such as building trust between employees and leaders, which will reinforce the positive effect of onboarding procedures.

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[8] Regarding the words of Anna Pluta, Ph.D., Prof. US, and Aleksandra Rudawska, Ph.D., from the 5th Scientific Conference "Human capital in the enterprise and the economy – an interdisciplinary perspective", Międzyzdroje 16.05.2024 (paper entitled "Human capital in the enterprise and the economy". "Same but different – reasons for different perceptions of HR practices by employees").

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Ewa Jadwiga LIPIŃSKA[1]

SELF-PROMOTION OF THE MONOGRAPH "OUTLINE OF THE THEORY OF THE STATE AS AN ECOLOGICALLY SAFE ORGANIZATION IN EMPIRICAL RESEARCH"

Four concepts – ecological security, social responsibility, sustainable development, and environmental management – are analyzed to show that the same terminology can represent different meanings and approaches to the development of a state or urban areas. This research implies a discussion on (i) a transformation leading to confrontation and rapprochement between states and nations, (ii) ecological security as a complex, multi-level, and multi-threaded concept of state development, (iii) social responsibility because the essence of state development lies in breaking traditional social behaviors that use environmental resources, (iv) practicality of the sustainable development concept because it determines social justice and joint responsibility for the theory of state development, and (v) environmental management inspiring the integration of the above-mentioned development trends. The results are discussed. Formulated definitions of the state's ecological security and of socially responsible and sustainable development of the city are given.

Keywords: ecological security, regional cities, environmental management, social responsibility, sustainable development.

1. INTRODUCTION

It is not easy to answer the question about the consequences of global environmental problems that are perceived as local problems because they were created in those places and have their effects in those places (Zhang, 2020; Salvioni, Astori, 2013).

The global effects and implications of social and economic growth usually result from states' governance processes.

The source of the practical significance of the development of states as ecologically safe organizations can be found in the concept of *freedom*. Freedom should not be confused with "independence", of which there are different types depending on the sphere of life that freedom concerns (Rykiel, 2006; Balcerowicz, 2017).

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The environmental impact of states' environmental policies relates not only to the protection of health and life or the environment, but also to social and economic justice and equality of countries. These challenges are burdening local governance structures and systems.

The global market has not developed specific proposals for an objective and independent of will or worldview combination of three concepts: ecological safety with social responsibility, sustainable development and environmental management. Meanwhile, the interpretation of their essence and role in states results from new philosophical directions that were not referred to in the period before the annexation of Crimea by Russia (in 2014), the COVID-19 pandemic (in 2019–2022) or the Russian-Ukrainian war (since 2022).

The aim of this article is to promote the monograph "Outline of the theory of the state as an ecologically safe organization in empirical research" published in 2022 by the Publishing House of the Rzeszów University of Technology resulted to some extent from editorial limitations. The modest size of this work was due to some extent to editorial limitations. The monograph sets out a theoretical framework for determining when a state is ecologically safe, using the example of Polish regional cities.

The thematic scope of each book is always a matter of choice. This is partly due to the definition of the scientific discipline – rarely unambiguous – that the book is to address. The thematic scope of the book was the result of a conscious choice by the author. It resulted especially from the awareness of the colossal knowledge that had to be selected and organized.

The monograph has 572 pages and 11 chapters. These are: "Introduction", theoretical part entitled "Multi-aspect considerations on the development of the state" with 6 chapters, empirical part entitled "The influence of regional cities on ecological security" with 4 chapters, "Conclusion" and "Bibliography".

In terms of content, the monograph is based on five assumptions. First, it is written for the reader from the point of view of his or her interests and cultural traditions. It should be understood in a conservative way – more as a collection of knowledge that the reader should know and less as a collection of information that the reader is more likely to read in order to confirm their views.

Secondly, the narrative convention adopted in the monograph acknowledges the fact that some explanations refer to formal or structural properties of the system (Huneman, 2018). These structures are usually expressed in biological, physical, mathematical or philosophical terms (Shapiro, 2017; Batterman, Rice, 2014; Jones, 2014; Lange, 2013; Rice, 2012; Dorato, Felline, 2011; Huneman, 2018). This fact distinguishes these explanations from mechanistic explanations (Craver, Darden, 2015), and from general processes (Woodward, 2003).

Thirdly, the monograph is based on the assumption that the development of the state as an ecologically safe organization is not reduced to describing *how it is* and *how it should be*.

Fourthly, the monograph concerns the macrostructures and microstructures of political management on a local and regional scale, including intra-city ones.

Fifthly, the topic of managing other forms of state security was consciously abandoned because – in the author's opinion – the issue of security deserves much more than a few generalities to which it would have to be limited.

This article, and the discussed monograph, implement the goals of the "National Urban Policy 2023" (2015). Importantly, the monograph is the first description of the author's research. The presented research was conducted in 2019–2022.

2. LITERATURE REVIEV

The article discusses the state as an ecologically safe organization characterized by terminological and conceptual discipline. The author draws attention to the fact that the concept of *ecological safety* has never been formally defined. However, it was sometimes used interchangeably with the – also essentially undefined – concept of "concrete actions" aimed at protecting citizens and their future generations from threats resulting from insufficiently harmonised social and economic development with the requirements of environmental protection (Leśniak, 2014; Paczuski, 2005).

The author refers to the Constitution of the Republic of Poland (1997), which may currently seem to some political organizations or individuals to be an anachronistic remnant from an earlier period when, before the development of the new power, legal obligations necessarily rested with private citizens and not with public officials. However, values support the constitutional legitimacy of even a not always robust and routine environmental law enforcement program.

Environmental protection as a tool for ensuring ecological security should be guided by the principle of sustainable development. Ensuring this obligation assumes achieving such a state of the natural environment that allows for safe residence in it and enables the development of humans – using its resources (Wyrok K 23/05). The environmental protection order includes two actions by public authorities (Wyrok K 23/05): preventing and improving the deterioration of the environment. However, considerations of environmental protection law lead to the conclusion that by implementing this law, each organization becomes an ecological organization without going into details of how ecosystems function.

Sustainable development is an argument for social responsibility in the context of justifying the existence of the state organization. The main objection to a coherent understanding of the terms *social responsibility* and *sustainable development* is their partial adoption and mutation by various interests. Real development requires that *pure economics* should apply only to those practical development modifications that are useful for environmental management (Lemaître, Vitcheva, 2020).

The implementation of the environmental management concept requires adopting the correct orientation – in the policy of organizational order, dissemination of values and ethical principles – common to the network of organizations. The objectives are the adopted control systems for preventing environmental risks because they are interdependent with the conditions of global responsibility and sustainable development of countries. This Community strategy combines the environmental aspects of market and non-market practices in the development of techniques for environmental safety (Salvioni, Astori, 2013).

The extreme formalism of this statement is that it is a purely nominalistic understanding and – like all such proofs – has little scientific value. Transferring this idea to the constitutionality of ecological safety, it turns out that the concept of *environmental protection* is synonymous with *the appropriate state of the environment* (Leśniak, 2014). This means that public authorities are obliged to ensure the state of the environment in accordance with the needs of socjety (Wyrok K 23/05).

In theory, state security is considered traditionally: in terms of territorial integrity, inviolability of borders, presence of authority, subject to the same laws, to create unity in each local community (Fierke, 2015; Sesboüé, 2012). Community security policies – in the context of local communities' histories, different cultures and shared values – tend to renew ineffective rules, but if left under control, they should be removed (Fierke 2015; Rothschild, 2008). Tradition is therefore presented not as being placed next to the content of security but as being consistent with the content of creating and enforcing security. The discussion on ecological safety is therefore related to the way in which a person, group or society understands this safety and their awareness of functioning in a safe social space (Rothschild, 1996; Rothschild, 2008).

The article does not omit the basic theoretical formulation: *cross-border security* that is ambiguous and encompasses border communities. The concept of cross-border environmental impact – as a real social object – is based on the assumption of additivity, i.e. independence of the elements of the whole of a mechanistic type. Mechanistic wholes can be treated – in response to cross-border events – as unorganized sets, i.e. those that do not exhibit internal organization. The connections between them are coincidental and irrelevant. The components included in or excluded from the set do not undergo any changes, which indicates the lack of links integrating such a set. The features of the team as a whole therefore coincide with the sum of the features of its components, considered separately (Rykiel, 2001). The author relates this reflection to constitutional principles and changing international conditions.

At the methodological level, the author makes "a synthesis" of ecological security, but without success because she notices that it is acceptable to reject innovations in creating this security when they may increase costs. The excess of these traditional behaviors leads to a loss of value (Sesboüé, 2012; Rykiel, 2006).

Practical solutions for ensuring security remain a subject of research to confirm the conclusion that a progressive state expresses its influence on the sense of security in its historical locations in socjety (Gu et al., 2019; Fierke, 2015). However, the science of security cannot justify the facts because at the same time as the announcement of unknown circumstances of the threat and increased security, the realization of anti-security is announced.

The author emphasizes the fact that in security policy two reasons have legal force: in the context of the increase in the speed and quantity of international information transfer, there has been an increased interest in human security and knowledge about crimes against man, as well as ways to prevent these crimes; in the context of increased access to the amount of information, there has been an increased interest in threats because even distant countries can be included in international interventions. This is due to the much smaller power of reaction and influence in local conflicts. Other countries can defend freedom more effectively than formally constituted political local authorities.

Assuming that the failures of governments in the policy of ecological security are the result of the influence of powerful economic groups, the author encourages us to accept the challenge of improving the development results of countries by improving the tools of ecological security.

3. METHODOLOGY

The author does not separate the definition of *a state* from the definition of *a nation* or *a society*. Many of these definitions were presented and after some time they were

unsatisfactory because they omitted some aspect of the study of the state in which the discipline became interested during that time.

In general, definitions of *the state* can be divided into two groups: normative definitions and descriptive definitions (Rykiel, 2006). The definitions from the first group tried to present what the state should do or what it does do; they always refer to space. The definitions from the second group tried to indicate what the state actually does.

The author uses various metaphors to capture the relationship between the state and its forms of organization. They are useful in understanding how the state shapes the natural environment to maintain this *public interest* in various social spaces. Institutions specify the concept of *social interest* when such a situation occurs in order to explain its content and demonstrate that such interest speaks for or against the proposed solution. The concept of *social interest* is not an abstract concept, it is a concrete concept and must result from a specific situation requiring the defense of this interest even by violating the good name of another person, group of people or institution (Wyrok SN 1973).

It is worth noting that in a state governed by the rule of law, the concepts of *social interest* and *public interest* are semantically identical but are not synonymous with the concept of "state interest" (Żurawik, 2013). In addition, the public interest cannot be considered as *the economic* or *fiscal interest* of the state (Wyrok SN 1993). The process of satisfying the public interest can therefore be expected to eliminate the negative effects of market mechanism imperfections – from the point of view of global and local ecological security.

The aim of the monograph was to establish a theoretical framework for determining when a state is ecologically safe, using the example of Polish regional cities. The continuation of this goal was to provide, among others, a definition of *the ecological security of the state*, as well as the definition of *a socially responsible city* and the definition of *sustainable development of the city*.

The subject of the article could then be defined as an outline of the theory of development of an ecologically safe state based on the study of whether Polish regional cities are ecologically safe.

The thesis was adopted: the concept of an ecologically safe state is based on the concept of cities as an object of knowledge – as opposed to cities as a tool for action. In this article – unless otherwise stated – the state or city are always understood as an object of knowledge.

In this context, this article explains, among other things, the meaning of the definition of *the ecological security of the state*, *social responsibility and sustainable development of the state*, and *environmental management of the state*.

The selection procedure of the community focused on the most developed cities in Poland. It was assumed that the community of regional cities of Poland has features resulting from the advanced social and economic development of these cities. This means that cities cooperate internationally and have extensive use of digitalisation and conceptualise direct or potential social and economic benefits from the natural environment in line with theoretical frameworks and initiatives supported by government, regional or local authorities, based on the development policies of these cities. Statistical certainty was increased by the purposive selection of regional cities. The sample could not be drawn because no public statistics data contain information on the individual characteristics of cities that are difficult to record. The individual characteristics of cities become apparent only when fulfilling obligations (e.g. resulting from the global pandemic or the war between Russia and Ukraine).

Ultimately, 18 regional cities of Poland were considered, i.e.: Białystok, Bydgoszcz, Gdańsk, Gorzów Wielkopolski, Katowice, Kielce, Kraków, Lublin, Łódź, Opole, Olsztyn, Poznań, Rzeszów, Szczecin, the capital cities of Warsaw and Wrocław, as well as Toruń and Zielona Góra – the seats of the provincial assemblies. The names of regional cities in the further record were replaced by numbers (from 1 to 18) and the order of numbers does not correspond to the alphabetical list of these cities. Research is not a process of assigning definitions regarding the behavior of a specific individual or group of individuals, which would result in assigning them characteristics or labels according to which they could be assessed by others. The analysis and evaluation only refer to the development in the face of the civilization challenge of catching up with more developed cities.

The article is based on five data sources: presentations by other authors (conference papers, peer-reviewed journals, article and reports of university, industrial or organizational nature); 18 strategiach rozwoju miast regionalnych; 18 environmental protection programs of regional cities in Poland; national "EMAS Register – list of organisations registered in the eco-management and audit system" (Regulation (EC) No 1221/2009); author's questionnaire on the "model of an integrated eco-management and city audit system with the goals of sustainable urban development and urban social responsibility". The first data source was discussed in the theoretical part of the monograph and the remaining four data sources are described in the empirical part of the monograph.

A multi-criteria comparative and descriptive analysis of the collected material was used because it is a helpful instrument for implementing social responsibility and sustainable local development when they are integrated with spatial planning. In urban development, decision support systems are an instrument of urban planning when they combine planning alternatives and scientific knowledge and facilitate stakeholder consensus. Consequently, the combination of multi-criteria analysis with a decision support system offers a tool for quantitatively solving spatial decision problems. This tool does not provide an objective answer in terms of *what and how to do best*, but supports decision-makers in three ways (Ringenston, Höjer, 2016): identifies decision criteria; evaluates action options that refer to decision criteria; analytically combines assessments. The synthesis of evaluation techniques creates a basis for decision analysis.

Two criteria were adopted for the analysis of an ecologically safe state: social and economic development factors and the influence of adopted regional cities development strategies. These criteria were related to environmental aspects and the analysis was based on the adopted forms of development and the expected effects of urban development. Multi-criteria analysis enabled the integration of diverse interests of cities and the assessment of their ecological safety.

The theoretical issues were established in the context of the coherence of four international concepts: ecological security, social responsibility, sustainable development and environmental management.

The empirical issues of the study are summary in nature because they refer to the entire population.

The results were generalized to the entire population because specific regularities of the studied phenomenon were detected with a clear and concise characterization of ecological safety. Probability theory was not used because inference is made when the study is representative in the context of a random sample.

The practical application of these results can be seen in four contexts: strategic assessment of the values that need to be implemented to achieve real ecological security; determining mitigation measures to cope with counteracting environmental benefits in

solutions leading to ecological security; determining top-down or bottom-up approaches in the development of ecologically secure cities; determining the state's competences in the field of ecologically secure solutions and such management of cities that ecological security initiatives are coordinated.

4. RESULTS

There is no ecological security policy not only outside of time and space but also without a group of people practicing this policy and without the subject of this policy (Rykiel, 2006). Ecological security is considered in the context of the question about the subject of formulated spheres creating the structures of cities and spatial forms of cities – as places covered by development strategies.

The analysis of the current state of development and quality of 18 regional cities of Poland identified six specific common features of these cities: administrative centers of their regions, economic centers of their regions, labor markets of their regions, educational centers of their regions, cultural centers of their regions and centers of influence on the ecosystems of the regions. These common features of Polish regional cities are not common because other urban centres do not have them. In the objective sense, regional cities – as special places for investing capital within the region or even the country – are also the largest markets for producers and consumers within their region or country.

The analysis of the surveys revealed a diverse approach of the authorities of regional cities to providing reliable information based on the survey questionnaire as a source of information often used by researchers (Tetrevova, Jelinkova, 2019; Tetrevova et.al., 2017). The survey contained 79 questions and 13 tables, and the time to complete the survey depended on the substantive preparation of the individual. By opting for electronic correspondence, presidents of regional cities had the opportunity to be among those creating the best management model.

It is worth mentioning some research results from the empirical part of the monograph (Lipińska, 2022). Nine regional city offices did not respond to the survey: Katowice, Lublin, Olsztyn, Opole, Poznań, Szczecin, Toruń, Wrocław and Zielona Góra. The survey was partially completed and returned by three city offices: Białystok, Gorzów Wielkopolski and the capital city of Warsaw. A different response was provided – recorded in writing – by nine city offices: Białystok, Bydgoszcz, Gdańsk, Gorzów Wielkopolski, Kielce, Kraków, Łódź, Rzeszów and the capital city of Warsaw. In the context of these other responses, substantive explanations on the city management system were provided by six city offices: Bydgoszcz, Kielce, Kraków, Łódź and Rzeszów (however, without returning the survey questionnaire) and the capital city of Warsaw. Nine city offices directly reported the lack of an implemented integrated eco-management system: Białystok, Bydgoszcz, Gdańsk, Gorzów Wielkopolski, Kielce, Kraków, Łódź, Rzeszów and the capital city of Warsaw.

It can therefore be stated that the three survey questionnaires obtained from city offices (Białystok, Gorzów Wielkopolski and the capital city of Warsaw) represent a response rate of approximately 17% for all 18 voivodeship city offices in Poland. A good summary of the survey experience was the provision of other substantive written explanations by six voivodeship city offices (Bydgoszcz, Kielce, Kraków, Łódź, Rzeszów and the capital city of Warsaw), which constituted approximately 33% of other explanations.

The survey questionnaire was handled by two offices in two city offices whose names were clearly related to the concept of environmental protection: Environmental Protection

Department of the City Office in Białystok, as well as the Department of Integrated Development and Environment of the City Office in Bydgoszcz.

The survey questionnaire was handled by two offices in two city offices with names that clearly corresponded to the concept of sustainable development: Office for Intelligent Sustainable Development Management of the Kielce City Office, as well as the Department of Integrated Development and Environment of the Bydgoszcz City Office.

Finally, the survey questionnaire was handled by six offices in six city offices whose names did not correspond to the research issues: Secretariat of the Deputy Mayor of the City Office in Gdańsk, Department of Integrated Territorial Investments and Strategic Programming of the City Office of Gorzów Wielkopolski, Department of Organization and Supervision of the City Office of Kraków, City Strategy Office in the Department of Architecture and Development of the City Office of Łódź, Department of Organization and Administration of the City Office of Rzeszów, as well as the Department of Work Organization in the Organization Office of the Capital City of Warsaw. The last one indicated that three offices cooperated in preparing a written response as an additional attachment to the survey.

The survey question about the objective coexistence of the environmental management system with social responsibility and sustainable development concerned not *the best* but rather *the actual* or *structural* framework of this system, not so much *justified* but rather *determined*, not so much by *the arrangement* but rather by *the operation* of the system elements. The question of the objective existence of the city was not *a material object*, but *a system* consisting of elements that were physically connected, especially *functionnally*.

The analysis showed that nine (i.e. 50%) regional cities participating in the survey admitted that they did not have a decision on implementing *a city environmental management system*.

By conducting self-criticism, officers were able to objectively assess the scope of cities' management tasks. Four officers did so (i.e. 22%). This criticism revealed the earlier possession of implemented standards – i.e. a quality certificate confirming compliance with standards for the quality management system (PN-EN ISO 9001:2015), environmental management system (ISO 14001:2015) and environmental management in the context of assessing the eco-efficiency of product systems (ISO 14045:2012) – but without continuation during the research period.

The empirical analysis covered the national EMAS Register to draw attention to the need to distinguish the issue of geographical individuality of regional cities from the issue of the location of their borders. Sectoral reference documents of city offices – regarding best environmental management practices, environmental performance indicators and development excellence criteria – refer not only to the public administration sector but also to other sectors.

The analysis showed that 4 106 708 entities conducted business activity in Poland. Of these, 91 entities, i.e. 0.002%, were recorded in the national EMAS Register (as of 25.07.2021). This fact does not mean, however, that all these entities were economically active. Among these 91 entities were organizations that: suspended their activities and information about this fact was recorded in the national EMAS Register; ceased their activities but information about this was not recorded because it is not in the Central Statistical Office database or they are not entrepreneurs but foundations and associations. There were 65 active entities, i.e. those with current environmental declarations and therefore recorded in EMAS, i.e. 0.001% of 4 106 708 entities with a potential impact on the environment.

The analysis revealed that only one city had a current environmental declaration (as of 25.07.2021): the Wrocław City Office registered in 2012 and verified in 2020 in the EMAS Register. The lack of an environmental declaration in the remaining 17 regional cities means that they cannot promote themselves as environmentally managed.

In the case of social and ecological activity of regional cities, the author of the article identified 16 city development policies and 18 sub-policies of development of these cities, the scope of which depended on the internal and external conditions of these cities. This context was described in the chapter "Catalogues of elements of the structure of the development strategy of regional cities in Poland".

The author developed 13 catalogues: a catalogue of city development challenges (128 elements were classified); a catalogue of city development strengths (92 elements were classified); a catalogue of city development opportunities (132 elements were classified); a catalogue of city development weaknesses (126 elements were classified); a catalogue of city development threats (96 elements were classified); a catalogue of city development directions (121 elements were classified); a catalogue of city development activities (91 elements were classified); a catalogue of city strategic development goals (108 elements were classified); a catalogue of city detailed development goals (82 elements were classified); a catalogue of city operational development goals (97 elements were classified); a catalogue of city strategic development tasks (105 elements were classified); a catalogue of tasks for detailed development of cities (94 items were classified); a catalogue of results of development activities of cities (114 items were classified).
These classifications are illustrated in 13 tables, with development challenges arranged according to 7 development directions and the remaining elements arranged according to 18 development sub-policies. These documents lacked information on environmental aspects. On this basis, the author concludes that there is no real environmental management system in regional cities and no real ecological security of these cities.

Finally, it should be noted that in the literature, the issue of recording environmental aspects is not directly addressed, although these issues are referred to in publications (Tetrevova, Jelinkova, 2019; Tetrevova i in., 2017). It can therefore be stated that the lack of progress in the development of ecological safety is evidence of the lack of social responsibility and sustainable development of such communities. Security that is purposeful, prudent, effective and meets needs is based rather on the study of the effects of previously existing crisis situations.

5. DISCUSSION

The research method revealed several facts.

From the point of view of selecting Polish regional cities for the study, this selection was not intended to fully present how the country's ecological security is achieved. It was intended to show what this process looks like in Poland because it also has international significance. The author is aware that the selected regional cities are seriously overrepresented in the selection and other developing cities have not been included.

From the point of view of analyzing national and English-language literature, in-depth descriptions of urban projects were not always available even on the internet. A complete listing of all available web applications in each literature database was not considered a realistic intention within the study.

From the point of view of the development strategy of regional cities, the examples selected for analysis cannot be perceived as comprehensive solutions for achieving

ecological safety. Similarly, the selection of regional cities was not intended to fully present what an ecologically safe city currently looks like in Poland or even the world. The documents examined are visions or dreams transformed into policies, plans, projects and programmes as the initial capital of the expectations of city stakeholders. Their course was not monitored and their effects were not analyzed, but possible effects were discussed. No reliable monitoring studies were found on the environmental impact of these plans, projects and programmes. Superficial or common information was found (although colorful, attractively designed presentations of the cities' products and services). No comprehensive data was found on the effects of political decisions that led to the non-implementation of a policy, plan or project due to a lack of knowledge about the environmental aspects of cities. The lack of such political decisions could be due to two reasons: this information is not available on the Internet and implementations in such cases abandon formalized public information principles.

From the point of view of the national register of organisations in the environmental management system as important public information, this environmental certification system enabled the rapid identification of Poland's regional cities.

From the point of view of the surveys, the idea was to obtain information on the voluntary environmental management of regional cities in Poland.

From the point of view of data analysis, the aim was to obtain results that would reveal the actual ecological security policy through mutual correlation, i.e. indicate differences or similarities in the management mechanisms of implementing the development strategy of regional cities in Poland.

The processes and results of urban development activities were compared with the intensification of their use to determine the environmental aspects of these cities. This analysis describes how urban development strategies can support the reduction of negative environmental impacts and the use of natural resources in cities. Such a social transformation is essential to increase the ecological security of the country. This fact may apply to other state management implementations.

The justification for the current development of Poland as an ecologically (un)safe organization required the inclusion of target values (i.e. environmental aspects) in the analysis in order to make two terms realistic: *social responsibility* and *sustainable development*.

6. CONCLUSIONS

This article is a self-promotion of the monograph "Outline of the theory of the state as an ecologically safe organization" (Lipińska, 2022) based on the theoretical and practical context of the development of Polish regional cities. It is advisable to begin a concise summary of the most important theses of this monograph by emphasizing that ecological security is a universally desired phenomenon in every period because it is related to the political, social, economic and institutional development of the state and the spatial development of cities and their regions, as well as to the accumulation and dispersion of sources of negative impact on the natural space and its degradation.

The article draws attention to the fact that various concepts and terms related to *social responsibility* and *sustainable development* and *environmental management* are created, but their complexity leads to different opinions because they can be considered in many different ways. They often blur and hinder real protection because public and private

organizations see other opportunities for their development or are encouraged to use different methods of management.

In this article, in line with the author's concept of the monograph, an attempt was made to improve the clarity of understanding the state as an ecologically safe organization according to the implications of ecological safety, social responsibility, sustainable development and environmental management. Analyzing the differences in the conceptual structure of these four concepts can help clarify ambiguities in theory and research and hidden assumptions to uncover inconsistent findings on the social and ecological impacts of decisions made in other countries as well.

The author formulated, among other things, a definition of

> the ecological security of the state: and it is comprehensive security, i.e. protection of the health and life of people and protection of the environment, protection of cultural heritage and protection of property, i.e. a rigorous and broad-based system of protection in advance, which consists in preparing and effectively responding to an emergency (e.g. natural disasters, cyberattacks, pandemics and potential war invasions).

The author formulated a definition of

> socially responsible and sustainable development of the city: and socially responsible and sustainable development of the city as an organization means universally accepted ecological issues, i.e. in the process of city management, in the system of organizing the urban community and in economic relations with interested parties. The city as an organization creates a coherent system of values of the community using the natural and technical space of the city. This space serves to achieve real ecological security of the city. In this context, environmental aspects of the city are continuously identified in all its spatial forms, i.e. production, consumption, power, symbolism, exchange and residence.

These definitions are an incentive for the authorities to reach for the environmental aspects of their public and non-public organisations, in order to catalogue these aspects and to fully respect only positive aspects in development investments, or to update the development strategy of regional centres.

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Ali MADOUNI[1]

UNDERSTANDING WATER SCARCITY AND CONFLICT DYNAMICS IN AFRICA: ADDRESSING GEOPOLITICAL TENSIONS, HUMAN SECURITY, AND DEVELOPMENTAL IMPACTS

This article examines the intricate relationship between water scarcity and conflict dynamics in Africa, where crucial environmental pressures intersect with escalating sociopolitical conflicts. Water shortage, resulting from climate change and population growth, leads to increased competition for limited resources and a more significant possibility for violence. Transboundary conflicts over shared water bodies, such as the Nile Basin, have often enclosed this critical confluence of contending national interests overlaid with concerns around regional stability. Securitization theory acts as a lens conceptual framework that explains how water insecurity, under a nationalizing frame, became a national security issue with prior incipient policy trends and deepening socioeconomic disparities. The document discusses the implication of water-related challenges for human security, especially in vulnerable communities that depend on agriculture and natural resources, and helps to develop informed policies that foster peace, stability, and equitable development underpinned by water scarcity in Africa through synthesizing theoretical insights and empirical findings.

Keywords: water scarcity, conflict dynamics, human security, securitization theory, developmental impacts.

1. INTRODUCTION

Water scarcity is a problem that erodes not only environmental sustainability but also regional stability, particularly in Africa. Where climate change, population pressures, and economic disparities converge, the continent's already limited water resources become further stretched, and competition ensues for access, control, and management of this valuable resource. The issue gets further complicated in transboundary water bodies, where disputes regarding water rights can lead to regional tensions between neighbouring countries. These tensions, which are often founded on geopolitical competitions, are exacerbated by socioeconomic differences and a rapidly growing population dependent on water for agriculture, industry, and sustenance.

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The securitization approach also heightens the challenges of water scarcity, where the argument is framed that water might be imagined as national or regional security. It enables states to deploy it as a reason why ordinary means would not be adequate in acquiring water access and securing it over other public priorities, frequently violating international cooperation and diplomacy. The securitization process is critical to recognizing how water scarcity is not merely an environmental problem but a thoroughly political one that can set off conflicts or promote collaborative governance structures.

Gender is among the most significant issues omitted in discussions of water scarcity. Women, especially in rural communities, are disproportionately affected by water scarcity owing to their primary responsibility for gathering water, domestic work, and sanitation. Their involvement in water management and decision-making is still inadequate, even though they play a central role in organizing water resources at home. This study thus integrates gender analysis into the overall discussion of water scarcity, highlighting the need for gender-responsive policies in water management.

Based on securitization theory, this paper will discuss the human security implications of water scarcity in Africa, particularly emphasizing the impacts on marginalized communities and vulnerable groups. It aims to contribute to an enhanced understanding of water scarcity, conflict dynamics, and human security and offer practical recommendations for more inclusive and sustainable water governance.

2. LITERATURE REVIEW

Africa's water crisis is directly associated with geopolitical competition, economic disparities, and environmental sustainability concerns. The continent's diversified climate, rapidly growing population, and limited water supply complicate the issue further. As Africa's population continues to grow, competition for access to water intensifies, and this typically results in heightened tensions between nations and even within nations. Water scarcity has emerged as a core area of future conflict, fuelled by African countries' environmental and socioeconomic fragility (U.N.U.N. Water, 2021). The issue fuels regional instability and extends existing inequalities, especially in rural and vulnerable groups that depend on water resources for livelihood (Grey, Sadoff, 2007; Homer-Dixon, 1994).

Securitization theory offers a valuable lens for making sense of water scarcity as a regional or national security threat. According to this theory, water is framed as a security threat requiring urgent, exceptional government measures. Framing water scarcity and competition as a regional or national threat has been at the core of shaping policy responses across the African continent. Securitization situates water as a matter of survival, where governments employ extreme means to defend their water sources (Zeitoun, Mirumachi, 2008). Securitization either amplifies tensions across borders or offers the promise of cooperation in managing transboundary waters, depending on the broader context of water governance.

Interstate transboundary water disputes between countries, such as the Nile Basin countries of Ethiopia, Sudan, and Egypt, demonstrate the complexities of water management in Africa. These disputes, primarily over dam constructions and other water infrastructure, depict the challenges in equitable water allocation across borders and water politicization (Allan, 2001; Cascão, Zeitoun, 2009). These clashes necessitate advanced, collaborative approaches to water resource management that balance national interests with regional cooperation, ensuring equitable and sustainable management regimes.

Other than these political concerns, water shortages disproportionately impact vulnerable populations, particularly the poor and rural communities. Marginalized communities, which are agricultural and natural resource-based, bear the brunt of limited access to water and sanitation facilities. Widening socioeconomic inequalities in these regions further increase their exposure to water shortages (UNDP, 2020; UNESCO, 2015).

Inclusive policies must tackle these issues, considering the gendered nature of water scarcity. Women, especially in rural areas, play an essential role in gathering water, sanitation, and domestic care but are not yet sufficiently involved in making decisions on water management. For more efficient and just water management, it is essential to incorporate gender considerations so that women are also involved in water governance and their requirements are addressed (Rathgeber, 1997; Zwarteveen, Meinzen-Dick, 2018).

3. METHODOLOGY

The article uses a mixed-methods approach to understand the complex interface between water scarcity and African conflict dynamics, specifically about managing geopolitical tensions, human security, and sustainable development (Smith & Johnson, 2023). The research methodology includes a systematic review of the literature and qualitative case study analysis, which provides an extensive understanding of how water-related issues intersect with other African socio-political dynamics.

The approach will entail a comprehensive case study of the Nile River Basin, focusing on transboundary water conflict challenges, governance intricacies, and implications for regional stability. The study will investigate how international collaboration and institutional arrangements can be utilized to avert conflict and facilitate equitable resource sharing. In addition, the research will feature input from domestic actors and water specialists, with a broader perspective on the issue (Jones et al., 2022).

4. GEOPOLITICAL TENSIONS AND TRANSBOUNDARY WATER DISPUTES IN AFRICA

Africa's transboundary water conflicts are shaped by complex geopolitical realities that intersect with history, economics, and the environment. Conflicts result most frequently from competing national interests, unequal access to water resources, and impacts on large-scale infrastructure projects like dams and irrigation schemes (Zeitoun, Mirumachi, 2008). The continent is representative of case studies that explain the varying levels of tension and cooperation between the riparian states. The Nile River Basin is characterized by a history of dispute over the share of waters; the GERD project is an example of increased tension between Egypt downstream and Sudan and Ethiopia upstream.

The case of the Senegal River Basin is one of successful regional cooperation within the regime of the Senegal River Basin Development Organization, which has furnished the institutional mechanism for the standard management and sharing of water resources among Guinea, Mali, Mauritania, and Senegal (Olsson et al., 2015).

Such dynamics concern international organizations' role and the concomitant diplomatic efforts towards containing transboundary water conflict. International organizations, such as the United Nations and the African Union, serve as facilitators and mediators of negotiations among water-sharing states. They offer negotiation and conflict resolution mechanisms and formulate cooperation in water governance (Cascão, Zeitoun, 2009). The diplomacy aims to create trust, transparency, and comprehension among the

opposing sides by highlighting the core features of equitable and sustainable water management.

New mechanisms for resolving conflicts are increasingly being applied to foster trust and understanding among nations, such as joint fact-finding missions, technology transfer, and hydro-diplomacy. These mechanisms enable parties to resolve disputes and find solutions unaided without external intervention (Zeitoun, Mirumachi, 2008).

The GERD project's mediation activities are good examples of international mediation and diplomacy. The A.U.-led process has sought to balance Ethiopia's development aspirations with Egyptian and Sudanese concerns for water security and downstream impacts. This is the background for diplomatic initiatives toward regional stability and cooperation in shared water resource management. Informed by these case studies and diplomatic action analyses, researchers and policymakers will better understand the successful strategies to alleviate geopolitical tensions, enhance water security, and support sustainable development in Africa's transboundary river basins.

5. DYNAMICS OF CONFLICT, HUMAN SECURITY, AND ENGENDERING DIMENSIONS OF WATER INSECURITY IN AFRICA

Water scarcity in Africa has gradually become a key determinant of conflict patterns, especially as it combines with pre-existing political, ethnic, and socioeconomic grievances. Competition over limited water resources -consumed for drinking, irrigation, and generating income- more likely than not exasperates existing tensions and leads to physical confrontations among individuals. This competition increases even further in areas where water is a chief survival resource, and regional or national-level policies overlook equitable allocation. The resulting violence for these water resources has high human costs, including mortality, displacement, destruction of property, and disruption of the social fabric, destabilizing already weak states further. Such conflicts, driven by water insecurity, also perpetuate poverty, instability, and insecurity cycles.

In addressing water scarcity, gender factors have a significant but usually under-appreciated role. African women primarily collect, manage, and distribute water at the household and community levels (Zwarteveen, Meinzen-Dick, 2018). The less accessible water exacerbates the problem for women, as more time and effort is required to procure water, impacting their ability to engage in economic, educational, and social life. During periods of heightened water scarcity or conflict, women and girls are most vulnerable to gender-based violence, exploitation, and disruption of daily life and livelihoods. Their responsibility for locating water and maintaining household health leads to their disproportionate burden from the insecurities that water scarcity generates, especially during conflict.

However, women are also essential for resolving conflicts and building peace in regions experiencing water scarcity. They have local knowledge, leadership skills, and resilience, all essential for building sustainable water management practices and resilience in the community against conflict. Involving women in water governance and peacebuilding is a means through which more effective, inclusive, and long-term solutions can be established. As part of conflict resolution initiatives, a gender-sensitive approach to water governance is increasingly viewed as the key to addressing the root causes of water insecurity while ensuring equitable and sustainable peace processes (Zwarteveen, Meinzen-Dick, 2018).

Gender inclusion in the discourse on human security and water scarcity is proof of the growing acknowledgment that addressing these phenomena requires more than technical solutions. Empowering women as decision-makers and stakeholders in water management and peacebuilding efforts will guarantee fair, sustainable water governance. This, in turn, improves human security, reduces the risk of conflict, and increases resilience in water-scarce regions.

6. SOCIOECONOMIC INEQUALITIES AND DEVELOPMENTAL IMPACTS

Socioeconomic inequalities, which compound water scarcity, remain significant, especially in areas with limited and poorly distributed water resources. Such imbalances further cumulate the prevalent disparities, and the marginalized groups are dealt with more harshly. For instance, poor neighbourhoods, Indigenous groups, and informal settlements in the majority of developing nations are hardest hit by water scarcity due to the absence of appropriate infrastructure and other amenities. It jeopardizes people's health and economic potential if there is no safe access to water, as it becomes a problem to keep agriculture going, run small businesses, and manage from day to day.

The developmental effects of a water shortage on the informal economy are devastating. For instance, the informal economy, often outside formal regulatory frameworks, relies mainly on accessible water resources for street vending, small-scale agriculture, and artisanal production. During water inadequacy or pollution, livelihoods are disrupted, initiating precarious incomes and increased vulnerability. This risk is especially acute for women, who bear the primary responsibility for water collection in most communities. This additional time burden, along with the health effects of contaminated water, worsens gender disparities and contributes to the further exclusion of women from decision-making. These gendered trends intensify socioeconomic disparities and prevent women from full participation in economic life (U.N. Women, 2022).

Considering these challenges, it is vitally essential to include economic development strategies. They need to be founded on preparation and capacity development strategies for water access and sanitation infrastructure in marginalized population settlements. This would have sustainable water resource management and resilience building in the informal economy. These economically empowering interventions on the margins -community-based approaches in water management, microfinance for water enterprises, and vocational skills training in water-saving technologies- can promote resilience against water scarcity effects. Inclusive engagement and gender-sensitive approaches in water governance and economic development programs are relevant to securing equable benefits and opportunities.

According to recent revelations, water management policy and development agendas need to directly incorporate socioeconomic and environmental considerations. Policymakers, in this respect, can avert potential harm to the informal economies and vulnerable segments of water scarcity by providing further consideration to policies on inclusive economic growth and resilience measures in support of people experiencing poverty. These strategies will build resilience and sustainable development, bridging societal socioeconomic dimensions. In effectively executing these strategies, very tight coordination among governments, civil society organizations, and international agencies is required, leading to long-term improvement in water supply security and increased economic prosperity for all.

7. THE NILE RIVER BASIN

The Nile River is the centre of the economies and livelihoods of over 250 million citizens residing in the 11 countries of East Africa. It offers fertile ground for cultivation. Activity on the Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile created a new geopolitical hotspot and triggered complex issues concerning sovereignty and water management.

This paper concentrates on the Nile River Basin case study to identify how water scarcity meets the dynamics of conflict and geopolitical tensions in Africa, as well as human security and developmental effects. GERD is Africa's most extensive hydropower construction, and Ethiopia started it to meet its energy and development needs. However, downstream nations like Egypt and Sudan highly depend on the Nile waters for agriculture, industry, and domestic consumption, as cited in Cascão & Zeitoun (2009). This move to build this dam has triggered sharp geopolitical tensions, mainly between downstream nations, firmly against possible water flow disruption, posing threats to food security, livelihood, and local stability.

This places diplomats at the table, brokered by international institutions such as the African Union, to chart a path through the water-sharing agreements and steer clear of potential hazards of conflict.

The competing interests in the GERD dispute involve historical grievances, colonial treaties, and competing national interests. Egypt regards the Nile's water as an issue of economic stability and security. Ethiopia perceives the GERD as a matter of development and sovereignty, which comes with the prerogative to develop its water resources. These various viewpoints reveal how water can contribute to kindling conflicts and illustrate the complex dynamics of water security, political stability, and regional cooperation in Africa.

Second, this Nile Basin GERD project has developmental and socioeconomic impacts. On the positive side, Ethiopia is looking forward to economic development related to hydropower. At the same time, lower water volumes may result in food insecurity and socioeconomic inequality for the downstream countries (Grey, Sadoff, 2007). All this ambiguity about the supply of water, and the GERD in particular, calls for water governance systems at the regional level that can ensure sustainable development, poverty reduction, and inclusive growth.

This research involves qualitative data collection and analysis to identify diverse stakeholders' perspectives in the nation, from Ethiopia, Egypt, and Sudan. In-depth semi-structured interviews will be conducted with government officials, water experts, and civil society organizations representatives to better understand the perspectives on local meanings, policy responses, and community impacts in these particular countries. It also involves a review of documents like policy documents, the media, and academic writings on the evolution of history, the laws that apply, and the international agreements on the Nile Basin water management.

To address the complex challenges of the GERD and other African transboundary water disputes, inclusive talks, transparent negotiations, and cooperative water management atives are urgently needed. To this end, institutional capacity-building specifically aimed at regional institutional mechanisms would be suggested. These institutions facilitate information sharing and sustainable water practices and balance environmental conservation with socioeconomic justice. Water cooperation can spread conflict risks, increase human security, and promote sustainable development in the Nile Basin and other regions.

7.1. Document Analysis

Policy reports, newspaper articles, and scholarly literature explicitly state the nature and qualities of water management in the Nile River Basin and the associated transboundary disputes. The precolonial, colonial, and postcolonial legal systems, as formulated during the colonial era, have significantly shaped the administration of the waters of the Nile. These institutions have influenced the distribution of water rights among riparian states and have served to extend controversy, such as the GERD controversy. Document analysis will be utilized to map the history of the evolution of water governance in the region, examining how legal structures and historical records have shaped current water-sharing regimes and patterns of conflict.

Moreover, the media receives political, public opinion, and stakeholder developments related to the GERD and other matters of the Nile Basin in real time. The above analysis will allow for careful consideration of the interlinked political, economic, and social forces at play in the Nile's water governance and for identifying likely solutions for managing transboundary water conflict.

7.2. Expected Outcomes

The Nile Basin case study aims to contribute to our understanding of how transboundary water conflicts impact geopolitical stability, human security, and development performance in Africa. Focusing on the GERD project, the study will analyse upstream infrastructure construction's socioeconomic and environmental effects on downstream riparian countries. The research will identify the interlinkages between water security and regional stability and how water conflicts undermine national and regional peace and development.

The study will also address the gender aspect of water conflict by emphasizing the importance of guaranteeing gender-sensitive and inclusive water governance systems. The anticipated outcomes will contribute to policy recommendations for increasing sound water management practices, conflict avoidance measures, and sustainable development strategies in the Nile Basin and other transboundary ecosystems in Africa.

These proposals will include strengthening regional cooperation frameworks, strengthening data-sharing platforms, and encouraging inclusive dialogue among the riparian states and other stakeholders. Ultimately, the encouragement of cooperative water governance will reduce risks of conflict, enhance human security, and maintain the long-term sustainability of the Nile Basin water resources.

8. LOCAL WATER CONFLICTS: UNDERSTANDING DYNAMICS AND PATHWAYS TO RESOLUTION

Typical conflicts over local waters usually have originated from competing interests between groups, ethnic factions, or business classes within a country. Imbalance in accessing waters, injustice done in the past, and breakdown in government are the primary reasons for conflicts (Owen, O'Neill, 2013). These conflicts disproportionately fall on marginalized communities that struggle to establish their rights to water and are more negatively impacted by water scarcity. For example, competing demands for water use between farmers and pastoralists in the Tana River basin in Kenya have repeatedly resulted in violence and displacement, illustrating the necessity of equitable and inclusive water governance systems.

Moreover, gender is at the heart of local conflicts. In regions like the Tana River basin, where water collectors primarily collect water daily water needs becomes extremely important i.e. conflict dynamics. In most of cases, women face even more violence or exploitation while of collecting water, thereby becoming even more vulnerable. Therefore, gender-sensitive conflict management programs are necessary s to address not only water needs but also questions of social equity in general.

Therefore, the needed study is intensive in understanding the intricacy of local conflict, transcending the general regional or national approach. This entails examination of the socio-political, economic, and environmental dynamics influencing the local stakeholders' dynamics. Localized conflict tendency to represent complex power relations and the intersection of water with identity, livelihoods, and land-use issues (Allouche et al., 2017). In South Africa, for instance, competition between urban peripheries for access to water underscores the intersection of water scarcity, urbanization, and socioeconomic disparities.

These are circumvention obstacles that can be resolved using situation-specific solutions that consider community participation, conflict-sensitive water management strategies reforms in institutions that build local capacity for resource management and solution.

Experiences in peacebuilding and conflict mediation elsewhere could be usefully transposed to initiatives that solve localized conflicts related to water resources. The tenets of cooperative governance, mediation, and people-centered natural resource management may open the doors for talks and get warring parties to a consensus. Likewise, transparency, accountability, and fairness in water resource access dispel tensions and increase social cohesion. Through effective adaptation to local conflict dynamics, policymakers and practitioners can enable resilience and enhance local social stability to achieve sustainable development goals (Selby et al., 2017).

9. SECURITISATION THEORY AND POLICY INTERVENTIONS

The securitization theory offers the eye through which one sees problems of solving problems critical link with national and international security. The heightened perception of water scarcity, driven by climate change and population growth, has made it a security concern due to its anticipated role in driving competition for limited resources. Water is a source of conflict that can rise to conflicts or fuel already ongoing ones in much of the globe, mainly where water resources lie across international borders or are inequitably distributed within countries. From the securitization perspective, knowing water is a question of stability and survival; it is an issue of the moment policy intervention by framing the issue not merely in environmental or development terms but in survival terms (Owen, O'Neill, 2013).

Gender is most often a forgotten but critical element in securitizing water. Where water scarcity adds an aggravating factor to those already in place, women primarily tasked with the function of water collection are disproportionately affected. Gendered impacts typically manifest as an increased vulnerability for women in accessing water, women's security while traveling for water, and their representation in water management decision-making. Thus, gender-responsive policies and mechanisms are required to counter the security dimensions of water scarcity more symmetrically (Bennett, 2021).

The linkage between water scarcity, food security, and agricultural productivity explains the trapped challenges in much of the globe. Water is at the core of agriculture; growing competition for this water directly affects food availability and production.

Decreased availability, especially in arid and semi-arid areas, can lead to crop losses, livestock deaths, heightened food insecurity, and further shocks to vulnerable communities. Due to this, water and agriculture policy frameworks that recognize these interdependencies in an integrated fashion are critical. They need to be designed gender-sensitive so that in policy formulation and implementation, women's role in agriculture and water collection is considered (Bennett, 2021).

Policy interventions in water sustainability management would be key in avoiding any conflict here. Policies promoting water diplomacy, cooperation, and equitable sharing of water resources between states or international organizations are becoming increasingly important. Cooperative frameworks and transboundary water agreements between riparian states, for example, have reduced tension significantly by promoting peaceful conflict resolution of water issues. Furthermore, investment in water-saving irrigation practices like drip irrigation and soil moisture management would increase agricultural output while saving water resources for the future.

Building resilience to water scarcity requires participatory water governance at the local level and equitable access to water resources for all, with marginalized groups, particularly women, not being left behind. This is possible through local, people-driven, community-based initiatives supported by the government and NGOs to enhance water infrastructure, storage, and grassroots water-saving technologies. These actions, in addition to strengthening community resilience, make an even more significant contribution to peacebuilding by focusing on the root causes of socioeconomic inequality driven by water scarcity (Owen, O'Neill, 2013).

10. INTEGRATED POLICY APPROACHES FOR SUSTAINABLE WATER MANAGEMENT IN AFRICA

As Africa grapples with the compounding effects of water scarcity, climate change, and socioeconomic inequality, it has become increasingly clear that integrated policy responses are needed to address their interlinkages. An inclusive and multi-sectoral approach to water management is critical to promoting sustainable development and enhancing resilience to climate change. These approaches aim to bridge gaps among sectors like water, agriculture, energy, and urban planning, unleashing synergies that enable sustainable resource management while also encouraging inclusive growth and minimizing regional imbalances.

One prominent example is the integration of water management policies and renewable energy initiatives. These policies can help increase water-use efficiency, decrease greenhouse gas emissions, and provide food security by improving agricultural practices. Renewable energy technologies such as solar-powered irrigation systems can be utilized to optimize water use in agriculture, particularly in regions with low water availability (FAO, 2021). This is part of broader climate adaptation strategies, reducing the consumption of conventional energy sources and increasing agricultural productivity under a changing climate.

In addition, the pairing of renewable energy and water management has also been revealed to bring considerable benefits to marginalized communities. Such joint policies increase water accessibility and reduce communities' vulnerability to climate-induced water stress, particularly for those in dry regions (Smith et al., 2022). The policies address water scarcity and open up new avenues for income through sustainable strategies.

However, the success of these multi-dimensional integrated solutions under African circumstances has yet to be objectively measured through empirical observation. While best practices have been developed in certain regions, such as Ethiopia and Kenya, where integrated watershed management programs have positively impacted water quality and agricultural productivity, further evidence of their effects, particularly in marginalized and vulnerable societies, is necessary. The study should discuss how such policies are translated into tangible benefits for communities, particularly those most vulnerable to water scarcity and climate impacts. This involves looking into the challenges facing policy implementation and identifying the reforms needed to enable these policies to be sensitive to local needs and lead to sustainable outcomes.

Furthermore, such comprehensive policies must be supported by robust institutional arrangements that foster collaborative governance. Such responses require multi-level stakeholder engagement and political commitment. Strong collaborative governance structures must bring government agencies, civil society, local communities, and international partners together to ensure transparency, accountability, and fairness in water management choices. This will ensure that water policies are fair and developed through the active participation of all stakeholders involved, particularly women and marginalized groups, whose access to water is typically most limited and whose voices are typically least heard in decision-making.

For example, gender-responsive water governance is needed to ensure the involvement of women – who often are household water managers and water collectors – in water management decision-making. Inclusive policies can empower women, providing them with a stake in decisions that impact their daily lives directly, e.g., the introduction of water-saving technologies or the installation of local water infrastructure facilities. The integration of gender dimensions in water management also enhances the resilience of communities since women are typically at the heart of water resource management at both the local community and household levels. Therefore, ensuring that women are by part of the design and implementation process of water policies, the success of such policies can be significantly enhanced, towards the attainment of the general sustainable development goals (SDGs).

In the end, integrated water management solutions require governments to build institutional capacities and reinforce partnerships that render communities more resilient to water scarcity and climate change. Economic growth, water constraints, and exposure to climate change impacts are inextricably linked. Hence, promoting partnerships between government, the private sector, and civil society can result in innovative solutions to water management problems while building economic resilience and social equity (World Economic Forum, 2024).

11. HARNESSING DIGITAL INNOVATIONS FOR WATER MANAGEMENT IN AFRICA

Implementing digital solutions and technology adoption for enhanced water management is the most significant chance to bring efficiency, transparency, and accountability across Africa. To that end, remote sensing technology has a significant contribution as it facilitates real-time monitoring of water resources and, thus, easier detection of change availability and quality. For changes instance, satellite remote sensing can be utilized for investigating vegetation health, soil moisture, and the state of water bodies -water resource planning and management requirements. It is also an instrument for

governments and stakeholders to utilize in evidence-based decision-making to act ahead of time in case of water scarcity and climate stress.

Blockchain technology also has several potential applications in open water management, such as ensuring safe and immutable records of water use and transactions. It promotes improving trust among the stakeholders since it creates decentralized and open systems, thus lessening the risks of corruption in water distribution and control (Hailemariam et al., 2020). Pilot projects were implemented in all but a few African nations, demonstrating that blockchain can streamline water governance processes, enhance the efficiency of resource allocation, and grant authority to local communities to make water management choices.

Cell phone applications have become viable means for collecting, disseminating, and community engagement in water data. Apps provide real-time reporting of water quality and availability and provide user feedback, providing a pathway towards participatory water resource management practices. By this, in those communities that are remotely located and may lack access to mainstream media, mobile applications may help the local communities contribute their information and monitor water infrastructure by utilizing such an application, the same way, they provide associated information which could be utilized under well-informed decision-making.

Furthermore, An artificial intelligence (AI)n water resources management has tremendous potential to optimize water-use efficiency and projectively forecast water demand patterns. Algorithms will be able to analyse complex data sets, analyse trends, and provide recommendations regarding adaptive management actions that reduce the risks associated with water scarcity (World Bank, 2024). AI-driven predictive models can enable governments and water utilities to increase planning resilience to climate variability, and optimize their respective water distribution networks amid growing populations.

12. CONCLUSIONS

This paper considers the multifaceted nature of water scarcity and its intersection with socioeconomic, political, and environmental conditions in Africa. By tackling the most relevant issues of socioeconomic inequalities, water governance, and gender, the paper identifies the need for inclusive and equitable strategies for water management to boost long-term resilience and sustainable development.

Gender disparities were highlighted as a significant concern, particularly in the deprived sections where women are disproportionately affected in water management and collection. These gendered disparities must be integrated into water governance to increase vulnerable sections' equality and empowerment.

In addition, securitization theory has been used to understand water scarcity as a national and international security problem, particularly where water resources cross boundaries. Such an understanding supports the imperative for collaborative water management and transboundary cooperation, particularly in regions like the Nile Basin, where geopolitical tensions often increase water-related conflict.

Technological innovations, such as AI, blockchain, and mobile applications, have been promising to enhance water governance and make water resource management more efficient and transparent. These technologies provide new opportunities for participatory governance and more effective decision-making processes, allowing all stakeholders – especially those in marginalized or distant communities – to be involved in water management practices.

   This paper advocates for coordinated policy interventions that link water management with trans-sectoral issues such as agriculture, energy, and urban development. The policies are to be designed to address interdependent issues that arise due to climate change, water scarcity, and socioeconomic inequality, and implemented through multi-stakeholder governance with government, civil society, and community participation.

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INTRINSIC MOTIVATION AS A DETERMINANT OF PROINNOVATIVE BEHAVIOUR

The subject of this article is intrinsic motivation and those factors of the organizational environment that are capable of stimulating it. This article presents the results of research carried out by interviewing people who independently made the decision to initiate the implementation of an organizational solution. It is assumed that such behavior is an expression of a high level of intrinsic motivation. Many factors contributing to the intensification of intrinsic motivation are known, but the interviews allowed us to "get to know" their subjective image, making it possible to understand how individual elements of the organizational environment are perceived by employees. They also enable a deeper understanding of the way in which intrinsic motivation is perceived as a subjective experience of the respondents. The results of this research enable a better understanding of the influence of external conditions on the level of this type of motivation, constituting a starting point for further research, as well as useful knowledge for practitioners of management.

Keywords: intrinsic motivation, self-management, innovations, organizational behaviour.

1. INTRODUCTION

The development of employee creativity promotes the organisation's ability to be innovative and effective, and also increases its ability to survive (Baer, Oldham, Cummings, 2003). Therefore, the development of employees' creativity should be one of the functions of the management system. However, the ability to act, to which creativity can be attributed, remains the domain of people and teams (Amabile, 1988; Cohen, Levinthal, 1990; Ford, 1996; Mumford, Gustafson, 1988; Pery-Smith, Shalley, 2003), with the best researched and well-established approach being the perception of creative ability as the property of the individual. Therefore, a relatively new theory of organisational creativity develops around individual and team creativity, looking for an answer to the question about the possibility of deliberate, systemic influence on employees in order to inspire them to undertake creative activity and strengthen its favourable attitudes (Sundgren, Dimenas, Gustafsson, Selart, 2005).

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The aim of this article is to identify the subjective perception of organisational conditions conducive to the development of an important component of individual creativity, which is intrinsic motivation (Deci, Ryan, 1985). According to Theresa M. Amabile (1988), in the area of employee creativity motivation is the most important issue, and at the same time the least considered by researchers, theorists and practitioners of creativity. Intrinsic motivation, like learning, enables flexible, creative responses. It also enables concentration on the task, which leads to greater efficiency in their execution (Utman, 1997). Of course, employee creativity may also be fostered by extrinsic motivation, but then in the decisions made by the employee, the employee takes into account the calculation of the expected benefits, the achievement of which depends on meeting the evaluation criteria included in the control procedure.

This mechanism limits the employee's spontaneity and freedom of action. On the other hand, involvement in the implementation of activities, the taking of which is not clearly determined by external factors, brings about a number of specific results:

1. It strengthens the sense of subjectivity (Deci, Ryan, 1980).
2. It has a positive effect on the employee's level of creativity (Zhang, Bartol, 2010). In the model of creativity (Amabile, Conti, Coon, Lazenby, Herron, 1996), it is considered the most important factor for creative behaviour (Byron, Khazanchi, 2015).
3. It inspires people to search for knowledge, to learn and to improve their skills (Cacioppo, Petty, Feinstein, Jarvis, 1996; Utman, 1997), which also supports creative processes, as it allows the employee to find many new ways to solve problems, come up with new approaches, as well as also maintaining their commitment (Shin, Zhou, 2003).
4. For some types of tasks, it also provides higher work efficiency than extrinsic motivation (Utman, 1997).
5. It gives rise to a range of positive emotional states (Nakamura, Csikszentmihalyi, 2002; Utman, 1997).

Activity with the above characteristics is a desirable phenomenon not only because of the benefits in the form of work efficiency and the creation of creative solutions. Repeating internally motivated activities in the long run will certainly have a positive impact on the level of knowledge and skills of the employee, as well as their commitment and job satisfaction.

This article attempts to identify the organisational factors that stimulate intrinsic motivation in the workplace. The conducted research is qualitative in nature. It was carried out as a series of structured interviews with people who took innovative initiatives on their own initiative. Interview questions were developed on the basis of known intrinsic motivation models (Deci, Ryan, 1980, 1985), empowerment (Gagné, Senécal, Koestner, 1997) or employee creativity (Amabile, 1988). The idea of the research presented was to focus on the subjective representation of the work situation in order to define the ways of perception of the work situation that activates intrinsic motivation. Interviews were conducted with people who, on their own decision, initiated an innovative activity and led to its implementation. It was assumed that the implementation of a creative act, which is undertaking development activities on the basis of one's own decision, is a sufficient indicator of a high level of intrinsic motivation (Prabhu, Sutton, Sauser, 2008; Tierney, Farmer, Graen, 1999).

2. FACTORS INFLUENCING THE LEVEL OF INTRINSIC MOTIVATION

Intrinsic motivation is based on an innate, organic need for competence and self-determination. It stimulates a wide range of behaviours and mental processes, for which the main reward is the experience of effectiveness and autonomy (Deci, Ryan, 1985). In addition to the firmly entrenched operant theory, works on motivation began to appear in the early 1970s, which kept the individual interested in acting despite the lack of noticeable consequences in carrying it out. Edward L. Deci relied on earlier views (White, 1959) suggesting that people engage in activities in order to experience their agency, effectiveness and competence. He assumed that intrinsically motivated behaviours are based on the inner human needs to be competent and self-determined (Deci, Koestner, Ryan, 1999). It turned out that this type of motivation is an important component of organisational creativity models, constituting the core process of innovative undertakings (Amabile et al., 1996). It is also a good predictor of employee creativity (Muñoz-Doyague, González-Álvarez, Nieto, 2008). Intrinsic motivation is the performance of a task for itself, due to the interest in it and excitement at the thought of the challenges related to its implementation, and not the benefit of its implementation. Those who are motivated in this way see that their involvement is free from strong external control; they feel that they are playing rather than working (Hennessey, 2019). This type of motivation is therefore a particularly valuable resource for the organisation, because it makes employees take action on their own initiative, put all their knowledge and ingenuity into its implementation, and continue with this effort until they are fully satisfied with the result. Moreover, the work performed inspires learning and development and allows the individual to intensely experience positive emotional states.

Intrinsic motivation, as well as the other mental states of an employee, is largely influenced by their immediate supervisor. Motivation is an intermediary between the leadership and creativity of employees (Amabile, 1988; Oldham, Cummings, 1996). Greg R. Oldham and Anne Cummings attribute a positive impact on the level of intrinsic motivation to leadership of a supportive nature towards the employee. As they write:

> When supervisors (…) show concern for employees' feelings and needs, encourage them to voice their own concerns, provide positive, chiefly informational feedback, and facilitate employee skill development. These actions on the part of a supervisor are expected to promote employees' feelings of self-determination and personal initiative at work, which should then boost levels of interest in work activities and enhance creative achievement (1996, p. 611).

More precise analyses of this subject have drawn attention to the impact of transformational leadership on the level of intrinsic motivation (Gong, Huang, Farh, 2009). The translation of its four dimensions: intellectual stimulation, individualised approach, charisma and inspiration to the condition of employees is explained as follows (Shin, Zhou, 2003):

1. Intellectual stimulation is accomplished by questioning universally divisible assumptions, questioning the status quo, encouraging the reformulation of problems, the use of imagination, cognitive curiosity and innovative approaches.
2. The individualised approach relates to employee development. It is about paying attention to their needs, showing empathy, and recognising and supporting individual initiatives and points of view.

3. Charisma, that is, a role model for believers. It can provide patterns of both behaviour and traits.
4. Inspirational motivation, that is, mobilising employees thanks to a convincing vision.

Empowering leadership also has a significant impact on intrinsic motivation. This type of leadership is aimed at increasing the commitment and motivation of subordinates by sharing power with them (Zhang, Bartol, 2010). This allows employees to experience autonomy as well as encourage and support them in managing their own activities. The trust expressed in this way in employees strengthens their awareness of the competences they possess (Guo, Peng, Zhu, 2023). Empowering leadership induces a psychological empowerment state that is characterised by four features (Zhang, Bartol, 2010):

- meaning – the feeling of the individual that the work performed by them is important,
- competence, self-efficacy or belief in the ability to perform tasks effectively,
- self-determination – the perception of freedom of choice in terms of how to initiate and perform tasks,
- influence – seeing your behaviour as having an impact on the result of your work.

However, the degree to which employees feel psychologically empowered in the context of empowering leader behaviour varies. These differences can be explained by the role played by identity theory, according to which individuals develop expectations regarding the behaviour corresponding to specific roles and then internalise them either as components of their own identity or else as that of the role played. Role identity is therefore a form of self-esteem or meaning assigned to oneself in relation to a specific role (Zhang, Bartol, 2010).

The intensification of the state of intrinsic motivation is also favoured by positive feedback. It inspires the employee to genuinely commit to the task, arouses interest and enthusiasm, and thus generates the "self-motivation" of employees (Deci et al., 1999). Changes in employees' attitudes are also reflected in their changed views and beliefs. The conviction of self-agency is related to intrinsic motivation. It is connected to convincing the individual that they have the knowledge and skills that allow them to carry out a creative undertaking (Gong et al., 2009). The structure of employees' views and beliefs can therefore be identified as an intermediary stage between leadership and intrinsic motivation.

In addition to the model of leadership conducive to intrinsic motivation, the literature also shows a pattern of leadership that has a destructive effect on this resource. This is the situation which emphasises external motivators, that is, remuneration, recognition and other gratuities, and not the work itself. Employees then react primarily to limitations and the goals imposed (Amabile, 1988). Work control has a similar effect. It is not an element of the task, but rather an external factor that imposes certain limitations on the employee's behaviour. The literature on the subject describes a number of mechanisms of the sabotage of intrinsic motivation as a result of the implementation of external motivators (Byron, Khazanchi, 2015). A decrease in intrinsic motivation and creativity occurs when the employee defines a given task as being performed for the purpose of obtaining remuneration. Moreover, the positive content of verbal feedback, when part of the control process, lowers the level of intrinsic motivation (Deci et al., 1999).

The characteristics of work also affect the level of intrinsic motivation (Hackman, Oldham, 1974). Workplaces characterised by a complexity of tasks will create a higher level of intrinsic motivation and creativity than those professions that are relatively simple

and routine. This is due to certain features inherent in complex work, which in this way affect the mental states of the employee. These are: (a) skill variety, defined as the opportunity to use many skills and talents at work; (b) task identity, defined as the opportunity to identify a whole piece of work; (c) task significance, defined as the recognition that a job has impact on others; (d) autonomy support, defined as the opportunity for freedom, independence, and discretion; (e) job feedback, defined as the information about one's performance obtained from job activities (Gagné et al., 1997).

3. CONCEPT AND METHOD OF RESEARCH

Many assumptions about the influence of certain organisational factors on intrinsic motivation have been confirmed by questionnaire studies (Gagné et al., 1997; Guo et al., 2023; Muñoz-Doyague et al., 2008; Oldham, Cummings, 1996; Shin, Zhou, 2003; Zhang, Bartol, 2010). Therefore, the author's intention was to investigate the subjective representations of factors that co-create the environment in which intrinsic motivation developed.

The research was conducted between September 2018 and February 2020 among employees of Polish enterprises. The condition for participation in the study was the personal authorship of an innovative solution that was approved and implemented in practice, or an implementation which is being carried out or planned for implementation. This solution was to be the result of their own idea, of which they were personally so convinced that they decided to try to implement it in practice, despite the fact that it did not come with any promise of gratification. Thanks to the criterion laid down, it can be assumed that people who experienced a high level of intrinsic motivation participated in the research.

The research was conducted using the interview method. The participants were asked to present their implementation history in the most complete and detailed way (Mueller, 2019). In order to make a comprehensive diagnosis of the inventive process, 19 open questions were formulated. N=16 participants took part in the research, who were the authors of projects meeting all of the abovementioned criteria. The interview was conducted in two different forms. In N=11 cases, a personal interview was conducted. The interviews were recorded (audio only) with the consent of the respondents and then professionally transcribed. The interviews lasted from 55 to 100 minutes. In N=5 cases, the respondents asked to submit a written answer, motivating it with the desire to have time to think about the answer. In the opinion of the researcher, such a modification of the procedure did not pose a risk of distorting the results, so it was accepted. Interview scripts and texts prepared directly by the respondents were developed using the NVivo programme.

4. THE RESULTS

N=16 respondents participated in the study: 11 women and 5 men, aged 25 to 41 years old. The average age of the respondents was $\bar{x}$=32.75 years, the average total length of service $\bar{x}$=10.31 years, and the average length of service in the company where the ideas of innovation were created $\bar{x}$=7 years. N=6 people are middle-level managers (3 men and 3 women), N=4 are independent specialists (2 men and 2 women), N=6 are administrative employees (6 women). The respondents represent the following industries: consulting, pharmaceutical, commercial, manufacturing, logistics and IT. Each of the respondents was

the author of an innovative solution. In all cases, the developed solutions were put into practice.

4.1. Responsibilities and origin of ideas

In the case of N=6 people – the administrative employees – the scopes of their duties were strictly described and left no freedom to define goals and tasks. The tasks of the remaining N=10 respondents can be described as complex work. A clear relationship was noticed between the sources of ideas and the positions in which the initiators of the implementations were employed. N=2 respondents in managerial positions realised their previously created personal vision. The other respondents, thanks to the implementation, wanted to: N=2 - get rid of frustrating limiting tasks, N=10 - test themselves and experience personal development, of which N=7 - test their own skills in the face of implementation difficulties, N=4 - prove themselves in relation to the conviction that the project is useful for the organisation. To generalise somewhat: in the case of the managerial staff, the idea resulted from their own vision for the development of the managed organisation, in the case of specialists it was the result of active participation in information- and knowledge-exchange networks, while in the case of administrative employees the idea of implementation was a result of multiple exposures to a specific situation, interpreted as being an imperfection of the organisation.

4.2. Leadership

In each case, the process of forming a decision about the respondent's personal involvement in the implementation project was reported as an internal, intimate process. In no case did this internal process involve the calculation of financial gains or of a better relationship with the supervisor or the improvement of their informal position in the team, nor was there any fear of criticism or objection from the superior. Only in N=3 cases did the authors of the ideas take into account the possibility of a refusal to implement them coming from higher levels of the organisation, but they had no doubts that such a refusal would only be caused by the actual merits of the idea. In any case, non-substantive reasons for a possible refusal, such as interpersonal problems or a struggle for power, were taken into account.

4.3. Emotions and learning

One of the respondents (female, 31 years old, 7 years of full work experience at her current place of employment, logistics industry, non-managerial position) stated her motivation as follows:

> (...) I was motivated by my curiosity about the difficulties encountered. Checking whether I will be able to cope in a given situation. The new challenge was primarily due to the will to develop. I imagined how the company could function after implementing what we had planned.

While working on the project, N=14 respondents experienced positive emotional states described as contentment, euphoria, excitement and enthusiasm. These emotions were associated with both the process of making the project a reality and its completion. However, the truly positive reactions were triggered by the discovery of previously unforeseen positive results from the implementation. One of the respondents (female, 25 years old, total work experience 6 years, work experience in the current company 4 years,

training and consulting industry, non-managerial position) described her reactions as follows:

> During the work on the project I mostly felt only positive emotions. It was a challenge that I like. If I am convinced that what I do and what I am trying to do will bring positive results, it motivates me to act. Besides, it's a chance for my own development. I treat each new task as a challenge and a lesson for the future.

If the originators are people who do not perform managerial functions, their emotional involvement plays a significant role. This involvement depends on internal factors that allow the originator to see opportunities for personal development and verification in the implementation of the project, as well as organisational factors: a positive opinion from their superior about the idea and support in its implementation by colleagues. A motivator of particular importance for the originators is discovering new, previously unnoticed benefits for the organisations resulting from the implementation.

In the case of N=4 managerial positions, emotions were presented as much more subdued. A middle-level manager in a trading company, a man aged 38, 16 years of total work experience, 13 years in the current place of employment, his motivation to implement the idea was "the will to save time and money and focus on the main task, i.e. sales". At the same time, he described his emotions related to the implementation of the project as follows:

> I like it when I can introduce changes that help the company gain an advantage over the competition. I liked the negotiations and convincing of [the board – in the original statement, the name of the company is mentioned here, L.P.] to implement the project. I have a sense of satisfaction when the competition introduces changes previously implemented at my place of work as innovative.

The project was only one component of the main task defined by this respondent, which is the feeling of personal authorship of the sources of the company's competitive advantage. At the same time, this respondent was the only one to mention an unpleasant emotional state – anger – which appeared when the implementation of the project was halted as a result of various forms of misconduct (delays, communication problems, etc.) by external bodies engaged in various stages of the implementation.

In the respondents' narratives, learning and development processes are presented as strongly related to emotional responses. The expected possibility of developing competences and checking oneself in solving problems were indicated as a source of excitement and these emotions were indicated as being a significant motivator in the decision to start implementing the imagined solution. The emotional toning down of managers' statements was accompanied by a different perception of the development and learning situation than for non-managerial positions. A good example of this is the abovementioned quote of the sales manager's statement – the thread of development as a result of the project's implementation concerns the organisation and not the respondent.

5. DISCUSSION

The research conducted fully confirmed the picture of intrinsic motivation presented in the literature on the subject. In each case, only the internal process was the inspiration for taking action – none of the respondents received an external promise of a reward for the

implementation, and none of them would be punished for not taking the action in question. The characteristic features of this process were the accompanying positive emotional state and positive attitude (joy, excitement, faith in success) to the tasks and problems, which were interpreted as opportunities for the development of knowledge and skills.

The literature on the subject highlights the role of leadership in creating intrinsic motivation. The interviews conducted revealed what this conducive leadership looks like in practice. Its most noticeable feature is the small number of references to the influence of leadership in the respondents' narratives, but the specific atmosphere of the company's operation, clearly visible in their statements, was certainly not created "by itself", but is the result of a specific manner of performing the functions of leadership. The features of leadership that allowed the intrinsic motivation of the respondents to develop can be presented on the basis of their statements as follows:

1. The presence of a clear vision in the employee team – in the process of generating ideas, the respondents were guided by an understanding of the goals of the organisations they co-created. Only thanks to a proper understanding of the sense and direction of the organisation's operation were the developed ideas accepted by their superiors.

2. The culture of development and learning. The necessity to obtain new knowledge and verify one's skills, which in the imagination of the respondents appeared as tasks to be carried out in the process of implementing the solution, were treated as interesting, encouraging and completely natural components of the work. Certainly, all other activities undertaken by employees aimed at their development are interpreted in a similar way: learning is a matter of course, no one knows and does not have to know everything.

3. Rationality. Some respondents were prepared to modify or even have their ideas rejected by their superiors. Such contingencies were approached with no emotion or fear. The respondents were sure that the change of the project or the refusal to implement it would result only from its merits, the knowledge of which would complement their knowledge of the company's operating model.

4. A good atmosphere of interpersonal relations. Only in N=1 cases did the research participant report negative interpersonal relations. In the remaining N=15 cases, relations between employees were defined as positive or very positive, based on trust, cooperation and mutual support.

5. Security and participation. None of the respondents had any doubts that it was worth submitting their idea. Nobody, even those considering the possibility of their ideas being rejected by their superiors, had the slightest concern about the presentation of their project. Collaboration, discussions, the sharing of knowledge, the exchange of views and ideas that constitute the actual participation of the employee in the life of the organisation. The employee sees themself as an active entity contributing to the situation, and not a passive performer of prescribed tasks, defined by an unknown "someone".

6. SUMMARY

The characteristics of the leadership promoting self-motivation found in this research are very similar to those attributed to leadership which is supportive, transformative and offers empowerment. In practice - in the everyday life of employees - leadership processes seem to be barely present, or not very noticeable. However, their impact is realised through

created work situations in which the employee feels safe and at ease, perfectly understanding their role as an active co-creator of the organisation, and not as a passive executor of orders. This deep and unwavering identification of employees with their role understood in this way is proof of leadership mastery and an important source of intrinsic motivation. Employees are aware of both their potential and the value of using it for the interests of the company, the good of colleagues and their further development as a human person and as a competent and creative member of the organisation. The research fully confirmed Amabile's reflection that "In organizational innovation, as in many things, putting some positive new thing into place might often be more burdensome and less effective than simply removing something that's been standing in the way" (Amabile, 1988, p. 163). The factors that could not significantly affect the level of intrinsic motivation in the presented research were diversity of work and feedback from the supervisor (Gagné et al., 1997; Deci et al., 1999). The low diversity of work, typical for administrative positions (N=6 respondents), resulted in a longer degree of "maturation" to make the decision to start the implementation than in the case of specialist and managerial positions (N=10 respondents). The feedback from the supervisor was important only as a green light for the implementation of the idea.

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CORPORATE TAX RATES IN THE CONTEXT OF TAX HARMONIZATION

Corporate taxes are important for this study since differences in rates can lead to distortions in economic competition and relocation of capital to countries with better tax conditions. The goal of this article is to verify whether countries with lower corporate taxes are catching those with higher rates. To achieve this objective, we conduct an analysis of the development of nominal and effective tax rates in EU member states for the period from 2004 to 2022. Afterward, we tested the relationship of these tax rates for corporate taxation using the Beta convergence model, observing the speed of convergence and examining whether the differences decrease over time. The results of the analysis demonstrate that the significant decline in nominal and effective tax rates during the observed period indicates an effort to enhance tax competitiveness and stimulate economic activity through tax measures.

Keywords: corporate tax rate, nominal tax rate, effective tax rate, tax harmonization.

1. INTRODUCTION

Tax harmonization in the European Union (EU) is one of the key issues in economic policy. Differences in corporate tax rates between member states can lead to economic distortions and capital relocation to countries with lower tax rates. This phenomenon, known as tax competition, can disrupt the balance of the single market and cause tax revenue losses in states with higher tax rates. Therefore, there is increasing discussion about the need for harmonizing tax policies within the EU. It is also necessary to consider that harmonizing tax rates is not a simple solution. While some member states, especially those with higher tax rates, would welcome more united rules, other countries with lower rates see tax competition as a means to attract investments and promote economic growth. This diversity of interests among member states creates complications in reaching an agreement on a common tax policy. Moreover, tax harmonization could reduce the tax sovereignty of individual countries, which could lead to concerns about the ability of national governments to respond flexibly to economic and social needs. In this context,

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debates on tax harmonization often focus on the question of to what extent the EU should be authorized to interfere in the tax decisions of individual states.

2. LITERATURE REVIEW

Corporate tax rates are one of the most important tools that governments have at their disposal to influence the business environment and economic growth. There are two main forms of tax rates: nominal and effective. Recent research (Dabla-Norris et al., 2023) confirms the close relationship between tax rates, tax revenues, and economic growth, refuting doubts about the existence of this relationship (Easterly, Rebelo, 1993). These claims are directly challenged by study (Arnold et al., 2011), who point out that an increase in corporate tax rates and the subsequent rise in corporate revenues lead to a decrease in GDP growth, highlighting the negative relationship between taxation, tax revenues, and GDP growth.

The nominal tax rate represents the legally established percentage of income tax that a company must pay on its profits. It is one of the key factors significantly influencing corporate taxes and thereby the attractiveness of a country for foreign investors. It also serves as an important economic and political tool by which the government can effectively guide and influence the activities of business entities. This rate is a simple and direct indicator but does not reflect the true level of tax burden. Study (Devereux, Lockwood, Redoano, 2008), point out how countries compete by lowering corporate tax rates in an effort to attract multinational companies. Their research shows that countries are motivated to maintain low tax rates, which leads to pressure for harmonization.

The effective tax rate (ETR), on the other hand, takes into account not only the nominal rate but also various tax reliefs, deductions, and other benefits that companies can use. ETR provides a more accurate picture of the actual tax burden that companies bear. Countries often use the difference between nominal and effective rates to attract foreign investment, where at first glance their nominal rates may be high, but after considering the reliefs, the actual tax burden is lower.

Factors influencing the difference between nominal and effective tax rates include the structure of the tax system in a given country, the number and type of tax reliefs and exemptions, as well as specific tax regimes aimed at supporting selected sectors of the economy or attracting foreign investors. This difference between nominal and effective rates is therefore key when analyzing the tax competitiveness of individual countries. A wide range of academic research addresses the topic of effective corporate taxes (Gupta, 2007; Lietz, 2013; Lopo Martinez, 2017; Wilde, Wilson, 2018; Weybourne, 2021). It is a very important aspect for foreign investors when deciding to enter a country.

In the context of the European Union, tax harmonization is highly significant for ensuring equal competition conditions among member states. Although the harmonization of direct taxes, such as corporate taxes, has not been fully realized, there is pressure towards its alignment, as significant differences between tax systems can lead to the relocation of capital and companies among member states (Zucman, 2014).

Tax harmonization focuses on minimizing so-called harmful tax competition, which occurs when states compete by lowering their taxes to attract foreign investors. This phenomenon can destabilize public finances and disrupt economic balance in countries with higher taxes. Nevertheless, efforts to fully harmonize direct taxes are often met with resistance, as member states wish to maintain their sovereignty in tax policy. Within the European Union, it is important to analyze whether there is a gradual convergence of tax

rates among individual countries, which would indicate successful steps toward harmonization

Tax competition among EU member states has been present for a long time. Countries strive to attract foreign investors by reducing the tax burden. This lowering of tax rates is often accompanied by specific tax regimes or reliefs that allow selected sectors or companies to pay lower taxes than would otherwise be implied by the nominal rate. Article (Wilson, 1999), provides a theoretical perspective on understanding tax competition between countries and its subsequent impact on corporate tax rates in the EU.

On the other hand, countries with higher rates often use tax reliefs as a way to compete with states with lower taxes. This allows them to support strategic sectors such as research and development while maintaining higher nominal tax rates at the legislative level. This complex relationship between tax competition, nominal, and effective rates forms the basis for further analysis of tax harmonization and its impact on the economic environment in the EU.

Existing research clearly shows that lower corporate tax rates significantly increase the attractiveness of EU countries, especially for foreign direct investments. In addition to the low tax burden, other factors play a crucial role, such as market size, access to the single European market, a similar language, and relations between neighboring countries, which can increase a country's attractiveness to investors (Delgado et al., 2014). The literature suggests that smaller and peripheral countries that do not benefit from a large market or central location may profit the most from lower tax rates, which contributes to their competitiveness in the international investment environment (Feld, Heckemeyer, 2011).

The impact of corporate taxes on foreign direct investment, from both a quantitative and qualitative perspective, was studied previously. This study (Becker et al., 2012) unequivocally confirmed that higher corporate tax rates have a negative impact on the flow of such investments. The influence of globalization, growing tax competition between states, and internal tax strategies of individual countries have contributed to the gradual decline of nominal tax rates since the 1980s. Study (Mutti et al., 2019; Devereux, Sorensen 2006) document that although the pace of this decline has fluctuated over the years, the trend towards lowering the tax burden is likely to continue in the future.

A key milestone in this area is the introduction of new EU tax regulations, effective from February 1, 2024, which establish a minimum tax rate of 15% for multinational companies operating in EU member states. The goal of these rules is to ensure greater fairness and stability in the tax environment in the EU and globally. The European Commission argues that these rules bring a modern framework better suited to the challenges of a globalized and digitized world (European Commission, 2024). While more than 140 countries around the world signed a global agreement on international tax reform in 2021, only the EU has actually implemented it.

3. METHODOLOGY

The aim of this contribution is to analyze whether countries with lower corporate tax rates (both nominal and effective) achieve higher growth rates and therefore catch up with countries with higher rates during the period from 2004 to 2022. To achieve this goal, we will analyze the development of nominal and effective tax rates in EU member states and subsequently test the relationship between these rates using the Beta convergence model. To verify the dependence between nominal and effective rates, we will use regression

analysis. The results of this study contribute to a better understanding of the tax harmonization process and its impact on economic competition within the EU.

For the analysis of the development of nominal and effective tax rates in the EU member states from 2004 to 2022, we will rely on data from Eurostat, which provides official data on nominal tax rates approved by national parliaments of the member states and also provides data on effective tax rates (ETR), which reflect the actual tax burden on companies after taking into account tax exemptions, reliefs, and special regimes. This data allows for a detailed analysis of changes in tax policies across EU countries over 18 years, providing a sufficient period to observe trends and changes within the process of tax harmonization.

For the purposes of our research, we will use the Beta convergence model, which is used to measure the speed at which economic indicators, in our case corporate tax rates, converge between countries. Beta convergence tests whether countries with lower tax rates are growing at a faster pace and thus catching up with countries with higher tax rates. In Beta convergence, a simple regression analysis is used, where the change in the tax rate is explained by its initial value. If the Beta coefficient is negative, it means that countries with higher initial rates are reducing their rates faster, leading to a convergence of rates between countries. In the context of our analysis, we will test Beta convergence for nominal and effective tax rates in the EU member states.

Formula: This formula for Beta convergence can be applied to various variables, such as effective tax rates (ETR) or nominal tax rates. The general formula includes the calculation of the average annual growth rate and a regression model.

Calculation of the average annual growth rate: The formula for calculating the average annual growth rate is as follows:

$$g_i = (1 / T) * \ln(Y_iT / Y_i0) \tag{1}$$

Where:
g_i is the average annual growth rate for country **i**.
Y_iT is the value of the variable (e.g., tax rate, tax revenue) in the final year **T**.
Y_i0 is the initial value of the variable (in our research in the year 2004).
T is the number of years in the analyzed period.

The regression model for evaluating beta convergence is as follows:

$$g_i = \alpha + \beta \ln(Y_i0) + \varepsilon_i \tag{2}$$

Where:
α is the intercept (constant), which captures the average growth when the logarithm of the initial value is zero.
β is the beta coefficient, which expresses the relationship between the initial value of the variable Y_i0 and the average annual growth rate. A negative β indicates convergence.
$\ln(Y_i0)$ is the natural logarithm of the initial value for country i.
ε_i is the error term that captures the deviations that the model does not explain.

4. RESULTS

Development of tax rates in EU countries (2004–2022):

Nominal tax rate

Despite efforts to harmonize tax systems within the union, tax competition between individual states still prevails, as evidenced by the wide range of tax rates (Table 1). Poland, as the only country from the V4 group, did not change its nominal tax rate throughout the entire observed period. Along with Poland, neither Malta nor Ireland changed their tax rates. Malta has the highest rate among them. Ireland maintains a rate of 12.5%, and Poland maintains a rate of 19%, although the government has long been attempting to reduce this rate to 15%. Other countries with stable nominal rates include Austria with a 25% tax rate (since 2005) and Romania, which changed its rate to 16% in 2005.

Table 1. Nominal corporate tax rates in %

Country/Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Austria	34	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Belgium	34	34	34	34	34	34	34	34	34	34	34	34	34	34	30	30	25	25	25
Bulgaria	20	15	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Cyprus	10	10	10	10	10	10	10	10	10	13	13	13	13	13	13	13	13	13	13
Czechia	28	26	24	24	21	20	19	19	19	19	19	19	19	19	19	19	19	19	19
Denmark	30	28	28	25	25	25	25	25	25	25	25	24	22	22	22	22	22	22	22
Estonia	26	24	23	22	21	21	21	21	21	21	21	20	20	20	20	20	20	20	20
Finland	29	26	26	26	26	26	26	26	25	25	20	20	20	20	20	20	20	20	20
France	35	35	34	34	34	34	34	36	36	38	38	38	34	44	34	34	32	28	26
Germany	38	38	38	38	29	29	30	30	30	30	30	30	30	30	30	30	30	30	30
Greece	35	32	29	25	35	35	24	20	20	26	26	29	29	29	29	28	24	24	22
Hungary	18	18	18	21	21	21	21	21	21	21	21	21	21	11	11	11	11	11	11
Ireland	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Italy	37	37	37	37	31	31	31	31	31	31	31	31	31	28	28	28	28	28	28
Latvia	15	15	15	15	15	15	15	15	15	15	15	15	15	15	20	20	20	20	20
Lithuania	15	15	19	18	15	20	15	15	15	15	15	15	15	15	15	15	15	15	15
Luxembourg	30	30	30	30	30	29	29	29	29	29	29	29	29	27	26	25	25	25	25
Malta	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Netherlands	35	32	30	26	26	26	26	25	25	25	25	25	25	25	25	25	25	25	26
Poland	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Portugal	28	28	28	27	27	27	29	29	32	32	32	30	30	30	32	32	32	32	32
Romania	25	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Slovakia	19	19	19	19	19	19	19	19	19	23	22	22	22	21	21	21	21	21	21
Slovenia	25	25	25	23	22	21	20	20	18	17	17	17	17	19	19	19	19	19	19
Spain	35	35	35	33	30	30	30	30	30	30	30	28	25	25	25	25	25	25	25
Sweden	28	28	28	28	28	26	26	26	26	22	22	22	22	22	22	21	21	21	21

Source: Eurostat (Own processing).

Currently, Hungary has the lowest nominal tax rate in the entire EU, at 9% since 2017. The rate was reduced from the original 19% to 9% in an effort to improve the business environment and attract foreign investors. Another country with the lowest tax rate is Bulgaria, which has maintained a 10% rate since 2007, and this level has not changed since then. Cyprus also belongs to the countries with lower rates, maintaining a 10% rate until 2012, after which it increased to 12.5% in 2013. Interestingly, this small economy has become home to many companies optimizing tax bases in other EU member states.

The highest tax rate during the observed period was in France, which had a rate of up to 44.4% in 2017. Similarly, other Western European countries such as Germany, Italy, and Spain, which are among the largest EU economies, had tax rates around 30%. These tax rates were gradually reduced in these countries. The most significant changes in

nominal tax rates among EU countries were seen in Greece, which had a rate of 35% in 2004, gradually decreased to 20%, increased again to 29%, and was at 24% in 2022.
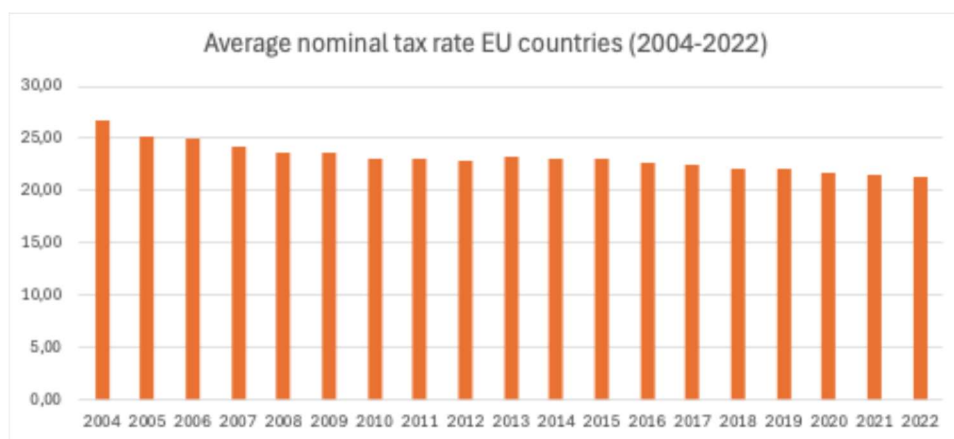

Figure 1. Development of the average nominal corporate tax rate in EU countries (2004–2022)

Source: Eurostat (Own processing).

The average nominal corporate tax rate (Figure 1) across the EU decreased from 26.73% in 2004 to 21.35% in 2022. This trend clearly confirms the need of national economies to enhance competitiveness and attract foreign investments by reducing tax rates.

Effective tax rate (ETR)

Effective corporate tax rates (Table 2) varied significantly across EU countries. The most significant change during the observed period was recorded in Greece, where the difference between the highest ETR of 30.5% in 2009 and the lowest rate of 17.5% in 2011-2012 reached as much as 13 percentage points. Another example is the Netherlands, where the difference between 2004 and 2022 was 9.4 percentage points. Currently, the effective tax rate in the Netherlands is 2.5 percentage points lower than the nominal rate.

On the other hand, Ireland is among the countries with the most stable rates, where the tax rate changed by only 0.3 percentage points during the entire period. Poland is another country with minor changes, where the effective rate fluctuated between 17.1% and 17.5% during the observed years. In Belgium, the effective tax rate reached its minimum in 2008 and 2009, when it was 8.8%, sharply contrasting with the maximum rate of 38.3%, recorded in France in 2016. This wide difference between rates reflects the significant diversity of tax systems within the EU, highlighting the different economic policies and strategic directions of individual countries. Bulgaria, which had the lowest effective rate of 8.8% from 2007 to 2010, along with Hungary, Cyprus, Estonia, and Latvia, belongs to countries with traditionally low effective tax rates.

Table 2. Effective corporate tax rates in %

Country/Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Austria	31,2	23,0	23,0	23,0	22,7	22,7	22,7	23,0	23,0	23,0	23,0	23,0	23,1	23,1	23,1	23,1	23,1	23,1	23,1
Belgium	29,5	29,5	25,7	25,4	24,9	24,7	25,3	25,9	26,3	26,5	26,7	27,8	28,3	29,3	24,9	25,0	23,2	23,2	23,1
Bulgaria	17,1	13,2	13,2	8,8	8,9	8,8	8,8	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
Cyprus	14,8	10,6	10,6	10,6	10,6	10,6	11,6	11,6	11,9	15,2	15,2	12,7	13,1	12,5	13,0	13,4	13,3	13,4	13,3
Czechia	24,6	22,7	21,0	21,0	18,4	17,5	16,7	16,7	16,7	16,7	16,7	16,7	16,7	16,7	16,7	16,7	16,7	17,0	17,0
Denmark	26,8	25,1	25,1	22,5	22,6	22,6	22,6	22,6	22,0	22,0	22,2	21,3	20,0	20,1	19,8	19,8	19,8	19,8	19,8
Estonia	20,4	18,8	18,1	17,3	16,5	16,5	16,5	16,5	16,5	16,5	16,5	15,7	15,7	15,7	15,7	13,9	12,1	10,2	10,2
Finland	27,2	24,5	24,5	24,5	24,5	23,6	23,9	24,7	23,3	22,6	18,6	18,9	19,1	19,5	19,6	19,6	19,6	19,6	19,6
France	35,0	34,8	34,4	34,4	34,6	34,7	32,8	32,8	34,2	34,7	38,3	38,3	38,4	33,4	33,4	33,5	31,5	28,1	26,0
Germany	35,5	35,5	35,5	35,5	28,2	28,0	28,0	28,2	28,2	28,2	28,2	28,2	28,2	28,8	28,9	28,9	28,9	28,9	28,8
Greece	30,4	27,8	25,2	21,7	21,8	30,5	21,0	17,5	17,5	24,1	24,5	27,5	27,6	27,6	27,6	22,9	22,9	21,1	21,1
Hungary	17,7	17,7	17,7	17,7	17,7	19,5	19,1	19,3	19,3	19,3	19,3	19,3	19,3	11,1	11,1	11,1	11,1	11,1	11,1
Ireland	14,3	14,3	14,4	14,4	14,4	14,4	14,4	14,4	14,4	14,4	14,1	14,1	14,1	14,1	14,1	14,1	14,1	14,1	14,1
Italy	31,8	31,8	31,8	31,8	27,3	27,5	27,5	24,9	25,1	25,1	24,2	23,8	23,6	23,7	23,8	23,8	23,9	23,9	23,9
Latvia	14,3	14,3	14,3	14,3	13,8	13,8	11,8	12,2	12,4	12,1	14,3	14,3	14,3	14,3	16,7	16,7	16,7	16,7	16,7
Lithuania	12,7	12,7	16,0	15,2	12,7	16,8	12,7	12,7	12,7	13,6	13,6	13,6	13,6	13,6	13,6	12,7	12,7	12,7	12,7
Luxembourg	26,5	26,5	25,9	25,9	25,0	25,0	25,0	24,9	24,9	25,5	25,5	25,5	25,5	23,7	22,8	21,8	21,8	21,8	21,8
Malta	32,2	32,2	32,2	32,2	32,2	32,2	32,2	32,2	32,2	32,2	32,2	32,2	32,2	24,3	24,4	25,3	25,1	25,2	23,3
Netherlands	31,9	28,4	26,7	23,1	23,1	22,2	22,2	21,8	22,6	21,6	22,6	22,5	22,5	22,5	22,5	22,5	22,5	22,5	23,2
Poland	17,1	17,1	17,1	17,4	17,4	17,4	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5	16,0	16,0	16,8	15,9
Portugal	24,6	24,6	24,6	23,7	23,7	23,7	26,2	26,2	28,4	28,4	28,4	26,6	26,6	20,0	21,4	21,4	21,4	21,4	21,4
Romania	22,4	14,7	14,7	14,8	14,8	14,8	14,8	14,8	14,8	14,8	14,8	14,8	14,7	14,7	14,7	14,7	14,7	14,7	14,7
Slovakia	16,5	16,8	16,8	16,8	16,8	16,8	16,8	16,8	16,8	20,3	19,4	19,6	19,6	18,7	18,7	18,7	18,7	18,7	18,7
Slovenia	21,5	22,1	22,3	20,9	20,0	19,1	18,2	18,2	16,4	15,5	15,5	15,5	15,5	17,3	17,3	17,3	17,3	17,3	17,3
Spain	36,5	36,5	36,5	34,5	32,8	32,8	32,8	31,9	32,4	32,9	32,6	31,5	29,0	29,0	29,0	29,0	29,0	29,0	29,0
Sweden	23,1	24,6	24,6	24,6	24,6	23,2	23,2	23,2	23,2	19,4	19,4	19,4	19,4	19,4	19,4	19,4	19,4	18,7	18,7

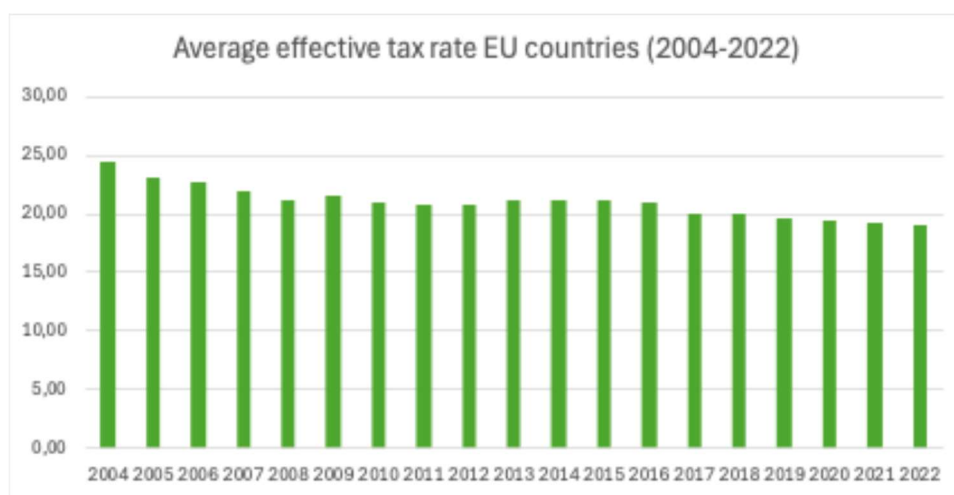Source: Eurostat (Own processing).

Figure 2. Development of the average effective corporate tax rate in EU countries (2004–2022)

Source: Eurostat (Own processing).

Similarly to nominal corporate tax rates, the effective tax rates also followed a similar trend during the observed period, with the average rate significantly decreasing over time (Figure 2). In this case, the rate decreased from 24.45% in 2004 to 18.98% in 2022. This phenomenon also reflects the willingness of European economies to reduce not only nominal tax rates but, more importantly, to lower effective tax rates to attract foreign investments to their territories.

Beta convergence – Nominal corporate tax rate (2004–2022)

The analysis of nominal tax rates (Table 3) for the period from 2004 to 2022 shows a negative beta coefficient of -0.0181. This negative coefficient indicates that countries with higher initial nominal tax rates (France, Italy, Spain, ...) in 2004 experienced a lower average annual growth of these rates by 2022, or in our case, a faster rate of decline. This result suggests convergence, where countries with higher initial rates tend to reduce their nominal rates or show slower growth while countries with lower corporate tax rates (Hungary, Bulgaria, ...) are catching up with countries that have higher rates.

Table 3. Regression model for nominal tax rates in EU countries

Regression Statistics								
Multiple R	0,510308204							
R Square	0,260414463							
Adjusted R Square	0,229598399							
Standard Error	0,011458212							
Observations	26							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	0,001109486	0,001109486	8,450607557	0,007731993			
Residual	24	0,003150975	0,000131291					
Total	25	0,004260461						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	ower 95,0%	Upper 95,0%
Intercept	0,046483484	0,02018255	2,303152172	0,030243839	0,004828748	0,088138	0,004829	0,08813822
Log of Initial Rate	-0,018064558	0,006214174	-2,906992872	0,007731993	-0,030889982	-0,00524	-0,03089	-0,005239134

Source: Eurostat (Own processing).

The intercept indicator is 0.0465, which represents the expected average annual growth rate when the initial value is close to zero. The R-squared value is 0.26, indicating that the model explains approximately 26% of the variability in the growth of rates between countries. A lower R-squared value suggests that there are other factors influencing changes in nominal tax rates. The negative trend indicating convergence is shown in Figure 3, which illustrates the growth rate against the logarithm of the initial tax rate, in our case, in the year 2004.
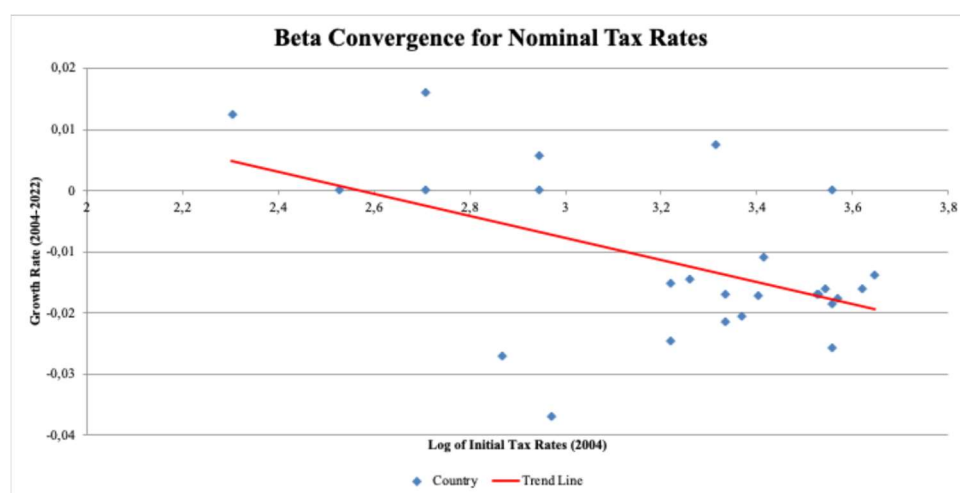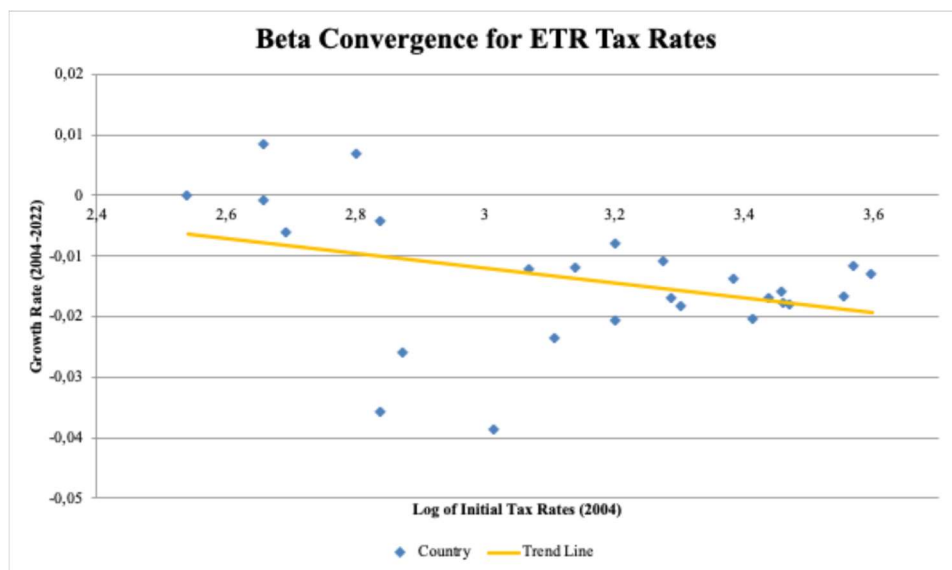
Figure 3. Beta convergence of nominal tax rates in EU countries

Source: Eurostat (Own processing).

Beta convergence – Effective tax rate (2004–2022)

The analysis of effective tax rates shows a negative beta coefficient of -0.01239, which also indicates convergence. Countries with higher initial ETR (France, Italy, Spain, ...) in 2004 experienced a lower average annual growth of these rates, or in our case, a faster rate of decline while countries with lower corporate tax rates (Hungary, Bulgaria, ...) are catching up with countries that have higher rates. The intercept indicator is 0.0252, which represents the expected growth rate when the initial value is zero.

Table 4. Regression model for effective tax rates in EU countries

Regression Statistics								
Multiple R	0,363649728							
R Square	0,132241124							
Adjusted R Square	0,096084505							
Standard Error	0,010422967							
Observations	26							
ANOVA								
	df	SS	MS	F	ignificance F			
Regression	1	0,000397339	0,000397339	3,657452637	0,067826			
Residual	24	0,002607318	0,000108638					
Total	25	0,003004657						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	ower 95,0%	Upper 95,0%
Intercept	0,025209999	0,020517137	1,228728895	0,231086063	-0,01714	0,067555	-0,01714	0,067555
Log of Initial Rate	-0,012398439	0,006483024	-1,912446767	0,067826026	-0,02578	0,000982	-0,02578	0,000982

Source: Eurostat (Own processing).

The R-squared value is 0.13, indicating that only 13% of the variability in ETR growth is explained by initial values. A lower R-squared value suggests that there are other factors influencing changes in effective tax rates.

Similar to nominal rates, the negative trend indicating convergence is shown in Figure 4, which illustrates the growth rate against the logarithm of the initial tax rate, in our case, in 2004.

Figure 4. Beta convergence of effective tax rates in EU countries

Source: Eurostat (Own processing).

5. DISCUSSION

When comparing the results, we can see that our analyses (nominal rates, effective rates) show negative beta coefficients, which indicates a tendency towards convergence. However, the degree of convergence and the explanatory power of the models differ to some extent.

Nominal rates: A beta coefficient of -0.0181 and an R-squared of 0.26 suggest a moderate level of convergence. The lower R-squared value indicates that other factors are influencing changes in nominal rates.

Effective rates (ETR): A beta coefficient of -0.0124 and an R-squared of 0.13 suggest weaker convergence. The lower R-squared value indicates that changes in effective rates are influenced by additional factors.

Overall, the results suggest convergence in both cases, but with varying strength and explanatory power. The stronger convergence between nominal and effective rates was observed in the analysis of nominal rates; however, the lower R-squared values in both cases indicate the influence of other factors on the changes.

6. CONCLUSIONS

The analysis of nominal and effective corporate tax rates in EU countries between 2004 and 2022 provides valuable insights into tax competition and convergence trends within the European Union. During the observed period, a general downward trend was recorded for both nominal and effective tax rates. Despite efforts to harmonize tax systems,

significant differences persist among member states, which suggests ongoing tax competition.

The results of beta convergence indicate that countries with higher initial tax rates (France, Italy, Spain, ...), whether nominal or effective, tended to reduce these rates more rapidly over the observed period and countries with lower corporate tax rates (Hungary, Bulgaria, ...) are catching up with countries that have higher rates. The relatively lower R-squared values for both regression models suggest that tax rate changes are also influenced by other factors.

In conclusion, we can state that there has been convergence in tax rates within the EU, but with varying intensity and explanatory power. Both analyses showed that nominal and effective tax rates exhibited weaker convergence, indicating that their development was influenced by various factors.

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THE POSSIBILITY OF MEASURING THE SOCIAL INNOVATION IMPACT

This study aims to explore the possibilities of measuring the impact of social innovation. The methodology for measuring social innovation was originally based on economic indicators, but aspects of the concept suggest that the fundamental purpose of the process is to ensure and increase well-being, which requires a rethinking of the measurement structure. Defining a model for measuring processes, both the outcome and impact, requires a combination of top-driven (theoretical) and bottom-up (practical) strategies. This paper methodologically explores possible methods and approaches for measuring the impact of social innovation programs through a structured review of the literature and an analysis of different measurement methods. The study concludes that continuous refinement and improvement of the methods is essential, and that a transparent and coherent structure is warranted. Given the difficulties and limitations of quantifying indicators, it is a question of evaluating rather than measuring the impact of social innovation programs.

Keywords: measuring, social innovation, indicators, impact.

1. INTRODUCTION

The social and economic challenges of the 21st century go beyond previous innovation research and require a new, thoughtful analysis of different types of innovation. Today's emphasis on innovation research also requires the study of innovations related to social issues. Alongside technical innovations, there is at least as much emphasis on efforts to ensure social well-being (Hochgerner, 1999). Defining a measurement structure for the social innovation process is essential because:

- in addition to economic and technological innovations, the role of social innovations in research, policymaking and the life of communities is of increasing importance,
- measurement helps to further explore the interactions between economic and social innovation,

the specific process of social innovation requires the development of scientifically sound and empirically verifiable indicators.

While there are several methodological recommendations for measuring technical innovation (e.g. the Community Innovation Survey – a biannual innovation survey carried

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out in EU Member States), the framework conditions for measuring social innovation are not yet clear. The basic objective of this study is to present a measurement structure that can provide a measurement of the social innovation process at the micro, meso and macro levels and analyze the link between each level of activity. The measurement framework is expected to allow for the analysis of the measurement results to generate social innovation efforts and to 'transfer' good practices that can be adapted to the most disadvantaged areas.

2. LITERATURE REVIEW

Defining a measurement structure for social innovation is a complex task that requires an examination of the opportunities and limitations of methodologies for measuring technical innovation. In measuring social innovation, the starting point is to define indicators and identify them as input, output and impact indicators, in line with the systemic nature identified for technical innovation.

Defining a model to measure the process, outcome and impact of social innovation efforts requires a joint examination of top-driven (often theoretical) and bottom-up (practical strategies based on civic engagement) strategies. The literature review suggests that measurement emphasizes the systemic nature of innovation processes (Dawson, Daniel, 2010; Carvache-Franco et al., 2018; Neumeier, 2017; Döringer, 2017; Mulgan et al., 2007; Cajaiba-Santana, 2014; Benedek et al., 2015; Szendi, 2018), but there is no uniformly accepted measurement methodology in the literature (Krlev et al., 2014, Benedek et al., 2015, Balaton, Varga, 2017, Szendi, 2018, Varga et al., 2023). The European Union guidelines focus on the assessment of the input, output and impact factors of the efforts related to the different levels, in line with the systemic nature of the innovation process. In addition to measuring the input and output factors of social innovation initiatives, the analysis of the impact on society is also emphasized. The main objective of each of the methods examined is to identify the social innovation potential at national, regional or local level. The focus is primarily on measuring social innovation potential, which is the set of capabilities that facilitate the creation of social innovations (Benedek et al., 2015; Szendi, 2018; Kleverbeck et al., 2019; Varga et al., 2023), as distinct from the basic conditions for social innovation, which are the necessary conditions for the creation and implementation of innovations in a given region or organization (Szendi, 2018; Varga et al., 2023; Varga, Tóth, 2024).

Studies focusing on measuring social innovation potential initially focused on macro-level analyses. There is considerable variation between macro-level studies in the indicators used. Measurement methods use both quantitative and qualitative indicators and consider the range of data available for a given country.

The focus of the analysis of meso-level social innovations is on the analysis of innovative regional cooperation. Once the interrelationships have been explored, it will be possible to identify the framework conditions involved in generating regional social innovation. Inter-municipal linkages, network analysis, identification and analysis of NUTS 2 and NUTS 3 level cooperation will allow measuring the process of regional social innovation. Measuring social innovation potential is a priority at regional level to help catching up. As in the case of national analyses, regional methods differ both in terms of their calculation procedures and the indicators used. One of the main reasons for this is that the range of data available in the regions concerned also varies. The analysis of social innovation at micro level is based on the involvement of enterprises, social enterprises and civil society organizations implementing social innovations at organizational level,

complemented by innovative partnerships between residents and municipalities. Through innovative co-operations, municipalities provide new responses to community problems that meet local needs, while at the same time improving community well-being. When examining initiatives at the organizational level, the cooperation between (local) government and the civil society based on innovative business models deserves special attention (Battilana and Casciaro, 2012; Grassl, 2012; Unceta et al., 2016). Local measurement methods are few, but their importance has increased recently. If the results of initiatives at local level can be quantified, good examples can be formulated that can be adapted to other organizations and municipalities, supporting the generation of further innovations. The local method is expected to identify and assess the basic conditions (necessary factors) and capabilities of social innovation, i.e. the social innovation potential.

3. METHODOLOGY

The possible methods and approaches for measuring social innovation impact vary depending on the different economic and social organizations. The aim is to continuously refine methods and make them more effective. Due to the difficulties and limitations of quantifying indicators, we are talking about assessing rather than measuring the social innovation impact.

The authors Dainiené and Dagiliené (2016) have defined the measurement dimensions of the impact of the social innovation process at the organizational level. The proposed method is a theoretical approach focusing on the social innovation process and a measurement method based on the dimensions of the Triple Bottom Line (TBL) approach. Each stage of the process also defines each stage of the measurement framework (Table 1).

Table 1. TBL dimensions and indicators

TBL DIMENSION	Indicator
social	community relations, product safety, initiatives on training and education, charity, volunteering, and the employment of disadvantaged groups
environmental	compliance with the legislation, insurance, landscaping, remediation, number of complaints, reports, water use, energy consumption, pollutant emissions, environmental risks and hazards, waste generation
financial	profit, cost accounting, product and service demand, prices, profit margins, innovation applications

Source: Author's own elaboration (based on Dainiené, Dagiliené, 2016).

The study will then identify the dimensions of the process after the selection of the social innovation endeavor, followed by the measurement framework and the calculation of the resulting social value. The study suggests that the main challenge of the study is to combine quantitative and qualitative indicators, one of the solutions being the use of the TBL approach to measure sustainable development. The Triple Bottom Line facilitates measurement at the organizational level along three dimensions (Elkington, 1997; Hubbard, 2009; Slaper, Hall, 2011; Dainiené, Dagiliené, 2016): social, environmental and financial. The TBL dimensions aim to identify and measure the impacts of organizational activities on people, the environment and the economy. According to the authors, there is

no single set of indicators that can be used to assess the full range of initiatives at the organizational level, but the use of the indicators proposed by TBL allows the value of social innovation to be measured. The dimensions proposed by the study help to measure the impact of the social innovation process on the economy, the environment and society.

The definition of the indicators linked to the dimensions depends on the organizational characteristics, but it can be said that they are mainly linked to the social dimensions of TBL (community, education, health or poverty).

The process of social innovation can be defined along the lines of input, output and impact factors, as is the case for the systemic nature of innovation. The methods associated with each stage of the process are illustrated by the chronological line of social innovation (Figure 1).
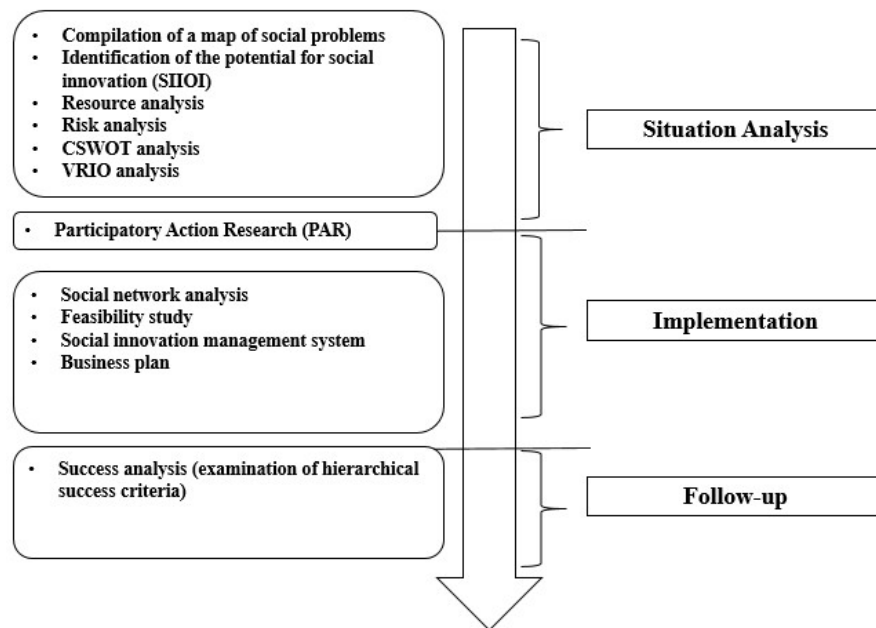
Figure 1 Chronological line of social innovation

Source: Author's own elaboration (based on Veresné Somosi, Varga, 2021).

4. RESULTS

Regarding the methodologies assigned to the stages of the social innovation process, a relationship matrix can be defined (Table 2), which can be used to characterise the almost all the research methods that can be recommended for their application (Veresné Somosi, Varga, 2021).

Table 2. Methodologies assigned to the stages of the social innovation process

Methods/ Interpretation range of application		Aim	Region/ county	Municipa-lity	Operating organiza-tion	Start-up organiza-tion	Project, program
1		2	3	4	5	6	7
SITUA-TION ANALYSIS	Compilation of a map of social problems	Compilation of a structured information market as an adaptation of the METAPLAN method.	X	X	X		
	Identification of the potential for social innovation	Determining the input, transformation and output factors characterizing social innovation.	X	X	X		
	Resource analysis	What effect do the individual elements of the organization, and their relationships have on competitiveness and sustainability.	X	X	X	X	X
	Risk analysis	Identifying sources of danger and determining the negative consequences of the occurrence of a source of danger.	X	X	X	X	X
	SWOT analysis	Structured analysis of internal capabilities and external environment.	X	X	X	X	
	VRIO analysis	Determining the compe-tencies of the examined unit.	X	X	X		
PARTICIPATORY ACTION RESEARCH (PAR)		It combines different knowledge and experien-ces with cooperative learning.		X			

Table 2 (cont.). Methodologies assigned to the stages of the social innovation process

	1	2	3	4	5	6	7
IMPLEMEN-TATION	Network analysis	Establishing a methodological framework model to map the pattern of social innovation processes and organizations.	X	X	X		
	Feasibility study	Decision support to help choosing between different options; providing adequate information to decision-makers on the financing, acceptance, modification or rejection of the proposed solution.					X
	Social Innovation Management System	Providing a sector-neutral, innovation-based innovation management methodology that can be used in practice.			X	X	
	Business Plan	In the case of an operating organization, the service of preparing the strategy; in the case of start-ups, the concretisation of the business concept and the creation of financing conditions.			X	X	
FOLLOW-UP	**Success verification**	Measuring the success of the social innovation process.	X	X	X	X	X

Source: Author's own elaboration (based on Veresné Somosi, Varga, 2021).

This creates the possibility of developing the methodological combinations that can most effectively support the development and implementation of social innovation and the assessment of the social innovation impact.

The reference objects for the application of the methods are different: region/county, municipality, operating organization, start-up organization, project/program.

The social innovation impact assessment, which determines the success of the initiative, is linked to the third (final) stage of the social innovation process (the follow-up assessment). The assessment of success is based on the evaluation of hierarchical success criteria. The main objective of the method is to measure the success of the social innovation process, which is a complex task. In defining the measurement structure, in addition to the quantitative elements, particular attention should be paid to the range of qualitative elements that are difficult to quantify. The constant increase in the number of societal challenges requiring long-term solutions and the dynamic changes in environmental factors require the promotion of innovative collaborations and the acceleration of the implementation of social innovation processes. The combined effect of these effects may be to increase the failure rate of initiatives.

5. DISCUSSION

To reduce or prevent failure, it is necessary to identify the factors and interactions between them that contribute to the success of the social innovation process. Determining the success of the social innovation process, as in the measurement used in the project management approach, requires the identification of key success criteria. As an initial step, it is necessary to identify the main factors contributing to potential failure, which can be seen as significant overruns in time and budget. These characteristics can be clearly quantified and identified as success factors. However, there is also a strong emphasis on the substantive interpretation of the success of the social innovation process, where the time and cost parameters outlined above are complemented by a qualitative assessment of the outcome of the initiative. The time and cost parameters, as well as the quality of the outcome of the endeavor, can be identified as success criteria of the social innovation process. However, in addition to these criteria, other criteria play a key role in judging success, mainly in terms of the benefits for the initiator or the stakeholders of the endeavor. To interpret success, a hierarchical model (Görög, 1996), which also measures the success of projects, can be proposed, in which the success of the social innovation process is judged at three levels:

- time, cost and quality,
- evaluation based on the satisfaction of the initiator of the endeavor,
- the satisfaction of those involved in the initiative.

The first level of evaluation in the hierarchical model (Figure 2) can be based on quantifiable results. The second level of measurement is for social innovation efforts that are difficult to quantify, where success can only be measured over a longer period and often indirectly. The third level is defined in the context of an evaluation process to determine the extent to which the initiative is being implemented and accepted by stakeholders. For this evaluation, it is useful to separate the stakeholders of the individual and/or group initiating the endeavour from the other stakeholders of the endeavour.

Figure 2. Understanding the success criteria of the social innovation process

Source: Author's own elaboration (based on Görög, 1996).

The hierarchical model for assessing the success of the social innovation process consists of a set of conditional levels but also allows for independent judgements of success at each level. This feature of the model offers several possibilities as follows (Daróczi, 2011):

- a priority order of success criteria can be established, which can only be determined by knowing the specific situation,
- the participants in the social innovation endeavour and those involved in the endeavour can assess the degree of success at a level appropriate to them.

Initiatives may have different perceptions of success and therefore there are often contradictions between success criteria, which makes it difficult to prioritise success criteria and reach an appropriate compromise. It should also be borne in mind that perceived success may change over time.

6. CONCLUSIONS

The paper describes the measurement methods of the social innovation process, their limitations and their potential for adaptation. The measurement methods of social innovation focus mainly on the measurement of social innovation processes at the macro level. Based on the indicators used in the measurement methods at local, regional and national level, a set of indicators can be developed which can be defined as the lowest common multiple of the different territorial levels. The quantity, type and weighting of the indicators used to measure processes at different levels can be determined according to the data that can be interpreted and made available at that level. The social innovation impact, as the final stage of the process, can be measured using a variety of methods, but the aim is to continuously refine and improve the methods. Because of the difficulties and limitations of quantifying indicators, we are talking about assessing the impact of social innovation, not measuring it. Impact assessment implies a continuous, long-term observation, a continuous collection of results, and the interpretation of these results within the timeframe set can provide inputs on how to assess the positive impact. The impact of the social innovation process can be measured by looking at the social, financial and environmental impacts (e.g. per capita income, educational attainment, number of long-term residential care facilities) generated by the initiatives. The evaluation process of the social innovation impact will assess the extent to which the initiative has been accepted by stakeholders during its implementation and how the impact of the social innovation initiative can be quantified. The analysis of the applicability of the results is also of particular importance in the economic development decision-making processes of each territorial unit.

Acknowledgement

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INNOVATION ECOSYSTEM MODELS: DEFINING THE ROLE OF THE UNIVERSITY IN THE INDUSTRY 5.0 PERSPECTIVE

The purpose of this research is to outline the role of universities in the existing models of innovation ecosystems. Based on a literature review, theoretical approaches are compared with the practical case study of Kyiv Academic University through focus groups and in-depth interviews with the ecosystem representatives and stakeholders. This research identifies that the key functions of the universities within the innovation ecosystems include being an academic and technology anchor, entrepreneurial university, institutional entrepreneur, knowledge-exchange leader, trust-builder, and political actor. This paper contributes to the theoretical foundations of the ecosystem functioning by arguing for the necessity to combine a linear approach for the structured innovation development progression, a helix model – for stakeholder engagement and a network model – and for dynamic interconnectivity. The conducted case study analyses confirm Academ.City ecosystem alignment with the best practices of the European regional innovation ecosystems and can be used as a benchmark for other universities in emerging economies.

Keywords: university, innovation ecosystem model, entrepreneurial university, dynamic capabilities.

1. INTRODUCTION

In recent years, increased attention from researchers and policymakers has been paid to the development and commercialization of innovations in Europe as a driver of its competitiveness. However, despite its high innovative potential, the EU is failing to advance its technology growth compared to China and the US. The decline of the EU's share of the global tech revenue from 22% to 18% from 2013 to 2023 resulted in only 4 of the world's top 50 tech companies being European (Draghi, 2024). Closing this innovation gap in advanced technology is defined as one of the three main areas of action to ensure the future sustainable growth of the EU. Moreover, the Industry 5.0 approach, prioritized

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by the European Commission as a paradigm of technology development (Industry 5.0 – Publications Office of the EU, 2021), implies that social sustainability should be balanced with the environmental and economic impact, leading to greater social inclusion and justice. This vision places human-centric actions and policies at the center of any innovation. It drives the need for life-long learning opportunities and talent training, thus fostering the role of education providers within the innovation process. Current research aims to summarise different models of innovation ecosystems and identify the role higher education institutions (HEIs) play in them. Based on the experience of the Kyiv Academic University – a public university building an innovation ecosystem with the HEI as its core, the study aims to explore how universities (academia) rethink their role in innovation development and commercialization, considering the Industry 5.0 perspective. Authors also define their interrelations with other ecosystem players and challenges faced by industry and society while collaborating with research and education institutions The study investigated the role of the universities within innovation ecosystems, comparing theoretical approaches with practical findings from the case study of the Kyiv Academic University (KAU). Focus groups and in-depth interviews conducted with the representatives of the place-based innovation ecosystem around KAU and the energy-innovation ecosystem in Ukraine were used to identify challenges and perspectives of innovation ecosystems formed around or having solid collaborations with research and education institutions.

2. LITERATURE REVIEW

2.1. Innovation Ecosystems and Industry 5.0

The innovation ecosystem concept is elaborated based on Moore's business ecosystem concept (1993). Valkokari and colleagues (2012) distinguished it from the business and knowledge ecosystem based on the role it plays in knowledge generation and its usage for value creation. Dodgson and co-authors (2014) define an innovation ecosystem as "a network of interconnected organizations, organized around a focal firm or a platform, incorporating both production and use side participants, and focusing on developing new value through innovation". The objective of the innovation ecosystem is to not only explore new knowledge but also exploit it for the purpose of creating and co-creating value (Taxt et al., 2022). Paassi and colleagues (2023) emphasize the importance of the dynamic perspective of the innovation ecosystem, concluding that the innovation ecosystem's internal dynamics and its positive outcome on the ecosystem's operation are defined by three elements: ecosystem actors, ecosystem properties, and the environment and outcome. Based on the above, we will further refer to the innovation ecosystem following the definition of Granstrand and Holgersson (2020): "An innovation ecosystem is the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors".

Innovation ecosystem actors include education and research institutions, startups and enterprises, financial entities, government structures, facilitating organizations (incubators, accelerators, innovation hubs, etc.) (Davalli et al., 2023) as well as customers (Paassi et al., 2023) and civil society (Taxt, 2022). This expansion of the ecosystem actors to include simultaneously the supply and demand sides of the innovation process, as well as policymakers and civil society, put them in the centre of the innovation, as expected by the Industry 5.0 approach. The latter goes beyond pure technology development. Industry 5.0

advocates for the worker and society's well-being and the win-win human-machine collaboration that will ensure "future-proof, resilient, sustainable and human-cantered" technological advancements (Breque, De Nul, & Petridis, 2021, p. 6). At the same time, Industry 5.0 priorities will also require changes within the innovation ecosystem structures and dynamics, including a broader request for human-centricity, nature-based and sustainable design, strengthening of the ecosystem learning capacity, and appeal for open social innovation support activities (CoP 5.0, 2024).

2.2. Innovation Ecosystem Models

Based on the literature review, we analyzed the evolution and identified the current vision of the innovation ecosystem models, including

- Linear Models
- Helix Models,
- Network Models.

Linear Models focus on a straightforward flow from research to development to commercialization (e.g., IDIA, 2017). The Linear Models emphasize the sequential progression of innovation stages, with a focus on the "product" development lifecycle. It is often mapped along measurable frameworks such as the Technology Readiness Level (TRL) (US Department of Defence, 2011) or Business Readiness Level (BRL) (Vik et al., 2021), enabling stakeholders to identify gaps or inconsistencies in innovation stages. However, the Linear Model's inherent limitation lies in its focus on sequential development, often overlooking the dynamic interactions among stakeholders that drive co-creation and adaptive innovation.

Helix Models emphasize the composition of the ecosystem actors, extending the number of collaboration groups, starting with the Triple Helix Model (involving collaboration between academia, industry, and government) to the Quintuple Helix Innovation System Model (adding civil society and environment as ecosystem actors). These models emphasize the dynamic interplay between stakeholders, ensuring that the needs and interests of all participants are integrated. Disaggregating the innovation ecosystem structure using Helix models allows for a better understanding of how stakeholder interactions drive innovation. It also ensures that gaps in stakeholder engagement are identified and addressed, fostering co-creation and shared value.

Network Models highlight interconnections and partnerships among diverse stakeholders (e.g., Valkokari, Paasi, Rantala, 2012; Gomes et al., 2018; Adner, 2006; Adner, Kapoor, 2016). These models are particularly adept at highlighting how relationships and collaborations drive ecosystem dynamics. Unlike the Linear Model, which focuses on a progression line, and Helix Models, which concentrate on stakeholder roles, the Network Models map the structural relationships that underpin innovation. Network Models are particularly effective at revealing how distributed innovation activities are orchestrated across the ecosystem, enabling a more fluid and adaptive approach to innovation management.

2.3. Innovation Ecosystem Performance Indicators

Innovation ecosystems are meant to generate multiple-dimension impact for their stakeholders. The industry 5.0 paradigm also implies that the innovation ecosystem follows the requirements for the triple-bottom-line performance, which is expected from all its individual actors. Therefore, it is necessary to measure and monitor the performance of the innovation ecosystem by its output indicators.

Most of the innovation ecosystem research and indexes primarily focus on the knowledge output and economic impact (Chatti, Drabo, Gagnon, 2024). Within knowledge output, researchers demand that other than publication, measures and outputs must be recognized for the ecosystem performance, especially in the context of Industry 5.0 (Ozols, Sarkane, Avotis, 2024). Davalli and colleagues (2023) mention the importance of data interoperability, global alignment of the ecosystem needs and principles with international standards and practices (e.g., EU Green and Digital Transition, (EC, 2019), and open standards and open source for the ecosystems' success and therefore these parameters should be monitored and measured. Taxt and colleagues (2022) emphasize the wider social role of the innovation ecosystem through participation in policymaking, culture, and architecture, in creating global opportunities for the local communities, and by introducing green and sustainable innovations (specifically through universities as its actors). Ozols and co-authors also emphasize promoting and utilizing digital technologies (ICT, AI, IoT, cyber-physical systems) to deliver customized solutions for social innovation.

The above considerations allow us to summarise the basic performance indicators for innovation ecosystems across several groups of output indicators:

1. Knowledge output:
   a. Patent and publication rates.
   b. Open innovation, e.g., use of open data platforms for innovation and transparency.
   c. Knowledge transfer – adopting university-led research into the industry or public service.
2. Economic Impact
   a. Job creation in high-tech and deep tech sectors.
   b. The GDP contribution of the innovation-driven industries of the ecosystem.
   c. Establishment and business performance of the new business entities (spin-offs and startups).
3. Social and Environmental Impact
   a. Adoption of clean technologies, green energy, and circular economy and human-centred practices.
   b. Efforts to ensure equitable benefits of innovation across different stakeholders, including underrepresented groups, including through policymaking.
   c. Quality of life improvements.
   d. Volume and impact of the citizen-led grassroots innovation projects.

3. METHODOLOGY

A literature review was conducted to outline the possible roles of the universities with the innovation ecosystems. A case study method was further used to investigate how existing theoretical models and corresponding roles of universities and research institutions are applicable in the contemporary context of an emerging economy and an ecosystem, focused on the Industry 5.0 technologies. We used Kyiv Academic University and the place-based innovation ecosystem, that is being created around it to analyze the practical functioning of such an ecosystem and identify existing challenges of the effective and efficient integration of universities into the innovation process. Apart from analyzing the existing structure of the ecosystem, 20 interviews were conducted with the ecosystem stakeholders coming from all four groups of the quadruple helix and related to the energy

innovation market. Four focus groups were held with representatives from academia (2 focus groups), business, and civil society.

4. RESULTS

In the latest report on European competitiveness, special attention was paid to the role of research and higher education in the innovation process. M. Draghi (2024) underlined the underused potential of the EU's innovation due to the lack of cooperation between higher education and research institutions and other partners to exploit economies of scale. Moreover, low incentives for cooperation with businesses and for entrepreneurial activities are mentioned as obstacles to proper technology deployment and competitive growth of EU countries. Despite that, the global economy provides best practices for innovation processes, where universities form innovation ecosystems around their research and manage to attract other actors for the general success of the ecosystem.

Several key roles were identified, attributed to the university as an actor of the innovation ecosystem (Ozols, Sarkane, Avotis, 2024; Taxt et al., 2022; HEInnovate, 2023; Heaton, Siegel, Teece, 2019):

- Universities as anchor tenants, deciding on the key technology development directions, new research programs.
- Entrepreneurial universities, supporting entrepreneurship, innovation, and commercialization activities, fostering the generation of new ventures.
- Universities as institutional entrepreneurs.
- Universities, taking on the knowledge-exchange function as opposed to purely technology-transfer function, providing research infrastructure for collaborative research with the private sector.
- Universities as trust-builders across the innovation ecosystem, ensuring an enhanced level of communication and collaboration across ecosystem participants while orchestrating these relationships.
- Universities as political actors, advocating policy changes and fostering social justice.

Across most of these functions, universities can facilitate the implementation of the Industry 5.0 principles to be applied by all the stakeholders and the ecosystem as a whole. Davalli and colleagues (2023) outline that the ability of the ecosystem to foster dialogue and collaboration among stakeholders is needed to synchronize the societal challenges with the policy strategies and tailor the appropriate innovative solutions to be acceptable and sustainable in the long term. Universities can be responsible for this process through their role of trust-builders and political actors, making sure that technology is adopted and deployed for the benefit of the local communities, society, and planet with a human-centered (Breque, De Nul, Petridis, 2021) and eco-centered (Forbes Coaches Council, 2024) perspective at the core of the innovation development.

However, based on the coevolution view of the innovation ecosystem models, researchers argue that the university's role should change with the increase in the ecosystem's maturity level. Moreover, the dynamic capabilities to sense the environment, seize opportunities, and maintain competitiveness are key to the university's effective and efficient contribution to developing the innovation ecosystem.

Kyiv Academic University is coordinating the project of creating Science Park "Academ.City", which aims to foster innovation and entrepreneurship within the research institutes of the National Academy of Sciences of Ukraine (NASU). The project started as

a quadruple-helix model, formed around the infrastructure and operational capacity of KAU and 12 research institutes of the NASU. The ecosystem integrates four groups of stakeholders: academia, industry, government, and civil society. Some of the representatives of the ecosystem across the quadruple-helix groups are listed in Table 1.

Table 1. A selective list of Academ.City Innovation Ecosystem Partners

Quadruple-Helix Group			
Academia	**Business**	**Government**	**Civil Society**
Adlershof Science Park University of Helsinki Reutlingen University Kyiv-Mohyla Academy The Arctic University of Norway Technical University of Varna Algebra University Colleague University of Wurzburg Noosphere	*Ukrainian Cluster Alliance G-Fore Rezos Brands ISE Accelerator Yuria Pharm Impact Hub Fasttrack Goodguys Vertical*	*Ministry of Education of Ukraine Ukrainian Startup Fund Kyiv City Military Administration Kyiv Region Military Administration Ukrainian National Office for Intellectual Property and Innovation (IP Office)*	*NGO Innovation NGO "Club of Economists"*

Source: own elaboration.

Dealing mainly with deep tech innovations, the Academ.City innovation ecosystem is prioritizing the principles of Industry 5.0, namely social and environmental sustainability and social justice. Therefore, operations and relationships inside the ecosystem imply following the open science and innovation approach (Chesbrough, 2024), establishing extensive dialogue across ecosystem participants and wider society through internal and external digital communication tools, and building trustworthy and horizontal management structures that promote collaboration and transparency.

Academ.City ecosystem follows the effectuation approach in its development and builds its expansion strategy through the "crazy-quilt" principle (Sarasvathy, 2024). Partnerships with new ecosystem participants are created with self-selecting stakeholders, those who demonstrate pre-commitments and are willing to invest their own human and financial resources to co-create new projects and values within the whole innovation ecosystem of the Academ.City. As a result, it is gradually evolving to the Network model, where diverse stakeholders are encouraged to build interconnected partnerships within temporary projects or around certain ecosystem structures (e.g., digital innovation hub, TISC, etc.).

KAU, being the coordinator of the ecosystem, plays the leading role in identifying its vision and strategy, as well as the road map for its further development. Results obtained from the focus group and the in-depth interviews conducted within the KAU ecosystem participants proved that stakeholders recognize the existence and value of the university's roles within the ecosystem according to the theoretical and practical approaches described earlier in the text (see Table 2).

Table 2. Stakeholders' confirmation of the university's role within the innovation ecosystem

University role	Stakeholders' opinion
Deciding on key technologies	"We need to enforce living labs."
Entrepreneurial universities	"We do 1-day workshops, pitching events, hackathons, and startup nights" to involve students in entrepreneurial activities."
Institutional entrepreneur	"Universities need to define their value proposition and communicate it strategically and efficiently."
Knowledge-exchange function	"…will consider undertaking joint trials, projects, experiments or research … and publish their outcomes for the benefit of the innovation ecosystem."
Trust-builders' function	"Invite students and startups for free pizza parties" to establish rapport and build an atmosphere of trust and co-creation
Universities as political actors	"Tech alone is not enough for innovation. We need societal adaptation."

Source: own elaboration.

5. DISCUSSION

The paper described three main innovation ecosystem models - linear, helix, and network models - outlining the differences in their creation approaches. Innovation ecosystem models differ in their foundational focus and approach but are inherently interrelated. Linear and Helix models differ in terms of their focus on either the ecosystem's "product" or "customer," and it is necessary to disaggregate any ecosystem structure using the principles of both models. It is necessary to ensure that the interests of all helix stakeholders are met. Therefore, the quadruple helix or any advanced helix model should be utilized. On the other hand, it is essential to identify the possible gaps in the innovation stage development that are not addressed by the activities and services of the innovation ecosystem. Thus, the linear model helps plot ecosystem operations on the TRL and BRL progression line to trace inconsistencies. In turn, Network Models map the relationships and interdependencies that sustain the ecosystem, enabling strategic partnerships and adaptive innovation. By combining these models, an innovation ecosystem can simultaneously ensure structured progression (Linear Models), multi-stakeholder engagement (Helix Models), and dynamic interconnectivity (Network Models). This integrated approach helps identify gaps, optimize stakeholder alignment, and leverage partnerships for sustainable and impactful innovation.

The analyzed case study allowed supporting theoretical foundations of the innovation ecosystem development and assessment approach by the practical evidence from the Academ.City innovation ecosystem in Ukraine.

Following Schaeffer and colleagues' (2024) research findings on the role of public universities in emerging countries, KAU, as a research-intensive university supported by the research institutes of the NASU, can build a strong innovation ecosystem and positively impact its further growth.

The open-innovation approach of the Academ.City aligns with the best practices of other European regional and place-based ecosystems (Davalli et al., 2023) and the

confirmed importance of open innovation flow and its appropriate orchestration (Paasi et al., 2023).

6. CONCLUSIONS

The aim of the study was to identify the theoretical foundations of the role of the higher education and research institutions in innovation development and the composition of the innovation ecosystems. Investigated models allowed to identify six main functions of the university within such ecosystems, namely technology anchor, entrepreneurial incubator and supporter, institutional entrepreneur, knowledge-exchange facilitator, trust-builder, and political actor. KAU and Academ.City ecosystem case study confirmed that these activities are both anticipated and valued by the participants and stakeholders. Further research will dive deeper into the ways of evaluating the efficiency of the activities conducted by universities as the actors and stakeholders of the innovation ecosystems to define the guidelines and the most suitable metrics to evaluate the quality of the innovation-related activities, maximize triple-bottom-line impact, and avoid innovation theatre.

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ADDITIONAL INFORMATION