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SUSTAINABLE DEVELOPMENT GOALS IN KAZAKHSTAN'S ACADEMIC LANDSCAPE: A CRITICAL BIBLIOMETRIC STUDY ON SUSTAINABLE DEVELOPMENT

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Abstract. *Purpose* – The purpose of this study is to conduct a bibliometric analysis of the academic activities of Kazakhstan's academics and to present a comprehensive map of the academic landscape in the country.

Research methodology – The study combines synthesis and comparative scientific analysis of concepts and methods in the literature. It involves secondary data analysis, statistical processing, and bibliometric analysis to gather and interpret the data.

Findings – The analysis reveals a significant gap between the practical applications of Sustainable Development Goals (SDGs) in Kazakhstan and the academic research on the topic. Furthermore, academic activities and practices in Kazakhstan do not align well with the official reports on the SDGs. While some SDGs have comparable publications in Kazakhstan to global averages, others present distinct challenges and problematic issues unique to the country.

Research limitations – The study faces limitations due to the lack of data or difficulty accessing relevant information.

Practical implications – This research is crucial for promoting SDGs as it aids in understanding global issues, identifying knowledge gaps, and fostering interdisciplinary collaboration to address complex issues related to sustainable development. Additionally, examining a country's academic activities through the lens of SDGs is essential for assessing the nation's academic awareness and engagement with these global goals.

Originality/Value – The article provides a unique and valuable perspective on integrating sustainable development goals within Kazakhstan's academic landscape, highlighting achievements and areas needing improvement.

Keywords: Kazakhstan, sustainable development goals, sustainability, bibliometric analysis, academic awareness, knowledge gaps.

JEL Classification: I12, I23.

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1. Introduction

Since the beginning of human existence, people have used nature as an essential resource to continue their lives. Especially after the industrial revolution, technological progress and the dramatic increase in the world population have increased the pressure on resources (Keiner, 2005). Therefore, nature, seen as an unlimited resource to meet the increasing consumption and production needs, has been exploited and destroyed under the pretext of development efforts. Two main political mistakes bring about this destruction. The first assumes that the

ecosystem's response to resource use is linear, predictable, and controllable. The second is evaluating humans and nature as independent entities (Folke et al., 2002). It has fueled development efforts in areas and accelerated the over-exploitation of resources by neglecting environmental values (Rasul, 2016).

However, factors such as the arms race of global actors, the unbalanced distribution of income in the world, and, most importantly, the increase in environmental degradation led to the development of awareness about "consuming the world." They contributed to developing action plans for future generations. Since the 1970s, the search for a balance between development and the natural environment has gained momentum. As a result, the "Sustainable Development" model emerged as the preeminent approach to long-term development; it prioritizes care for the planet and its inhabitants by considering environmental and human capital factors, as well as those that have an impact on the well-being of all forms of life (Tıraş, 2012). The term was first used to describe a way of acting that ensures present needs are met without jeopardizing the ability of future generations to do the same (Bilir, 2022) in the 1987 report titled "Our Common Future" (Bebbington & Unerman, 2018), has gained widespread acceptance. In particular, the 2008 global financial crisis highlighted the need for a more sustainable world. The United Nations took initiatives to bring together the business world, civil society, and the public sector around common global goals (Annan-Diab & Molinari, 2017). In the report titled "Transforming Our World: The 2030 Agenda for Sustainable Development" (United Nations, 2015), published in September 2015, "Sustainable Development Goals (SDG)" consisting of 17 targets and 169 sub-targets were adopted.

This study analyzes academic research in Kazakhstan through the lens of sustainable development goals (SDGs). The objective is to systematize the metadata of Kazakh scientists' publications on the SDGs and assess the Academy's role in national practices. Researchers can use this systematized literature to identify new interdisciplinary research problems related to the SDGs. The method employed is bibliometric analysis, using data sourced from the SCOPUS database, chosen for its specific search algorithms tailored to sustainable development goals (Rivest et al., 2021), and many international academic institutions that accept the subject as an indicator are based on the results in this database.

This comprehensive approach to sustainable development emphasizes the interconnectedness of social, economic, and environmental factors, highlighting the need for integrated solutions. By aligning research efforts with the SDGs, universities can play a crucial role in addressing complex global challenges and driving positive change. Collaboration between researchers, policymakers, and stakeholders is essential to ensure that sustainable development goals are effectively implemented and monitored for long-term impact. Additionally, ongoing evaluation and adaptation of strategies will be necessary to address emerging issues and ensure progress towards a more sustainable future.

The structure of the study is as follows: In the Section 1 of the study, a brief theoretical framework is presented. The Section 2 briefly describes the authors' methodological approach, while the Section 3 describes the findings and offers a comparative interpretation of the outputs. Section 4 discusses the findings, while Section 5 concludes the paper by addressing the study's limitations and offering suggestions for future research.

2. Theoretical framework

The Sustainable Development Goals (SDGs) aim to achieve balanced development that conserves natural resources for future generations. They emphasise that the environment and development are interdependent. Traditionally, development efforts focused on controlling social-ecological changes, often slowing overall progress. This paradox underscores the need for an integrated approach that combines environmental sustainability with economic growth (Folke et al., 2002). For example, economic development has increased environmental pollution, increasing global carbon dioxide and other pollutant emissions (Biermann et al., 2017). The SDGs thus refer to one of today's most significant challenges. For sustainable development to be successful, the economy, society, and environment should be emphasized, and cooperation should be ensured simultaneously. The ecological facet of the idea holds that the ecosystem maintains a state of dynamic equilibrium regardless of external perturbations, and it promotes the idea that biological and physical systems are complementary. As a result, sustainable development has emerged as the model for current and future development (Allen et al., 2018). This model recognizes the interconnectedness of social, economic, and environmental systems, and emphasizes the importance of balance and harmony between them. It also highlights the need for long-term thinking and planning to ensure that resources are managed responsibly for future generations. Sustainable development is not just a goal, but a mindset and a way of living that prioritizes the well-being of both people and the planet. By embracing this model, societies can work towards a more prosperous and equitable future for all.

The inclusion of sustainable development goals in the development strategies of the world enabled these goals to be handled in different dimensions and used as an indicator to understand the development levels of countries (Fullman et al., 2017). For each of the 17 goals, countries have carried out and continue to do several activities. Each country strives to realize SDGs related to geography and society in this context (Griggs et al., 2014). While hope for success in realizing the SDGs remains, a high level of national and international financial and political participation is required so that "no one is left behind" in 2030 (Lim et al., 2016). Further, it is believed that science and technology can only play a central role in sustainable development if they are used to guide countries in "developing the right responses" (Griggs et al., 2014) to better implement their SDG integration processes (Cash et al., 2003). Therefore, it is crucial for countries to prioritize funding and support for scientific research and technological innovation to ensure the successful implementation of the SDGs. By harnessing the power of science and technology, nations can develop effective strategies to address environmental challenges, promote inclusive economic growth, and improve social well-being. It is imperative that governments, businesses, and organizations work together to create a more sustainable future for all, leaving no one behind in the pursuit of global development goals.

In order to achieve the goals, set forth by the SDGs, it is essential for countries to prioritize collaboration and cooperation on a global scale. This includes not only financial and political support, but also a commitment to sharing knowledge and best practices in sustainable development. By leveraging the power of science and technology, countries can make informed decisions and take effective actions to address the complex challenges facing our

world today. It is through this collective effort and dedication that we can work towards a more sustainable and equitable future for all.

Academic support is vital for integrating the SDGs' economic, social, and environmental aspects. Research communities help measure progress, align objectives with governance, and promote holistic sustainable development (Biermann et al., 2017). To implement the SDGs globally, universities must lead in sustainable development. Despite external and internal constraints, the SDGs provide a framework for constructive solutions, enhancing universities' contributions to local, national, and global well-being (Fullman et al., 2017). The formulation of the SDGs offers opportunities to review and enhance the conceptual foundations of research areas, allowing researchers to redefine and improve studies to achieve social, environmental, and economic sustainability (Bebbington & Unerman, 2018). It is known that sustainable development is analyzed in detail by policymakers (Pizzi et al., 2020). By aligning research goals and outcomes with the SDGs, universities can demonstrate their commitment to addressing pressing global challenges and fostering positive change. This alignment also allows for greater collaboration between academia, government, and industry in working towards a more sustainable future. By embracing the principles of the SDGs, universities can play a crucial role in advancing knowledge, driving innovation, and promoting holistic well-being for present and future generations.

Analyzing academic activities related to the SDGs is crucial for understanding current states and informing future projections. The SDGs enable academics to engage with policymakers and communities, bridging the gap between research and action. Aligning their work with the SDGs helps researchers communicate their relevance and contribute to a more sustainable future (Belmonte-Ureña et al., 2021). Furthermore, by aligning their research with the SDGs, academics can also attract funding and collaborations from organizations and institutions that prioritize sustainability. This not only enhances the impact of their work but also allows for greater dissemination of knowledge and best practices. Ultimately, the integration of the SDGs into academic activities can lead to a more coordinated and effective approach towards achieving sustainable development goals on a global scale.

3. Methodology

This study examines the research on Sustainable Development Goals conducted by scholars in Kazakhstan. Bibliometric methods, commonly used to identify patterns and trends in each field (Xi et al., 2015), were used to analyze a total of 9,473 articles published in the SCOPUS database between 1968 and 2023. The analysis aimed to determine the position of Kazakhstan's academic community concerning Sustainable Development Goals and practices. The R software package, Bibliometrics (Aria & Cuccurullo, 2017), was utilized to analyze and visualize the data, with the burst detection algorithm developed by Jon Kleinberg (Lamba & Madhusudhan, 2022) also employed in the analysis. Using R software packages and visualization tools makes it a suitable method for this research (Çiğdem, 2021).

The data collection process for the study involved two stages. In the first stage, searches were conducted using keywords determined for each target in the SCOPUS database, resulting in 16 separate datasets. Due to potential data repetition from publications fitting

multiple targets, these datasets were combined to comprehensively analyze the country's situation. Additionally, individual analyses were performed for each target using the 16 datasets obtained.

To conduct trend topic analyses, publications lacking keyword information were excluded from the dataset. Two sets of keywords were utilized: those determined by authors and those assigned by the SCOPUS database. As authors' keywords lack standardization and may require extensive preprocessing, analysis was focused on the database-assigned keywords. Out of 5745 publications identified with database keywords, 3728 were removed from the dataset to facilitate trend topic analysis.

4. Findings

4.1. Overview of sustainable development goals

When the SCOPUS database is examined, it is seen that there are approximately 23 million academic studies on sustainable development goals worldwide. Table 1 reveals a surprising global output of these publications. Kazakhstan's academic contribution is approximately 0.05%, totalling 10,299 studies. According to the Sustainable Development Index published annually, Kazakhstan performs relatively well in practical application compared to OECD, Eastern European, Middle Eastern and North African countries, but its academic activity lags

Table 1. Academic publications on Sustainable Development Goals

SDG	Global	KZ	%
1. No poverty	46 492	77	0.17%
2. Zero hunger	390 529	610	0.16%
3. Good health and well-being	17 287 943	4 756	0.03%
4. Quality education	94 783	338	0.36%
5. Gender equality	130 019	107	0.08%
6. Clean water and sanitation	179 950	173	0.10%
7. Affordable and clean energy	1 186 081	1 439	0.12%
8. Decent work and economic growth	375 847	1 064	0.28%
9. Industry, innovation and infrastructure	150 232	258	0.17%
10. Reduced inequalities	200 541	231	0.12%
11. Sustainable cities and communities	520 473	557	0.11%
12. Responsible consumption and production	325 365	422	0.13%
13. Climate action	643 280	570	0.09%
14. Life below water	501 316	114	0.02%
15. Life on land	427 806	351	0.08%
16. Peace, justice, and strong institutions	725 047	797	0.11%
Total*	23 185 704	11 864	0.05%
Unique Total	21 787 223	10 299	0.05%

Note: *Since a publication can be associated with more than one goal, this figure does not give the number of unique publications. Unique publication statistics are given in the last row of the table titled "Unique Total."

behind many of its peers. For example, Tunisia ranks 69th and Iran 88th in the World Sustainable Development Index, both behind Kazakhstan's 65th position (Sachs et al., 2022). However, according to data from the SCOPUS database, the Czech Republic ranks 39th globally with 104,823 publications, Iran ranks 22nd with 219,663 publications, and Tunisia ranks 56th with 33,514 publications.

Despite its strong practical efforts, Kazakhstan remains inadequate in academic efforts related to sustainable development (Figure 1). The effectiveness of academic activities in this area is determined not only by the number of publications, but also by their compliance with certain criteria, such as keywords. Therefore, careful keyword selection in publications is crucial to establish a meaningful relationship with sustainable development goals. The second issue that should be mentioned in this regard is determining for which purpose Kazakhstan is effective academically. Kazakhstan academics proportionally contributed the most to the 4th, eighth, ninth, and first goals. From this point of view, it can be said that Kazakhstan focuses on education quality, economic development, industrial innovation, infrastructure, and fighting hunger, respectively. Among the objectives, the 14th goal (underwater life) is the lowest concentration, at 0.02%. Although Kazakhstan is a vast landlocked country and universities with higher broadcasting efficiency are concentrated in different areas in the terrestrial regions of Kazakhstan, the problem of the Caspian Sea is increasing its importance daily. Regarding contribution to the field, Kazakh academics must increase publications related to the 14th goal around the Caspian Sea problem. Although the highest number of publications from Kazakhstan seems to be in publications related to the 3rd goal (4756), the ratio of this number to publications worldwide is the second lowest among all goals.

Academics made 78.17% of the publications on sustainable development throughout Kazakhstan from 15 universities, shown in Table 2. The table shows that the first three universities (Nazarbayev University, Al Farabi Kazakh National University, and L.N. Gumilyov Eurasian National University) make up 35.94% of the publications throughout the country. Although

Figure 1. Kazakhstan's SDG Index Indicators (Sachs et al., 2022)

Table 2. Ranking of Kazakhstan Universities by number of publications

No	University	Pub.	Per.	SDG-1	SDG-2	SDG-3	SDG-4	SDG-5	SDG-6	SDG-7	SDG-8	SDG-9	SDG-10	SDG-11	SDG-12	SDG-13	SDG-14	SDG-15	SDG-16
1	Nazarbayev University	1741	14,675	4	8	690	56	17	26	438	78	24	31	113	62	89	18	15	72
2	Al Farabi Kazakh National University	1717	14,472	15	74	546	39	16	24	217	178	41	53	109	65	106	21	61	152
3	L.N. Gumilyov Eurasian National University	808	6,811	5	32	121	33	5	16	126	171	32	27	50	29	41	5	24	91
4	Kazakh National Medical University	518	4,366		5	479	2	5			3		2	6	4				12
5	Nazarbayev University School of Medicine	424	3,574			418	2									4			
6	Astana Medical University	361	3,043		6	327		2			4			6	8	6		2	
7	Kazakh National Agrarian Research University	343	2,891		99	88	2		10	23	15	9	4	12	9	34	2	30	6
8	Khoja Akhmet Yassawi International Kazakh-Turkish University	318	2,680		13	160	15	3	4	18	29	7	7	9	4	15	2	8	24
9	Satbayev University	348	2,933		14	43	5	2	20	110	37	5	5	27	31	22	8	12	7
10	Semey Medical University	236	1,989			230			2					4					
11	Karaganda Medical University	268	2,259		7	218	4		11	5	3		2	8	7	3			
12	Saken Seifullin Kazakh Agrotechnical University	268	2,259		78		6	3	3	37	41	9	8	18	6	27		25	7
13	Buketov Karagandy University	258	2,175	4	7	45	20	3	2	67	37	12	8	9	10	4		4	26
14	Abai Kazakh National Pedagogical University	246	2,073	19	13		58	9		10	46	2	9	16	15	7		8	34
15	M. Auezov South Kazakhstan University	197	1,660	3	48		11	3	4	31	31	8	2	13	15	6		3	19

Nazarbayev University ranks first in the total number of publications, Al Farabi Kazakh National University has the highest number of publications in nine of the sixteen goals analyzed. Again, in many goals, the effectiveness of these two universities is striking. Abai Kazakh National Pedagogical University is the most published university for the first and fourth goals. In terms of the second goal, Kazakh National Agrarian Research University is the university with the most publications.

4.2. Keyword analysis

When the latest academic trends in Kazakhstan are examined, it is noticed that the main concepts in 2021 and 2022 are "attitude" and "energy consumption". The prominence of "COVID-19" before sustainable development gained traction reflects its enduring importance. Sustainable development themes have become important since 2017, and "attitude" indicates increased awareness. The focus on "energy consumption" in 2022 is in line with Sustainable Development Goal 7 and demonstrates Kazakhstan's commitment to tackling energy challenges.

To gauge the perspective of the Kazakh academic community on the Sustainable Development Goals (SDGs), a comparative analysis with global publications is crucial. Utilizing the framework provided (Rivest et al., 2021) Table 3, compared with our research findings, highlights keyword trends in both global and Kazakh scholarly outputs across each SDG. This comparison shows how Kazakh academic discourse aligns with or differs from global trends. The chart also reveals trending topics within each SDG since 2016, offering a concise view of the evolution of academic discourse in Kazakhstan.

Table 3. Most used keywords in publications around the world and Kazakhstan

SDG1			SDG2	
	World	KZ	World	KZ
1	poverty	social protection	malnutrition	food security
2	social protection	poverty	biological control	agriculture
3	health insurance	social rights	food security	agro-industrial complex
SDG3			SDG4	
	World	KZ	World	KZ
1	cancer	cancer	trainees	inclusive education
2	aids	children	apprenticeship	higher education
3	stroke	central asia	professional training	educational environment
SDG5			SDG6	
	World	KZ	World	KZ
1	gender	gender	wastewater	groundwater
2	std	gender equality	water management	water resources
3	women	discrimination	water quality	central asia
SDG7			SDG8	
	World	KZ	World	KZ
1	photovoltaic	energy efficiency	human capital	economic growth
2	energy efficiency	renewable energy	labor market	economic development
3	biodiesel	renewable energy sources	labour market	innovation
SDG9			SDG10	
	World	KZ	World	KZ
1	infrastructure	innovation	medicaid	migration
2	manufacturing	innovations	social justice	foreign direct investment
3	internet access	competitiveness	financial crisis	migration policy

End of Table 3

	SDG11		SDG12	
	World	KZ	World	KZ
1	solid waste	heavy metals	recycling	environmental pollution
2	urban	smart city	recycle	corporate social responsibility
3	road network	air pollution	composting	heavy metals
	SDG13		SDG14	
	World	KZ	World	KZ
1	climate change	climate change	marine	caspian sea
2	co2	central asia	oil spill	aral sea
3	co2 emissions	water resources	conservation	zooplankton
	SDG15		SDG16	
	World	KZ	World	KZ
1	bioremediation	remote sensing	human rights	crime
2	extinction	land use	corruption	criminal law
3	conservation	soil	community engagement	corruption

From 2011 to 2022, SDG-1 progress saw 77 academic publications and practical advancements, achieving a 100% SDG Index score. Moderate progress from 2011–2015 surged in 2016–2017. Despite fewer academic contributions from 2018–2022, practical efforts remained strong. Kazakhstan focused on "disability," "drug use," and "family," with emphasis on "Social Protection" in 2017–2018, and diverse topics after 2018. Figure 2 highlights evolving academic focus since 2016, differing from Table 3. Practical implementation of SDG-1 in Kazakhstan shows consistent progress.

From 1978 to 2022, SDG-2 saw 610 publications, with Kazakhstan focusing heavily on practical projects to eliminate hunger, though academic research lagged. The SDG Index shows consistent growth, with project interest rates over 50%. From 1978 to 2009, only 15 works were published, but since 2010, there has been a significant increase with 469 articles and 59 conference papers. Compared to global trends, Kazakhstan shares thematic connections, particularly in organics and agriculture. Unlike SDG-1, SDG-2 topics change yearly: Agriculture Production

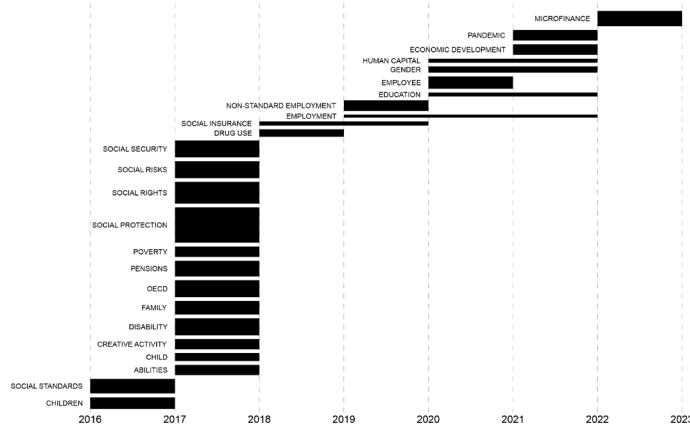

Figure 2. SDG1 topics' burst by years

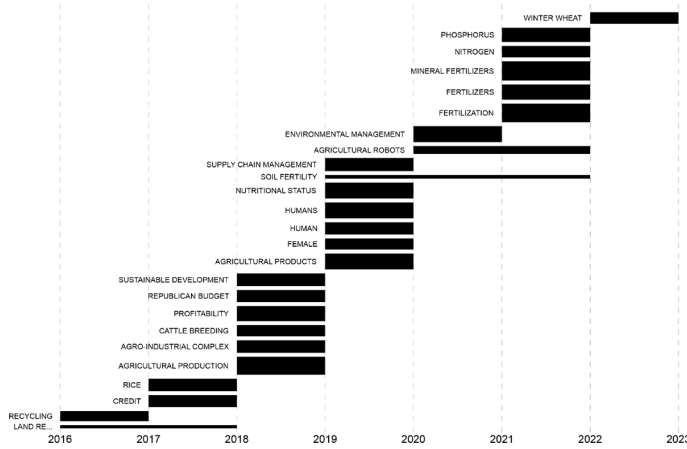

Figure 3. SDG2 topics' burst by years

(2018–2019) and Mineral Fertilizers (2021–2022). Figure 3 highlights shifts, with initial weak interest in Soil Fertility transitioning to Agriculture Robots' prominence from 2020 to 2022.

SDG-3, despite its broad scope, shows the lowest global impact. In Kazakhstan, practical projects outpace research initiatives, with 4756 academic papers published since 1974 – the highest among all SDGs in the country. The SDG Index indicates a 75% success rate for practical work, reflecting substantial impact, and SDG-3 has the most practical projects. Comparative keyword analysis reveals alignment between Kazakh and global research trends, excluding "COVID-19" despite its recent prominence. Thematic progression is dynamic: "Drug effects" were prominent from 2016–2017, and "Coronavirus disease 2019" became significant in 2021–2022. Figure 4 shows a decline in themes like "Statistics and Numerical Data" and "Standards" (2016–2018), while "Human immunodeficiency virus infection" was prominent from 2017–2019.

As seen in Figure 5, SDG-4, covering 1994 to 2022, saw 338 academic works. Growth was stagnant from 1994 to 2012 with only five publications. From 2012 to 2022, activity surged with 5–10 publications annually. Of 294 academic publications, 270 are articles, five are book chap-

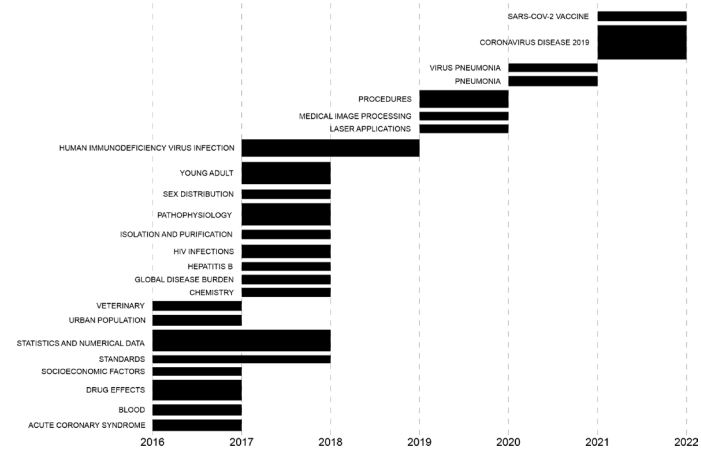

Figure 4. SDG3 topics' burst by years

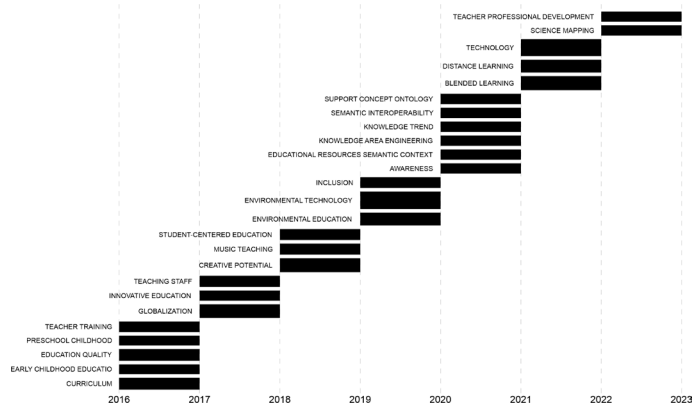

Figure 5. SDG4 topics' burst by years

ters, 33 are conference papers, and 10 are reviews. A significant increase from 15 publications in 2015 to 43 in 2016 coincides with the initiation of the Sustainable Development Goals. The SDG Index shows an 85% success rate for practical projects, highlighting strong implementation efforts. Comparative analysis shows that Kazakhstan focuses on quality and the learning environment, while global research covers more diverse topics. SDG-4 is a highly active research area, with themes around technology, such as "Environmental technology" (2019–2020) and "Technology" (2021–2022). Topics within SDG-4 encompass various facets of education.

From 2002 to 2022, SDG-5 saw 107 academic publications. Activity was limited until 2013, then increased, peaking by 2018. The publications include 98 articles, three book chapters, four conference papers, two reviews, and one letter. Practical projects performed well with a 75% interest rate, though academic contributions are relatively low. Keywords in Kazakhstan align with global trends, focusing on gender and women's rights. Figure 6 shows themes like "Labor Relations" (2019–2020), "Social Protection and Employment" (2020–2021), "Human Trafficking" (2016–2018), and "Female Empowerment" (2018–2020).

From 1982 to 2022, SDG-6 in academic discourse saw 173 publications. Growth was passive until 2013, with only 15 publications, but steadily increased afterward. Practical projects in

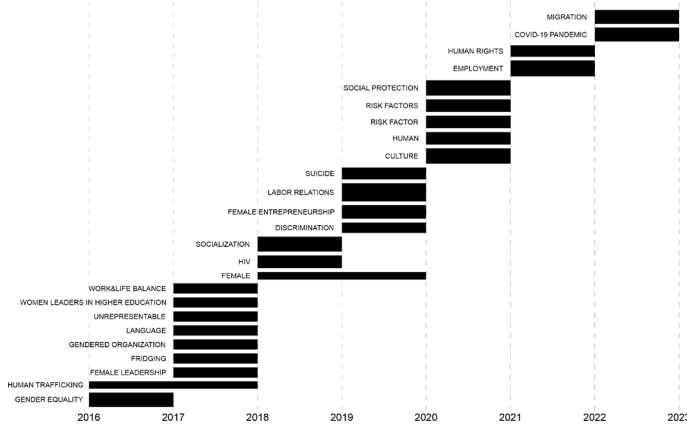

Figure 6. SDG5 topics' burst by years

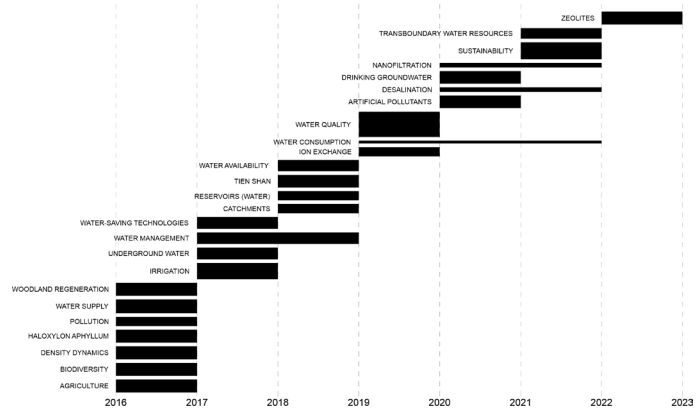

Figure 7. SDG6 topics' burst by years

Kazakhstan show a 75% effectiveness rate, indicating a strong impact. Keywords align closely with global trends, with a specific focus on the Aral Sea, highlighting Kazakhstan's pertinent issues. Figure 7 shows thematic trends: "Irrigation" (2017–2018), "Water Management" (sustained until 2019), and "Water Quality" (explosive from 2019–2020). Other themes like "Water Compensation," "Desalination," and "Nanofiltration" have remained relevant until 2022.

SDG-7 has seen 1439 academic publications, mainly articles and conference papers. While scholarly attention is robust, practical projects lag, needing improvement according to the SDG Index. Academic interest began in 1993, with significant growth since 2012, aligning with broader trends. Global keywords focus on energy elements, while Kazakhstan emphasizes renewable and safe energy. Figure 8 shows dynamic topics, with "Energy harvesting" prominent from 2016 to 2017, and "Lithium batteries" relevant until 2019. From 2019 to 2022, the theme of "Renewable energy" emerged as a sustained and pertinent topic.

SDG-8, introduced in academic discussions in 1996, has accumulated 1064 publications by 2022. Academic interest was initially slow, with only 29 publications until 2011, but significant growth has occurred since then. Of these, 840 are articles and 135 are conference papers. In practical projects, SDG-8 maintains stability with an interest rate of approximately

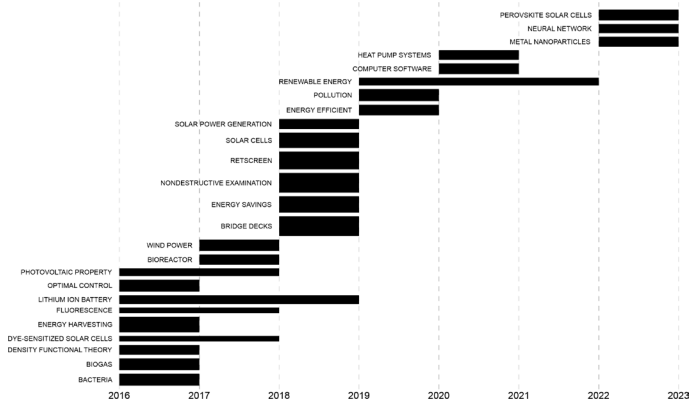

Figure 8. SDG7 topics' burst by years

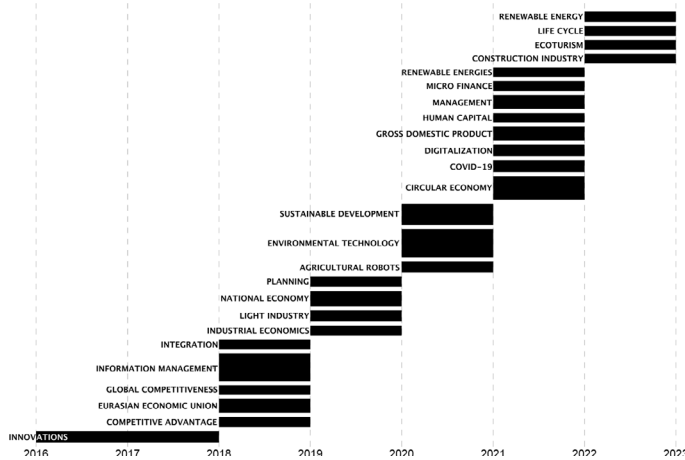

Figure 9. SDG8 topics' burst by years

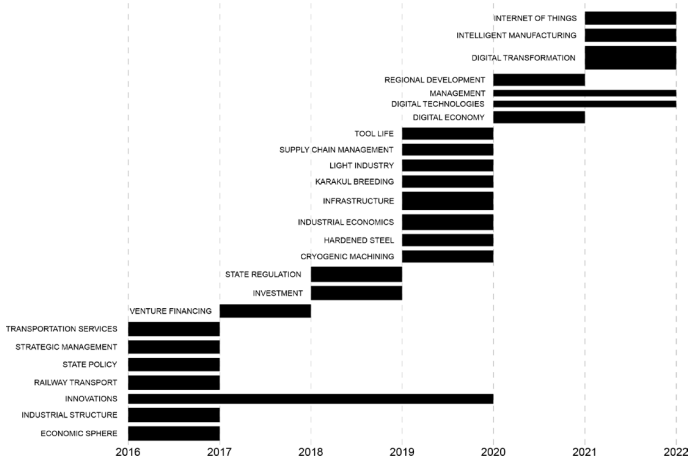

Figure 10. SDG9 topics' burst by years

75%, though some projects fall below 100%. Comparative analysis of academic publications shows close alignment between global and Kazakhstan research trends. Figure 9 depicts the evolution of hot topics within SDG-8, with "Innovation" dominating from 2016 to 2018, followed by shifts to "Information Management" (2018–2019), "Environmental Technology" (2020–2021), and "Circular Economy" (2021–2022).

SDG-9, introduced in 2001, has amassed 258 publications by 2022. Academic interest was slow until 2013 but has since surged. Practical projects show steady progress, with an interest rate of approximately 50%. Keywords align between Kazakhstan and global trends. Figure 10 highlights "Innovation" (2016–2020) and "Digital Transformation" (2021–2022) as prominent themes.

SDG-10, introduced academically in 1994, has gathered 231 publications by 2022, mainly articles and reviews. Academic interest was slow until 2011 but surged after 2012. In practical publications, SDG-10 excels with a 95% interest rate, yet only two projects have been imple-

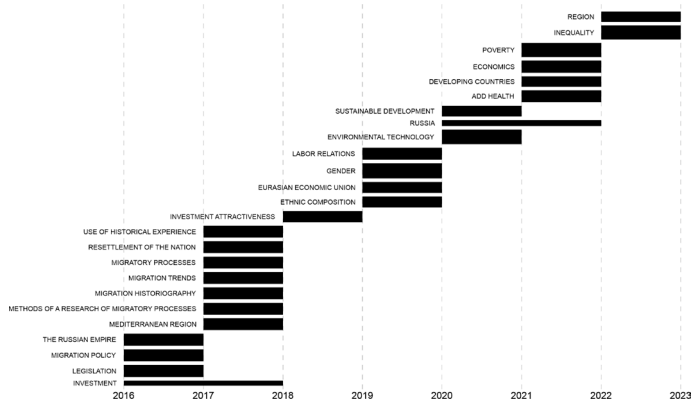

Figure 11. SDG10 topics' burst by years

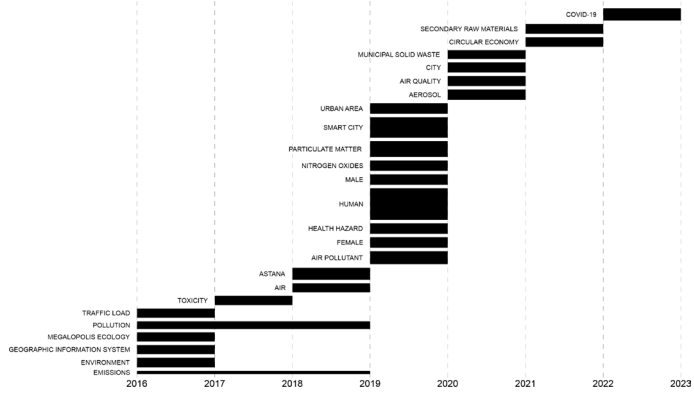

Figure 12. SDG11 topics' burst by years

mented. Comparative analysis of keywords shows suitable alignment. Thematic trends show "Investment" dominating from 2016 to 2018, shifting to "Gender" in 2019–2020, and "Poverty" from 2021 to 2022. Figure 11 reveals a decrease in the "Russia" theme from 2020 to 2022.

SDG-11, introduced academically in 1994, has seen 557 publications by 2022, mainly articles and conference papers. The pace was slow until 2010, with only 15 papers, but significant growth has occurred since 2011. Practical projects show average performance with no significant growth, and efficiency declined in 2021. Comparative analysis of keywords shows limited similarity. Figure 12 illustrates thematic trends, with "Pollution" and "Emissions" dominating from 2016 to 2019, shifting to "Human" from 2019 to 2020. "COVID-19" emerged as a prominent theme from 2022 to 2023, reflecting evolving global priorities within SDG-11.

SDG-12, introduced academically in 1998, started slowly until 2012, with only 16 papers. Since then, the publication rate has steadily expanded, reaching 422 papers by 2022. Practical projects aligned with SDG-11 show positive results on the SDG Index, with a 90% interest rate. Comparative analysis indicates thematic alignment with global trends, although Kazakhstan emphasizes environmental pollution. Figure 13 illustrates thematic trends, with "Heavy Metals" prominent from 2017 to 2019, "Environmental Pollution" becoming explosive from 2018 to 2019, and the "Circular Economy" emerging from 2021 to 2022.

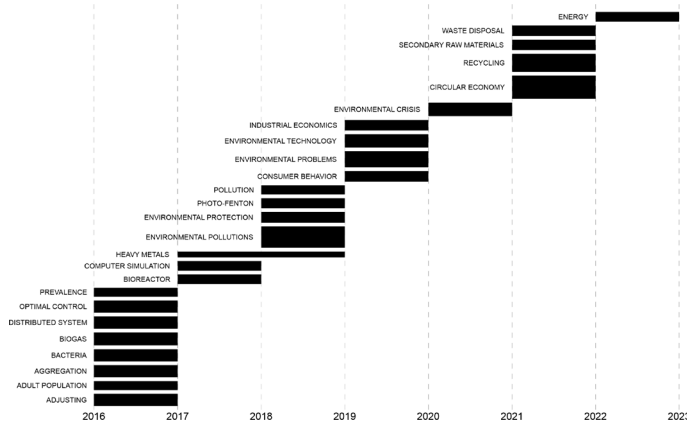

Figure 13. SDG12 topics' burst by years

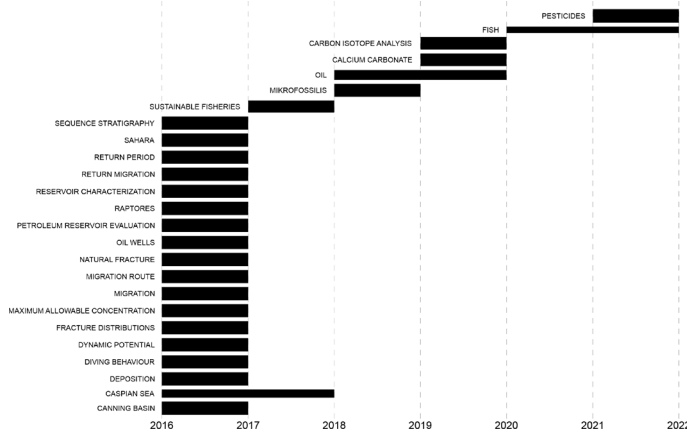

Figure 14. SDG13 topics' burst by years

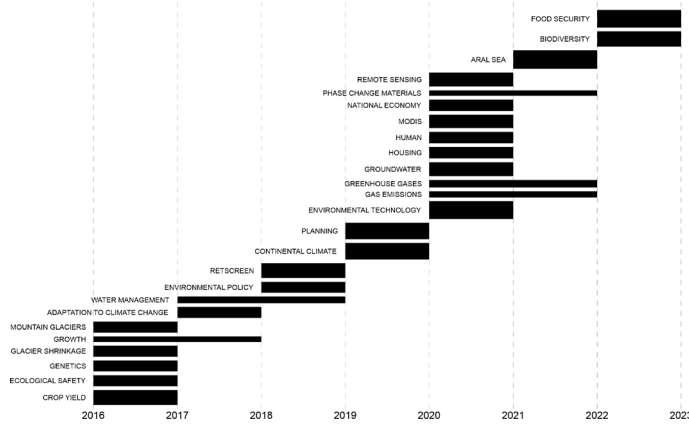

Figure 15. SDG14 topics' burst by years

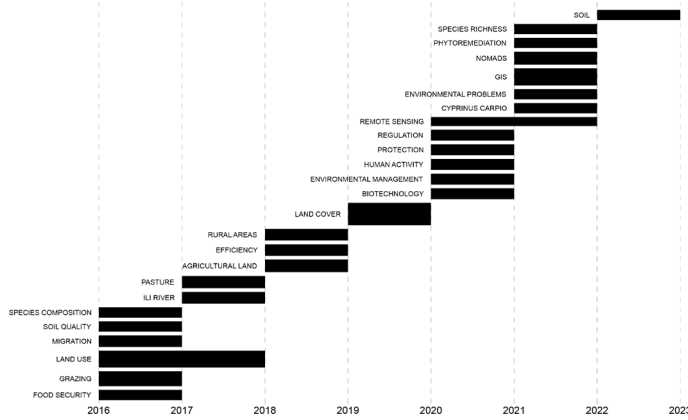

Figure 16. SDG15 topics' burst by years

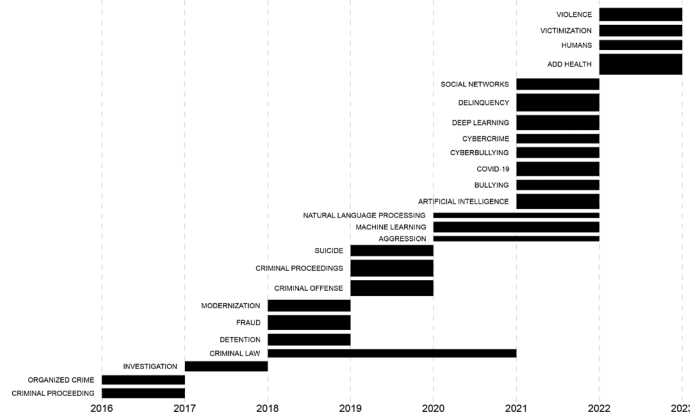

Figure 17. SDG16 topics' burst by years

SDG-13 entered academic discourse in 1992, initially slow until 2011, with 43 papers. Since then, the publication rate surged, totaling 570 papers today. Practical projects show satisfactory performance, but SDG-13 lags behind other goals, at a red level. Ongoing projects have a 50% effectiveness rate. Comparative analysis indicates alignment with global trends. Figure 14 illustrates diverse dynamics within SDG-13, with themes like "Growth" (2016–2018) and "Water Management" (2017–2019) showing sustained relevance. "Continental climate" and "Planning" were prominent from 2019–2020, while enduring themes like "Gas Emissions," "Greenhouse Gases," and "Phase of Change Materials" persisted from 2020–2022. "Food Security" is emerging as a current theme within SDG-13.

SDG-14 presents a unique challenge for Kazakhstan, lacking direct ocean access but facing issues with the Aral Lake and the Caspian Sea. Academic publications on SDG-14 total 114, highlighting the need for attention. While Kazakhstan has no direct practical projects, academic efforts exist. Comparative analysis shows thematic connections with global trends, with a focus on the Caspian Sea and the Aral Sea. Figure 15 depicts dynamic topics within

SDG-14, with active themes mainly from 2016 to 2017. From 2016 to 2018, the Caspian Sea theme was consistent but not explosive. "Oil" was relevant from 2018 to 2020, while "Fish" gained prominence from 2020 to 2022, and "Pesticides" became explosive from 2021 to 2022.

SDG-15 entered academic discourse in 1980 but saw passive growth until 2002, with only six publications. From 2002 to 2013, growth was slow and unstable. However, since 2014, a progressive and stable pattern emerged, totaling 351 publications. Practical projects for SDG-15 lag in efficiency, with a 55% rating. Comparative analysis shows a distinction between global trends, focusing on land ecology, and Kazakhstan's emphasis on agriculture. Figure 16 illustrates thematic trends, with "Land use" (2016–2018) as the most prominent, followed by "Land cover" (2019–2020) and "Remote Sensing" (2020–2022). "GIS" was an explosive theme during this period.

SDG-16, initiated in 1995, has amassed 797 publications. Growth was slow until 2009, with eight papers. A significant increase occurred in 2013, with 53 publications. Practical projects vary in performance, with some yielding positive results. Comparative analysis of trending keywords aligns with global trends. Figure 17 illustrates thematic trends, with "Criminal Law" (2018–2021) as a pertinent topic. "Aggression," "Machine Learning," and "Natural Language Processing" intersect from 2020 onward, persisting until 2022. "Add Health" emerged as an explosive theme for 2022 and 2023 within SDG-16.

5. Discussion

The Sustainable Development Goals (SDGs) are crucial for ensuring a livable world for future generations. In academic research, the SDGs offer a framework for addressing complex global issues and establishing targets for measuring progress toward sustainable development. They guide researchers across various fields – such as economics, environmental science, and public health – in identifying areas needing new knowledge and designing studies that contribute to achieving these goals. Additionally, the SDGs promote interdisciplinary research, uniting scholars from different fields to tackle challenges that cannot be resolved by any single discipline alone.

Within these purposes, all people should act in harmony, from institutions to the business world, from academia to the public. A series of reporting activities are carried out that reveal the current situation of the countries in practice. Although there are discussions about its adequacy in the literature (Diaz-Sarachaga et al., 2018), the SDG Index of the United Nations, which is accepted as a primary indicator by Sachs (Sachs et al., 2022), was taken as a criterion in this study. This index reveals the progress of countries within the scope of each objective. However, academic awareness on this subject is essential and should not be ignored (Zilahy & Huisingh, 2009). Because the Academy also has the mission of producing scientific solutions to social problems. Therefore, this study aims to make a bibliometric analysis of Kazakhstan academics' academic activities and present a map of the academic perspective on the subject in the country.

The research highlights a noticeable gap between practical applications (projects implemented in cooperation with the UN, the Kazakhstan government, and NGOs) and academic activities related to sustainable development goals (SDGs) in Kazakhstan. This disparity can be attributed to the more developed academic infrastructure in countries with higher academic

advancement. Additionally, less technologically developed countries may lag in practical applications due to a lack of necessary know-how. However, since these issues are related to living conditions and the environment, they tend to manifest globally with similar effects, albeit in different ways and to varying degrees.

When Kazakhstan's Sustainable Development Index report is examined, it is seen that the activities for the country's first and tenth goals are reasonable. However, when the academic activities of the country are examined for the same purposes, the first goal comes in third place along with the ninth goal, and the tenth goal comes in eighth place. Likewise, the second objective, which draws a downward trend in the report, is in a better position than the tenth objective, ranking fifth in academic publications. This result shows that the academic activities and practices do not overlap and that the Academy's interests and practitioners focus on different purposes.

According to Table 3, we can divide the publications into three groups, 1 – there is an excellent correlation between the publications of Kazakhstan and the world, and 2 – they are similar, but not entirely. There is a difference, 3 – there is a weak connection between them. Publications on SDGs 1, 2, 3, 5, 6, 8, 9, 13, 14, and 16 are acceptable in the first group.

In these SDGs in Table 3, we see that the publications in Kazakhstan and the world are similar and very close, and thus we can say that they are moving in the same and dynamic way as the world's publications.

The second type they are SDGs 7, 12, and 15. These SDGs in Kazakhstan's publications differ from the world's. They are similar but not direct. These publications show that Kazakhstan has its own and other problematic issues that are not similar worldwide.

The third view of Table 3 is those decoupled SDGs with weak links and not similar common problems. They are SDGs 4, 10, and 11, in Table 3 we see that publications in Kazakhstan show different problems with publications in the world.

6. Conclusions

Rapid population growth, climate change, water scarcity, energy shortages, and unsanitary living conditions challenge our planet as countries pursue economic and sustainable development. Addressing these issues involves various activities to ensure a livable future. Universities, while not officially committed, play a crucial role through research in raising social awareness. The SDGs are essential in academic research, providing a framework to tackle global challenges. This study aimed to map scientific research on SDGs by Kazakh academics through a bibliometric analysis of studies in the SCOPUS database. We analyzed publication numbers and keywords to understand the country's academic focus on each SDG. As a result of our analysis: 1. We have seen that the number of SDG-related studies done by Kazakhstan academy is comparatively few compared to many other countries where Kazakhstan is better in practice. 2. According to our research findings, there is a gap between the practices in the country and academic research. 3. The topics in the SDG-related research conducted by Kazakh academics are similar to the studies conducted worldwide.

The study's first finding reveals that, unlike many countries, Kazakhstan places relatively low importance on SDG-related academic research. This may be due to Kazakh academics'

insufficient understanding of the SDGs and the need for publications to be indexed in the SCOPUS database with specific keywords. Kazakh researchers may not fully recognize how their work aligns with the SDGs.

The second finding indicates that while Kazakhstan performs relatively well in SDG implementation, there are few publications, and these often differ from practical applications. This may result from a lack of communication between the academic community and practitioners regarding the SDGs.

The third finding reveals that Kazakh academics generally align with global researchers in their SDG-related studies, with some minor differences. These differences likely highlight the prominence of local issues specific to Kazakhstan.

During our preliminary literature search, we found no research examining Kazakhstan's scholarly output related to the SDGs. We believe our study is novel in this regard and anticipate significant new insights. We also think the findings will benefit researchers, policymakers, and practitioners working on the SDGs.

The study has several limitations and suggestions for future research. Firstly, the indicators for SDG applications and academic research areas do not always overlap. For instance, the literacy rate, an indicator of SDG 4, may not be extensively studied academically because literacy is not a major social problem in post-Soviet countries. Secondly, our data set includes only publications in the SCOPUS database, based on its search terms. This creates two limitations: non-SCOPUS publications are excluded, and some relevant SCOPUS publications are omitted due to keyword preferences. Future research could reconstruct the data set by examining these publications in detail and updating our results. Additionally, analyzing situations in other countries could allow for more detailed comparisons.

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