BRIDGING THE FINANCIAL AND ACADEMIC GAP IN KEY SDGS: COMPREHENSIVE BIBLIOMETRIC ANALYSIS

Bridging the financial and academic gap in key Sustainable Development Goal(s): comprehensive bibliometric analysis

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INTRODUCTION

The Sustainable Development Goal(s), adopted at the UN New York Summit in 2015, define the Sustainable Development Goal(s) main directions of human development for the coming decades. The goals and their targets require the intensification of the efforts of all stakeholders of business, government, academia, communities and society to achieve them by 2030. In general, there is a positive link between Sustainable Development Goal(s) and country competitiveness (Plastun et al. 2019, 2020). Some developed countries have shown significant progress during the last six years in achieving the Sustainable Development Goal(s) targets. However, there is the problem of their achievement, especially in developing countries and other least developed. It is exacerbated by declining Sustainable Development Goal(s) financing both from public and private sources in light of the challenges posed by the Covid-19 pandemic and the recession caused by it.

The gap between the current level of Sustainable Development Goal(s) financing and the potentially needed private and public finance, along with the academic gap in justifying the most effective tools for Sustainable Development Goal(s) financing, makes the meta-analysis of publishing activity and information-analytical field in this area more urgent.

Despite the integrated effect on the economy, ecology and society from the progress in all Sustainable Development Goal(s), some are considered accelerators of structural changes. Among these are Sustainable Development Goal(s) 3, 4, 8, 9, 12, 16 (Voluntary national review of Sustainable Development Goal(s) progress in Ukraine (2020, p.10)

A review of Sustainable Development Goal(s)-related publications via SciVal tools shows a significant interest of scholars in sufficient Sustainable Development Goal(s)

progress. So, for the last five years, SciVal contains 5,609,394 Sustainable Development Goal(s)-related papers. The three most frequently mentioned goals in the academic research are Sustainable Development Goal 3 Good Health and Well Being (2,173,321 publications), Sustainable Development Goal 7 Affordable and Clean Energy (711,226) and Sustainable Development Goal 9: Industry, innovation and infrastructure (378,553 publications).

This monograph provides a comprehensive bibliometric meta-analysis of the most popular among academicians Sustainable Development Goal(s) 3, 7 and 9 in solving the problem of these Goals financing.

The bibliometric analysis of the scientific literature regarding Sustainable Development Goal financing should be extended by an empirical description, taking into account the Ukrainian companies experience. The source of research of such experience is the analytical data of the two most authoritative organizations in the field of corporate social responsibility in Ukraine:

1) “CSR Ukraine”, which in 2016-2019 held a competition of cases on corporate social responsibility. It was dedicated to the implementation of the Sustainable Development Goal(s) by Ukrainian companies;
2) The Ukrainian branch of the UN Global Compact network, prepared a final report based on 30 companies-signatories to the agreement on the implementation and financing of projects on all 17 Sustainable Development Goal(s) for 2015-2020 (during the accession of Ukraine and Ukrainian business to global goals sustainable development).

In the analytical materials of the “CSR Ukraine”, 116 cases from 64 companies participating in the competition were presented, as well as data from 97 non-financial reports of 100 largest companies of Ukraine for 2015-2019 and Progress

Reports of organizations-signatories of the UN Global Compact. These reports included 57 Progress Reports for the UN Global Compact, 28 companies that signed the agreement, 40 non-financial reports, 21 companies out of 100 companies ranked by the 200 largest companies in 2015 by BusinessCensor, and the 100 largest taxpayers in Ukraine in 2017–2019 according to the State Tax Service.

Within the voluntary business progress review framework of achieving Sustainable Development Goal(s) in Ukraine, 30 projects of 30 companies-signatories of the UN General Compact network in Ukraine were considered. The distribution of projects studied in the monograph is also uneven:

1) Regarding Sustainable Development Goal 3 – there is a link to the projects of 1 company, and 1 case is considered in detail;
2) Regarding Sustainable Development Goal 7 – there are links to projects of 3 companies, and 1 case is considered in detail;
3) Regarding Sustainable Development Goal 9 – there is a reference to the projects of 1 company, and 1 case is considered in detail.

Thus, in the context of the corporate social responsibility concept in Ukrainian business, the Sustainable Development Goal(s) in general and the studied Sustainable Development Goal(s) 3, 7, 9 did not become mainstream and were not incorporated into the activities of companies (strategy, management, projects, financial support) to the extent.

This monograph is devoted to overwhelming the lack of academic support (theoretical and methodological background) in Sustainable Development Goal(s) financing and the most relevant sources such as financing (private and public).

The monograph contributes to a theory and methodology of Sustainable Development Goal(s) meta-analysis. The

methodology used in this monograph includes several specific instruments and techniques to explore and analyse academic literature, including SciVal by Elsevier, VosViewer, in-built Scopus and Web of Science instruments, Publish or Perish software, Google Scholar, Google Trends, Google Books Ngram Viewer and Google Public Data Explorer.

The monograph results is the first attempt to activate the scholars to pay more attention to Sustainable Development Goal(s) financing and bridging the financial system and academia gap.

The monograph was performed within the framework of the research theme "*Conceptualization of the social-responsible investment segment as the basis of stock market transformation within fractal model*" (state registration number 0121U100473) financed by the State budget of Ukraine, bilateral Austrian-Ukrainian grant "Transforming Financial Markets: Responsible Investment and Sustainable Development Goals as an Element of Health Care Improvement" and prepared by a team of authors:

– Ph.D. in Economics, associate professor *Yuliia Serpeninova* (chapter 1);

– Doctor of Economics, professor *Alex Plastun* (chapter 2);

– Doctor of Economics, associate professor *Inna Makarenko* (introduction, chapter 3).

CHAPTER 1 SUSTAINABLE DEVELOPMENT GOAL 3 "GOOD HEALTH AND WELL BEING" FINANCIAL AND RESEARCH GAP

1.1 Sustainable Development Goal 3 and financing: scientific landscape in Scopus by SciVal metrics

Stenberg et al. (2017) evaluate the size of the financial gap to achieve Sustainable Development Goal 3 successfully. They estimate that an additional $274 billion in spending on health is needed per year by 2030 to make progress towards the Sustainable Development Goal 3 targets.

Despite the importance and critical role of financing in Sustainable Development Goal 3 achievement, academic literature mostly ignores this issue. Among 2.5+ mln papers published worldwide and related to Sustainable Development Goal 3, financial aspects are discussed in less than 0.01% of cases (Table 1.1). The same is true for the number of citations worldwide.

Table 1.1. Static analysis of Sustainable Development Goal 3 and Financing coverage in literature over the period 2016-2021 as at 10/07/2021

Research area	Topics	Topics cluster	Publications worldwide	Citation worldwide
SDG 3	55121	1493	2518232	22347258
SDG 3 Financing	40	28	50	814
SDG 3 and private finance	6	6	7	30
SDG 3 and public finance	9	8	9	38

Source: compiled by authors via SciVal by Elsevier

Stenberg et al. (2017) find that low-income and middle-income countries have no academic support related to substantial investments in Sustainable Development Goal 3; no

estimates of the additional resources needed to strengthen comprehensive health services are available for them in the research literature.

Dynamic analysis of Sustainable Development Goal 3 and Financing coverage in literature over the period 2016-2021 shows the absence of any positive tendencies in detected problems (Table 1.2). Overall, research output in the Sustainable Development Goal 3 field is increasing, but for financial coverage, tendencies are negative both for the number of published papers and citations. Academic interest is decreasing.

Table 1.2. Dynamic analysis of Sustainable Development Goal 3 and Financing coverage in literature over the period 2016-2021 as at 10/07/2021

	Overall	2016	2017	2018	2019	2020	2021
SDG 3							
Output	2518232	408065	415871	433057	456319	537252	267668
Cite	22 347258	6587546	5750574	4491515	3033654	2288122	195847
SDG 3 AND Financing							
Output	50	2	4	12	14	11	7
Cite	814	346	155	173	96	41	0
SDG 3 AND Public finance							
Output	9	0	1	2	4	2	0
Cite	38	0	0	5	31	2	0
SDG 3 AND Private finance							
Output	7	0	0	2	1	2	2
Cite	303	0	0	0	8	21	1

One of the possible explanations for this is that Sustainable Development Goal 3 is an object of interest from medicine and related spheres (Figure 1.1).

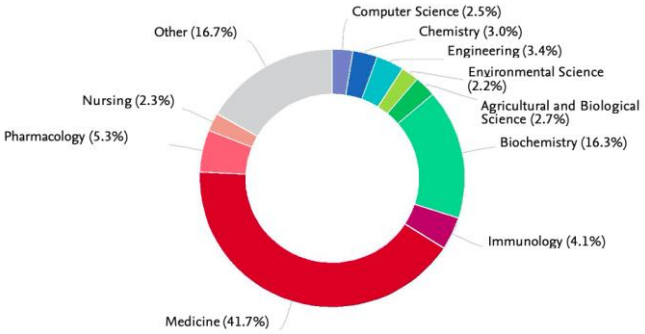


Figure 1.1. Structural analysis by subject area for the case of "Sustainable Development Goal 3"

Analysis of the top and relevant subject areas of Sustainable Development Goal 3 and Financing (Table 1.3) confirms the dominating role of medicine with nearly 30% of the total share.

Table 1.3. Top subjects and relevant subject areas of Sustainable Development Goal 3 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 3 and Financing		SDG 3 and Private Finance		SDG 3 and Public Finance	
	Area	%	Area	%	Area	%
1	Medicine	23.7	Energy	28.6	Medicine	31.3
2	Social Sciences	13.3	Social Sciences	21.4	Economics, Econometrics and Finance	12.5
3	Environmental Sciences	12.9	Computer Sciences	7.1	Computer Sciences	6.3
4	Energy	8.6	Engineering	7.1	Engineering	6.3
5	Economics, Econometrics and Finance	7.5	Earth and Planetary Science	7.1	Environmental Sciences	6.3
6	Energy	8.6	Medicine	7.1	Agricultural and Biological Science	6.3

continued Table 1.3

7	Engineering	4.3	Economics, Econometrics and Finance	7.1	Earth and Planetary Science	6.3

Indirectly these observations are confirmed by the analysis of top institutions (Table 1.4). The list of top institutions includes the World Health organization and medicine related organizations from India, South Africa, Switzerland and the USA.

Table 1.4. Top institutions (I), countries (C) and sectors (S) of Sustainable Development Goal 3 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 3 and Finance			SDG 3 and Private Finance			SDG 3 and Public Finance		
	I	S	C	I	S	C	I	S	C
1	World Health Organisation	G	Switzerland	Datta Meghe Institute of Medical Science	A	India	University of Basel	A	Switzerland
2	University of the Witwatersrand	A	South Africa	Jadavpur University	A	India	World Health Organisation	G	Switzerland
3	South Africa Medical Research Council	G	South Africa	University of California at Berkeley	A	United States	Swiss Tropical and Public Health Institute	G	Switzerland
4	University of Cape Town	A	South Africa	The London School of Economics and Political Science	A	United Kingdom	Indian Council of Medical Research	G	India
5	University College London	A	United Kingdom	ESIC Business and Marketing School	A	Spain	Jadavpur University	A	India

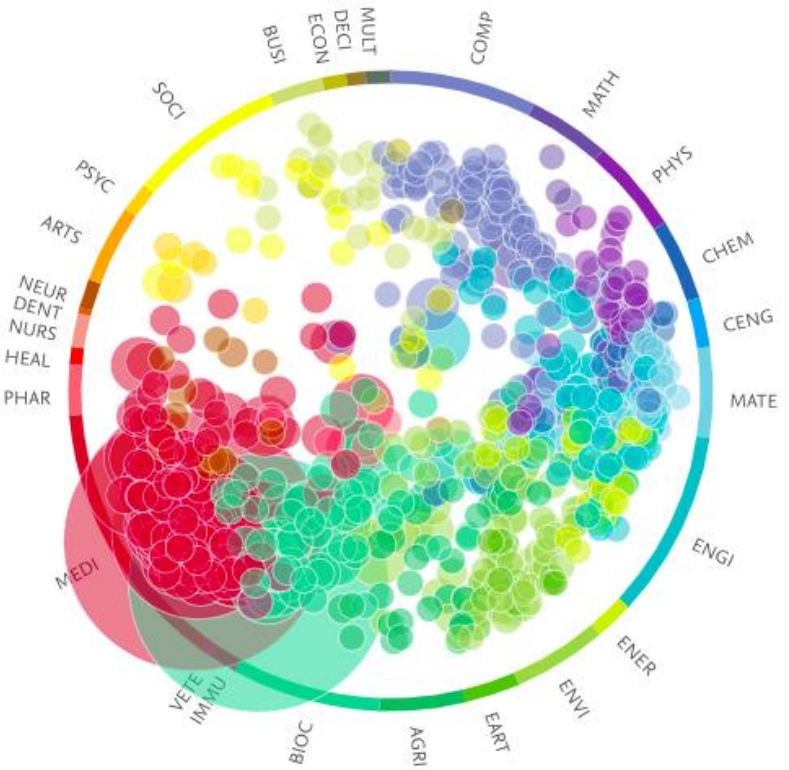
G – Government, A – Academic

Same conclusions achieved from the list of top journals: Sustainable Development Goal 3 and Financing topics explored by medics who publish their papers in titles like “The Lancet”, “International Journal of Health Policy and Management”, “BMC Public Health” etc. (Table 1.5).

Table 1.5. Top Scopus journals in Sustainable Development Goal 3 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 3 and Financing		SDG 3 and Private Finance		SDG 3 and Public Finance	
	Journal	Output / Citation	Journal	Output / Citation	Journal	Output / Citation
1	The Lancet	2 (360)	The Lancet	1 (16)	The Lancet Global Health	1 (11)
2	The Lancet Global Health	2 (160)	Development Engineering	1 (8)	PLoS ONE	1 (10)
3	World Development	2 (18)	Sustainability	1 (5)	Development Engineering	1 (8)
4	Sustainability	2 (18)	Law and Contemporary Problems	1 (1)	Iranian Journal of Public Health	1 (5)
5	International Journal of Health Policy and Management	2 (1)	-	-	BMC Public Health	1 (2)

Additional confirmation favouring the lack of special economic academic literature publications is available from the Top 1% Topics for Sustainable Development Goal 3 in 2021 (Figure 1.2) and key phrases” analysis for Sustainable Development Goal 3 (Figure 1.3).



Note COMP Computer Science; MATH Mathematics; PHYS Physics and Astronomy; CHEM Chemistry; CENG Chemical Engineering; MATE Materials Science; ENGI Engineering; ENER Energy; ENVI Environmental Science; EART Earth and Planetary Sciences; AGRI Agricultural and Biological Sciences; BIOC Biochemistry, Genetics and Molecular Biology; IMMU Immunology and Microbiology; VETE Veterinary; MEDI Medicine; PHAR Pharmacology, Toxicology and Pharmaceutics; HEAL Health Professions; NURS Nursing; DENT Dentistry; NEUR Neuroscience; ARTS Arts and Humanities; PSYC Psychology; SOCI Social Sciences; BUSI; Business, Management and Accounting ECON Economics, Econometrics and Finance; DECI Decision Sciences; MULT Multidisciplinary.

Figure 1.2. Top 1% Topics for Sustainable Development Goal 3 in 2021

Source: compiled by authors via SciVal by Elsevier

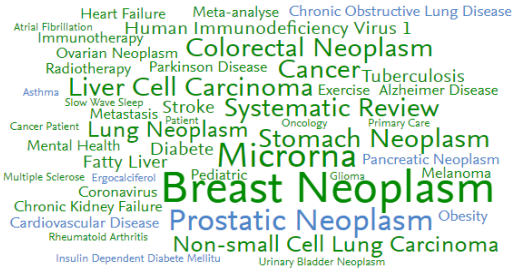


Figure 1.3. Results for key phrases analysis for Sustainable Development Goal 3 2016 to 2021

Source: compiled by authors via SciVal by Elsevier

There is no evidence in favour of positive changes in detected problem: analysis of newly emerged Topics for Sustainable Development Goal 3 in 2021 (Figure 1.4) showed that publications in economic journals are rather an exception for the case of Sustainable Development Goal 3.

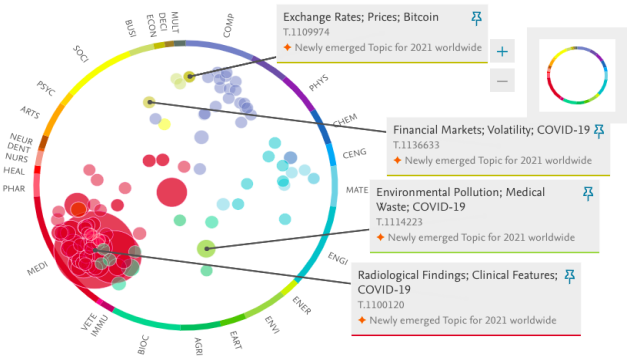


Figure 1.4. Newly emerged Topics for Sustainable Development Goal 3 in 2021

Source: compiled by authors via SciVal by Elsevier

Despite evidence that economic aspects of Sustainable Development Goal 3 and financing are ignored in academic literature, the high potential of this field is confirmed by analysis of top research areas clusters by prominence percentile (Table 1.6). Cluster “Electricity; Energy; Economics” is in the first position.

Table 1.6. Top research areas clusters by prominence percentile in Sustainable Development Goal 3 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 3 and Financing		SDG 3 and Private Finance		SDG 3 and Public Finance	
	Cluster	%	Cluster	%	Cluster	%
1	Electricity; Energy; Economics	99.264	Ozonization; Degradation; Wastewater Treatment	99.064	Electricity; Energy; Economics	99.264
2	Climate models; Model; Rainfall	99.130	-	-	Ozonization; Degradation; Wastewater Treatment	99.064
3	Ozonization; Degradation; Wastewater Treatment	99.064		-	Obesity; Motor Activity; Child	98.729
4	Industry; Innovation; Entrepreneurship	98.997	-	-	Corporate Social Responsibility; Corporate Governance; Firms	97.458
5	Microbial Fuel Cells; Anaerobic Degustation; Bioreactors	98.796	-	-	HIV; HIV Infections	95.652

The list of the most cited papers related to financing and Sustainable Development Goal 3 is in Table 1.7.

Table 1.7. The most relevant papers in Sustainable Development Goal 3 and Financing Coverage based on Scopus and SciVal

№	Authors (Year)	Bibliometric	Cite
1	Bhutta, Z.A., Coates, M.M. and 548 more (2016)	Global, regional, national, and selected subnational levels of stillbirths, neonatal, infant, and under-5 mortality, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. *The Lancet*, 388 (10053), pp. 1725-1774	345
2	Stenberg, K., Hanssen, O., Edejer, T. T. T., Bertram, M., Brindley, C., Meshreky, A., Soucat, A. (2017)	Financing transformative health systems towards achieving the health SDG(s): a model for projected resource needs in 67 low-income and middle-income countries. *The Lancet Global Health*, *5*(9), pp.875-887.	149
3	Rosenthal, J., Quinn, A., Grieshop, A.P. Pillarisetti A., Glass R.I. (2018)	Clean cooking and the SDG(s): Integrated analytical approaches to guide energy interventions for health and environment goals. *Energy for Sustainable Development*, 42, pp. 152-159.	79
4	Bruce M, C., James, H., Janie, R., Clare M S., Stephen T., Eva L.W. (2018)	Urgent action to combat climate change and its impacts (SDG 13): transforming agriculture and food systems. *Current Opinion in Environmental Sustainability*, 34, pp. 13-20.	45
5	Cluver, L.D., Orkin, F.M., Campeau, L., Toska E., Webb D., Carlqvist A., Sherr L. (2019)	Improving lives by accelerating progress towards the UN SDG(s) for adolescents living with HIV: a prospective cohort study. *The Lancet Child and Adolescent Health*, 3 (4), pp. 245-254.	25

Bhutta et al. (2016) analysed child mortality and found the drivers that might increase the pace of progress for child survival. These drivers include cost-effective intervention packages, including increasing overall government spending on maternal and child health, continuing investments in proven, high-impact child health programmes, as well as innovative financing mechanisms.

Cluver et al. (2019) identified three real-world development accelerators for achieving Sustainable Development Goal(s)targets in Africa: parenting support, government cash transfers, and safe schools. Financial aspects of accelerators show the best efficiency for shared funding across government ministries for programmes with cross-cutting effects.

1.2 Sustainable Development Goal 3 and financing: scientific landscape in WoS by in-built metrics

To confirm preliminary results based on Scopus data and SciVal instruments, further analysis based on WoS data is provided.

Results of dynamic analysis of Sustainable Development Goal 3 and Financing coverage in literature over the period 2015-2021 are in Table 1.8. Sustainable Development Goal 3 and Public finance, as well as Sustainable Development Goal 3 and Private finance, were totally ignored in the academic literature until 2021. The overall number of publications devoted to the broader Sustainable Development Goal 3 and Financing topic is 12 during six years. It is direct evidence of an unsatisfactory situation in the academic literature related to Sustainable Development Goal 3 and financing.

Table 1.8. Dynamic analysis of Sustainable Development Goal 3 and Financing coverage in literature over the period 2015-2021 as at 10/07/2021

	Overall	2015	2016	2017	2018	2019	2020	2021
SDG 3								
Output	233	1	12	19	33	42	85	41
Cite	2,001	0	0	78	255	507	721	433

continued Table 1.8

SDG 3 AND Financing								
Output	12	0	0	2	1	2	6	1
Cite	185	0	0	7	38	53	64	23
SDG 3 AND Public finance								
Output	3	0	0	0	0	1	2	0
Cite	21	0	0	0	0	0	12	9
SDG 3 AND Private finance								
Output	2	0	0	0	0	0	1	1
Cite	13	0	0	0	0	0	5	8

Structural analysis by research areas for the case of "Sustainable Development Goal 3" (Table 1.9) provides potential roots of this problem. Research activity is concentrated in Public Environmental Occupational Health (35.6% of all Sustainable Development Goal 3 publications selected from Web of Science Core Collection) and Environmental Sciences Ecology (18.5%). Business Economics has a share of only 2.1%.

Table 1.9. Structural analysis by research areas for the case of "Sustainable Development Goal 3" over the period 2015-2021 as at 10/07/2021

№	Research areas	SDG 3 publications selected from Web of Science Core Collection	
		Record count	%
1	Public Environmental Occupational Health	83	35.6
2	Environmental Sciences Ecology	43	18.5
3	Science Technology	37	15.9
4	Health Care Sciences Services	20	8.6
5	General Internal Medicine	15	6.4
	…		
12	Business Economics	5	2.1

Currently, medicine is the top and dominant relevant research area of Sustainable Development Goal 3 and Financing (Table 1.10).

Table 1.10. Top relevant research areas of Sustainable Development Goal 3 and Financing over the period 2015-2021 as at 10/07/2021

№	SDG 3 and Financing		SDG 3 and Private Finance		SDG 3 and Public Finance	
	Area	%	Area	%	Area	%
1	Public Environmental Occupational Health	33.3	General Internal Medicine	50.0	General Internal Medicine	33.3
2	Health Care Sciences Services	25.0	Health Care Sciences Services	50.0	Public Environmental Occupational Health	33.3
3	General Internal Medicine	8.3		-	Science Technology	33.3

According to WoS, most research activity is concentrated in the USA, UK, Brazil and India (Table 1.11) with top publisher Elsevier (Table 1.12).

Table 1.11. Regional aspect of Sustainable Development Goal 3 and Financing over the period 2015-2021 as at 10/07/2021

№	SDG 3 and Financing		SDG 3 and Private Finance		SDG 3 and Public Finance	
	Country	%	Country	%	Country	%
1	USA	58.3	England	100.0	Brazil	66.7
2	England	33.3	Ghana	100.0	India	66.7
3	Switzerland	33.3	South Africa	100.0	USA	66.7
4	Nigeria	25.0	Algeria	50.0	Algeria	33.3
5	Australia	16.7	Argentina	50.0	Argentina	33.3

Table 1.12. Top publishers in Sustainable Development Goal 3 and Financing over the period 2015-2021 as at 10/07/2021

№	SDG 3 and Financing		SDG 3 and Private Finance		SDG 3 and Public Finance	
	Publisher	%	Publisher	%	Publisher	%
1	Elsevier	16.7	Elsevier	50.0	Elsevier	33.3
2	Kerman Univ Medical Sciences	16.7	Kerman Univ Medical Sciences	50.0	Public Library Science	33.3
3	Taylor & Francis	16.7	-	-	Revista De Saude Publica	33.3

Based on the Bibliometric map of publications concerning Sustainable Development Goal 3 and Financing, the most popular papers concerning Sustainable Development Goal 3 and Financing are defined (Table 1.13). Most of them are not concentrated on crucial issues like econometric modelling to fill existing financial gaps or the most promising financial instruments used to finance Sustainable Development Goal 3. So existing academic literature demonstrates the lack of support to the Sustainable Development Goal 3 and Financing related issues.

Table 1.13. List of papers based on Bibliometric map of publications concerning Sustainable Development Goal 3 and Financing

№	Authors (Year)	Bibliometric	Cite
1	Stenberg, K., Hanssen, O., Edejer, T. T. T., Bertram, M., Brindley, C., Meshreky, A., Soucat, A. (2017)	Financing transformative health systems towards achieving the health SDG(s): a model for projected resource needs in 67 low-income and middle-income countries. *The Lancet Global Health*, *5*(9), pp. 875-887.	141
2	Micah, A. E., Su, Y., Bachmeier, S. D., Chapin, A., Cogswell, I. E., Crosby, S. W., Moghadaszadeh, M. (2020)	Health sector spending and spending on HIV/AIDS, tuberculosis, malaria, and development assistance for health: progress towards Sustainable Development Goal 3. *The Lancet*, *396*(10252), pp. 693-724.	12

continued Table 1.13

3	Davis, S. L. (2017)	The uncounted: politics of data and visibility in global health. *The International Journal of Human Rights*, *21*(8), pp. 1144-1163.	10
4	Joshi, A., Arora, A., Amadi-Mgbenka, C., Mittal, N., Sharma, S., Malhotra, B., Loomba, M. (2019)	The burden of household food insecurity in urban slum settings. *PLoS One*, *14*(4).	9
5	Ebener, S., Stenberg, K., Brun, M., Monet, J. P., Ray, N., Sobel, H. L., Torres, T. T. (2019)	Proposing standardised geographical indicators of physical access to emergency obstetric and new-born care in low-income and middle-income countries. *BMJ global health*.	8
6	Morgan, G. W., Foster, K., Healy, B., Opie, C., Huynh, V. (2018)	Improving health and cancer services in low-resource countries to attain the SDG(s) target 3.4 for noncommunicable diseases. *Journal of global oncology*, *4*, pp. 1-11.	4
7	Derkyi-Kwarteng, A. N. C., Agyepong, I. A., Enyimayew, N., Gilson, L. (2021)	A narrative synthesis review of out-of-pocket payments for health services under insurance regimes: a policy implementation gap hindering universal health coverage in sub-Saharan Africa. *International Journal of Health Policy and Management*, *10*(7), pp. 443-461.	1
8	Strong, K., Noor, A., Aponte, J., Banerjee, A., Cibulskis, R., Diaz, T., You, D. (2020)	Monitoring the status of selected health-related SDG(S): methods and projections to 2030. *Global health action*, *13*(1).	0
9	Masefield, S. C., Msosa, A., Grugel, J. (2020)	Challenges to effective governance in a low-income healthcare system: a qualitative study of stakeholder perceptions in Malawi. *BMC health services research*, *20*(1), pp. 1-16.	0
10	Nabukalu, J. B., Asamani, J. A., Nabyonga-Orem, J. (2020)	Monitoring SDG 3: assessing the readiness of low and middle-income countries. *International Journal of Health Policy and Management*, *9*(7), 297.	0
11	Wonodi, C., Obi-Jeff, C., Falade, A., Watkins, K., Omokore, O. A. (2020)	Pneumonia in Nigeria: The way forward. *Pediatric pulmonology*, *55*, pp. 5-9.	0
12	Vieira, F. S. (2020)	Health financing in Brazil and the goals of the 2030 Agenda: high risk of failure. *Revista de Saudi publica*, *54*.	0

Micah (2020) showed that although a substantial effort has been made to quantify progress towards Sustainable Development Goal 3, less research has focused on tracking spending towards this goal. To fill this gap, they estimated domestic health spending, disaggregated by source (government, out-of-pocket, and prepaid private) from 1995 to 2017 for 195 countries and territories and found that global health spending has increased, reaching $7.9 trillion in 2017 and is expected to increase to $11.0 trillion by 2030. Despite a significant increase in health spending on Sustainable Development Goal 3, the progress towards meeting the Sustainable Development Goal 3 targets has been mixed and has varied by country. Micah (2020) suggested that increases in spending do not always result in improvements in outcomes. This might be explained by the following factors: inefficient allocation of resources across interventions and populations, weak governance systems, human resource shortages, and drug shortages.

Masefield et al. (2020) analysing health sector stakeholders in Malawi found serious political, structural, and financial challenges to improving governance in the national health system, which will impact the government's goal of achieving UHC by 2030.

Nabukalu et al. (2020) assessed the readiness of low- and middle-income countries to monitor Sustainable Development Goal 3 and found the following challenges to monitoring Sustainable Development Goal 3: weak institutional capacity; fragmentation of monitoring and evaluation functions; inadequate domestic financing; inadequate data availability, dissemination and utilization of monitoring and evaluation products.

Vieira (2020) analysed the financing of the Unified Health System over the period from 2010 to 2019. Including the

possibility of achieving the Sustainable Development Goal 3 of the 2030 Agenda, the absence of changes in the current financing framework was found. It might lead to the high risk of non-compliance with Sustainable Development Goal 3 till 2030.

Derkyi-Kwarteng et al. (2021) raised important issues related to the practical aspects of health-care systems and payments there. One of them is informal cash and in-kind payments that means additional costs related to medical services for their consumers. Eventually, the real size of the financial gap might be much better than existing estimates based on official data and official payments.

Strong et al. (2020) discussed another research gap related to Sustainable Development Goal 3 achievement. Monitoring Sustainable Development Goal indicators and their targets play an important role in Sustainable Development Goal achievement. To create a successful monitoring system, transparent country data sources and replicable modelling methods are needed. Nevertheless, current academic literature does not provide appropriate support for this.

1.3 Sustainable Development Goal 3 and financing: scientific landscape in Google Scholar by Publish or Perish

Static analysis of Sustainable Development Goal 3 and related financing queries over the period 2016-2021 showed high interest in the financial aspects of Sustainable Development Goal 3. The number of papers related to Sustainable Development Goal 3 and financing is close to those with the general Sustainable Development Goal 3 topic. The most impressive fact is that the number of citations for financial aspects of Sustainable Development Goal 3 is higher than the overall Sustainable Development Goal 3 query. The same is true for the number of cites per paper, h- and g-indices.

Specific aspects of financing like private and public finance have minimal attention in the literature: all analysed metrics are dozens of times less (Table 1.14).

Table 1.14. Static analysis of Sustainable Development Goal 3 and Sustainable Development Goal 3 and Financing Queries over the period 2016-2021 as of 10/07/2021 (among most cited 1000 studies)

№	Metrics	SDG 3		SDG 3 and Financing		SDG 3 and Private Finance	SDG 3 and Public Finance
		Key words	Title and key words	Key words	Title and key words	Title and key words	
1	Papers	999	88	790	30	26	36
2	Citation	10679	290	12787	140	102	140
3	Cites per year	2134	58.0	2557.40	28.00	20.40	28.00
4	Cites per paper	10.68	3.30	16.19	4.67	3.92	3.89
5	Author paper	2.59	2	2.58	2.23	2.12	2.28
6	h-index	49	9	53	6	4	6
7	g-index	90	15	100	11	10	11

Source: compiled by authors via Publish or Perish

Dynamic analysis of Sustainable Development Goal 3 and Financing coverage in literature over the period 2016-2021 based on Google Scholar Data shows that the interest in the Sustainable Development Goal 3 in general and its financial aspects, in particular, is increasing (Figure 1.5). However, financing is a minor aspect of research activity in Sustainable Development Goal 3 (less than ⅓ of the overall number of Sustainable Development Goal 3 related papers).

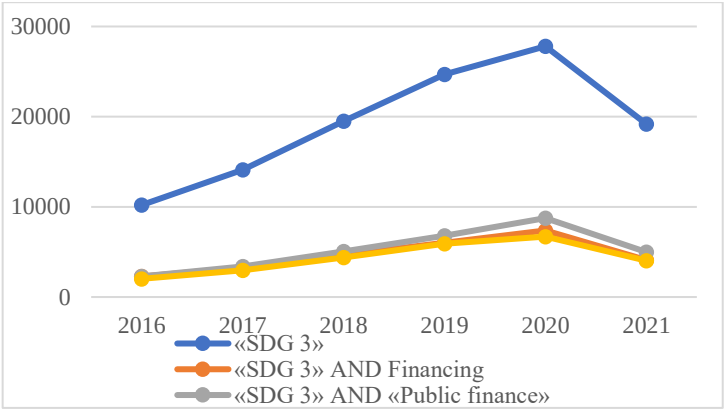


Figure 1.5. Dynamic analysis of Sustainable Development Goal 3 and Financing coverage in a literature over the period 2016-2021 as at 10/07/2021

Source: compiled by authors via Google Scholar

The most cited papers in Sustainable Development Goal 3 and Financing Coverage based on Publish or Perish are in Table 1.15.

Table 1.15. The list of the most cited papers in Sustainable Development Goal 3 and Financing Coverage based on Publish or Perish

№	Authors (Year)	Bibliometric	Cite
1	Asi, Y. M., & Williams, C. (2018)	The role of digital health in making progress toward SDG 3 in conflict-affected populations. *International journal of medical informatics*, *114*, pp. 114-120.	52
2	Seidman, G. (2017)	Does SDG 3 have an adequate theory of change for improving health systems performance? *Journal of global health*, *7*(1).	16
3	Ogu, R. N., Agholor, K. N., & Okonofua, F. E. (2016)	Engendering the attainment of the SDG 3 in Africa: overcoming the socio-cultural factors contributing to maternal mortality. *African Journal of Reproductive Health*, *20*(3), pp. 62-74.	16

continued Table 1.15

4	Howden-Chapman, P., Siri, J., Chisholm, E., Chapman, R., Doll, C. N., Capon, A. (2017)	SDG 3: Ensure healthy lives and promote wellbeing for all at all ages. *A guide to SDG interactions: from science to implementation. Paris, France: International Council for Science*, pp. 81-126	15
5	Walker, J. A. (2016)	Achieving Health SDG 3 in Africa through NGO capacity building-insights from the Gates Foundation investment in Partnership in Advocacy for Child and Family Health (PACFaH) Project. *African Journal of Reproductive Health*, *20*(3), pp. 55-61.	9
6	Rood, E., Khan, A. H., Modak, P. K., Mergenthaler, C., Van Gurp, M., Blok, L., Bakker, M. (2019)	A spatial analysis framework to monitor and accelerate progress towards SDG 3 to end TB in Bangladesh. *ISPRS International Journal of Geo-Information*, *8*(1), 14.	7
7	Bjegovic-Mikanovic, V., Abousbie, Z. A. S., Breckenkamp, J., Wenzel, H., Broniatowski, R., Nelson, C., Laaser, U. (2019)	A gap analysis of SDG 3 and MDG ⅘ mortality health targets in the six Arabic countries of North Africa: Egypt, Libya, Tunisia, Algeria, Morocco, and Mauritania. *Libyan Journal of Medicine*, *14*(1), pp. 607-698.	6
8	Eckermann, E. (2018)	SDG 3: a Missed Opportunity to Transform Understandings and Monitoring of Health, Well-Being and Development? *Applied Research in Quality of Life*, *13*(2), pp. 261-272.	4
9	Sundewall, J., Forsberg, B. C. (2020)	Understanding health spending for SDG 3. *The Lancet*, *396*(10252), pp. 650-651.	3

Asi and Williams (2018) argued that to meet the ambitious health goals of Sustainable Development Goal 3, digital health can help bridge healthcare gaps in conflict-affected areas. No mentions of financial resources required for this were mentioned in their research.

Sundewall and Forsberg (2020) showed that increased funding is needed to achieve Sustainable Development Goal 3, especially in low-income countries. A key strategy for

generating resources for Sustainable Development Goal 3 is domestic resource mobilisation.

Walker (2016) proposed to ensure that governments shift health funding sources away from aid and loans to innovative domestic funding sources which prioritize health.

Seidman (2017) examined whether Sustainable Development Goal 3 and associated indicators have an adequate theory of change for improving health systems performance. They found that analysed indicators do not track primary health care inputs, financial risk protection, or user satisfaction with the health system.

Howden-Chapman et al. (2017) analysed interactions between the Sustainable Development Goal 3 targets and those of other Sustainable Development Goal(s). Authors identified policy options for how to maximise positive interactions and minimise negative interactions between now and 2030 and beyond. Still, financial problems were not discussed directly.

Eckermann (2018) found that Sustainable Development Goal 3, along with many of the other Sustainable Development Goal(s), remains stuck in traditional twentieth-century discourse about measures of progress. The primary reasons for this include inertia.

Bjegovic-Mikanovic (2019) analysed the mortality related Sustainable Development Goal 3 targets, the likelihood to achieve them until 2030 and explored how they are defined. They found considerable differences between countries baselines and concluded on the necessity of setting realistic targets until 2030.

General range of financial instrument in Sustainable Development Goal 3 public and private finance are analysed in Serpeninova et al. (2020).

1.4 Sustainable Development Goal 3 and financing: clusterization in VosViewer

Using data from Scopus and SciVal, we created a bibliometric map of publications concerning Sustainable Development Goal 3 by keywords (Figure 1.6). As can be seen, financing is on the deep periphery of this map as evidence of a lack of attention to this issue in the academic literature on Sustainable Development Goal 3.

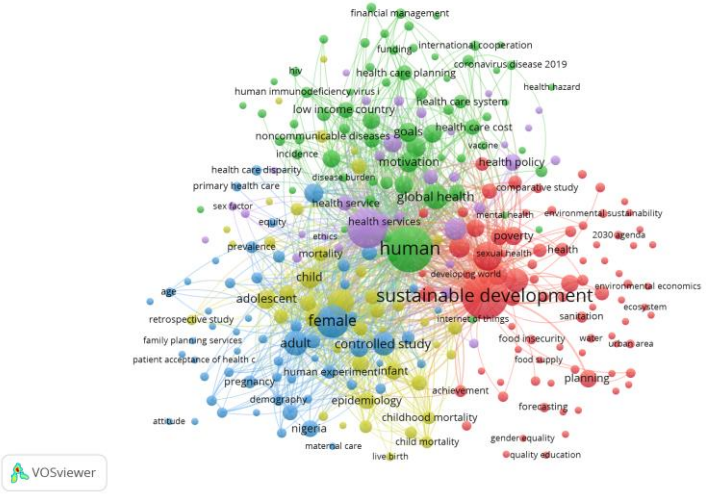


Figure 1.6. Bibliometric map of publications concerning Sustainable Development Goal 3 by keywords (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

Table 1.16 indicates that there are 5 clusters in the bibliometric map of publications concerning Sustainable

Development Goal 3. Funding and financing aspects are discussed within the Green (human) cluster. General aspects of Sustainable Development Goal 3 are discussed within the Red cluster (sustainable development). Nevertheless, in this cluster, there is no keyword related to financing or investment. Information from Table 1.16 clearly shows the lack of attention to financial aspects of the Sustainable Development Goal 3 achievement.

Table 1.16. Clusters in the bibliometric map of publications concerning Sustainable Development Goal 3 (in order of significance)

№	Cluster	Keywords
1	Red (sustainable development)	Sustainable development goals, Sustainable Development Goal(s), SDG 3, poverty, wellbeing, social determinants of health.
2	Green (human)	Global health, health insurance, health care planning, health care financing, funding, health expenditures.
3	Blue (female)	Adult, pregnancy, age, health curvy, child health services, demography.
4	Yellow (male)	Adolescent, infant, child mortality, epidemiology, traffic accident.
5	Purple (public health)	Governance approach, ethics, health care organizations, health services, health policy.

The analysis of the clusters shows that financial aspects related to Sustainable Development Goal 3 are grouped in one cluster, which presents financial issues as health care financing, funding, health expenditures, financial management, health resources, health insurance, health care planning. There is not any mention of private or public finance concerning Sustainable Development Goal 3. This proves the research gap in financing instruments in general, as well as public and private in particular (Figure 1.7). Results based on WoS data (Figure 1.8) confirm these conclusions.

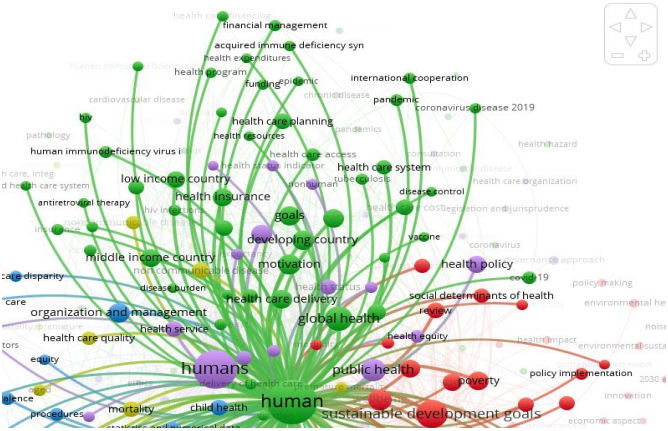


Figure 1.7. Cluster with financial aspects in Sustainable Development Goal 3 bibliometric map of publications by keywords (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

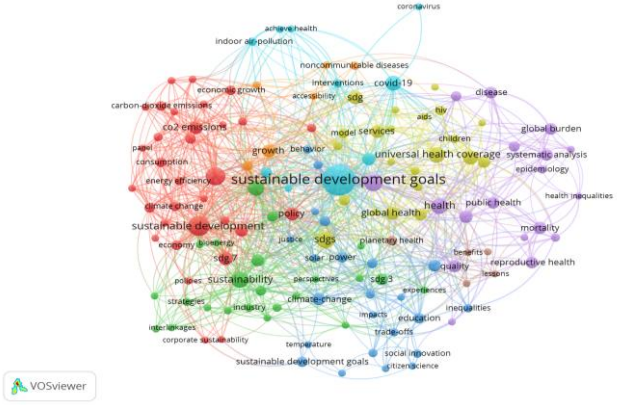


Figure 1.8. Bibliometric map of publications concerning Sustainable Development Goal 3 by keywords (data from WoS)

Source: compiled by authors via VosViewer

Bibliometric map of Sustainable Development Goal 3 related publications by authors provides the key names in this sphere based on Scopus and SciVal (Figure 1.9), WoS (Figure 1.10) and Publish or Perish data (Figure 1.11).

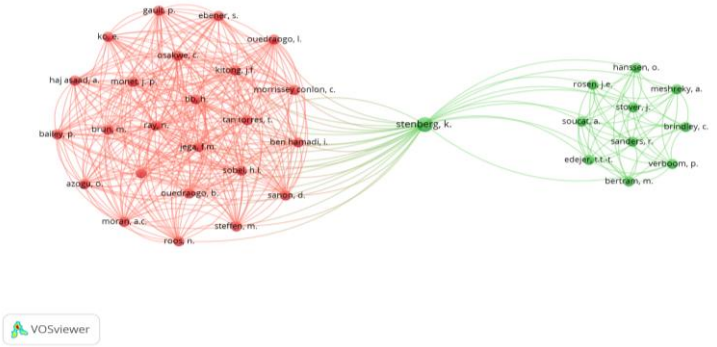


Figure 1.9. Bibliometric map of publications concerning Sustainable Development Goal 3 by authors (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

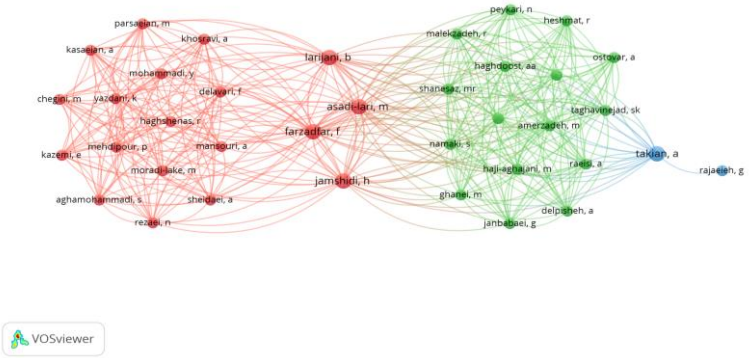


Figure 1.10. Bibliometric map of publications concerning Sustainable Development Goal 3 by authors (data from WoS)

Source: compiled by authors via VosViewer

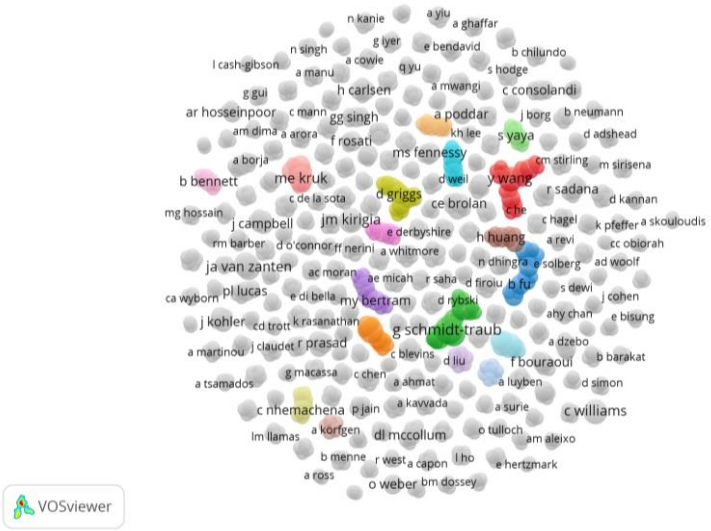


Figure 1.11. Bibliometric map of publications concerning Sustainable Development Goal 3 by authors (data from Publish or Perish)

Harzing, A.W. (2007). Publish or Perish, available from https://harzing.com/resources/publish-or-perish

Source: compiled by authors via VosViewer

1.5 Informational support for Sustainable Development Goal 3 and bridging financial gap via Google instruments

Internet queries concerning Sustainable Development Goal 3, Private Finance and Public Finance in 2015-2021 show no tendency in interest to these issues among Internet users (Figure 1.12).

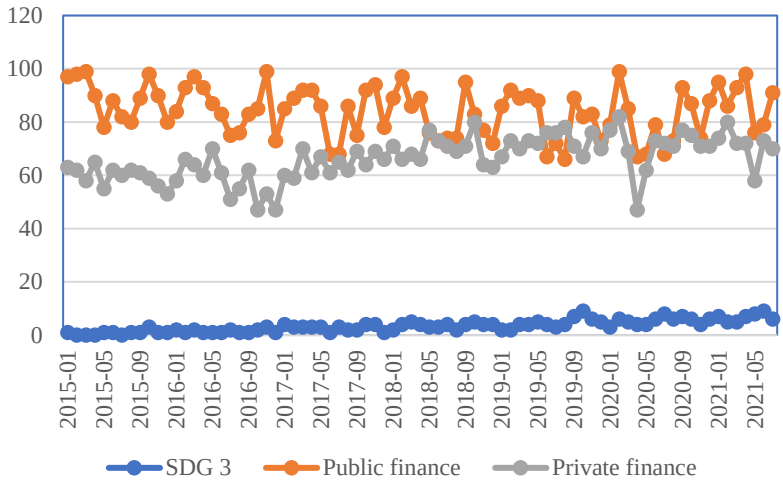


Figure 1.12. Internet queries concerning Sustainable Development Goal 3, Private Finance and Public Finance in 2015-2021 as of 10/07/2021

Source: compiled by authors via Google trends (https://inlnk.ru/bvK46)

Among countries with the highest interest in Sustainable Development Goal 3, Private Finance and Public Finance Germany, Netherlands, Japan, Thailand and Indonesia can be mentioned (Figure 1.13). This interest is not equal: Internet users from Germany are more interested in personal finance aspects related to Sustainable Development Goal 3, users from Thailand and Indonesia, on the contrary, are concentrated on public finance.

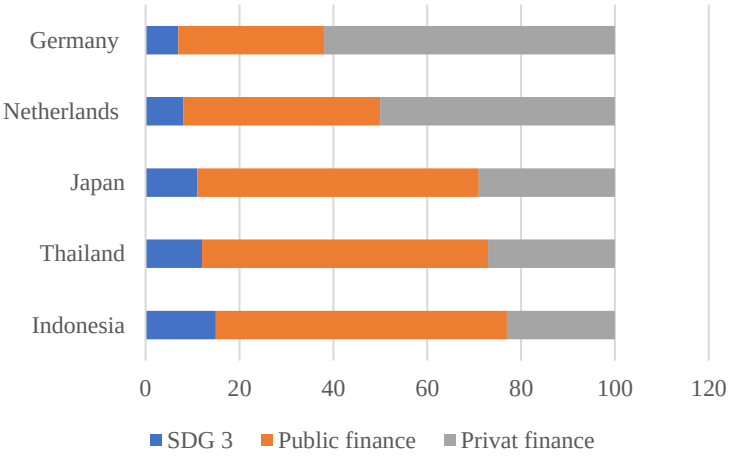


Figure 1.13. The level of Internet users" interest in search queries concerning Sustainable Development Goal 3, Private Finance and Public Finance in 2015-2021: top 5 countries, % as of 10/07/2021

Source: compiled by authors via Google trends (https://bit.ly/3iAAos3)

The overall number of Internet queries concerning Sustainable Development Goal 3 is much lower than public and private finance. It can be explained by the time of adoption of Sustainable Development Goal(s) (2015). This assumption is confirmed by the Ngrams concerning Sustainable Development Goal 3 and Private Finance (Figure 1.14) and Public Finance in 1900-2019 (Figure 1.15).

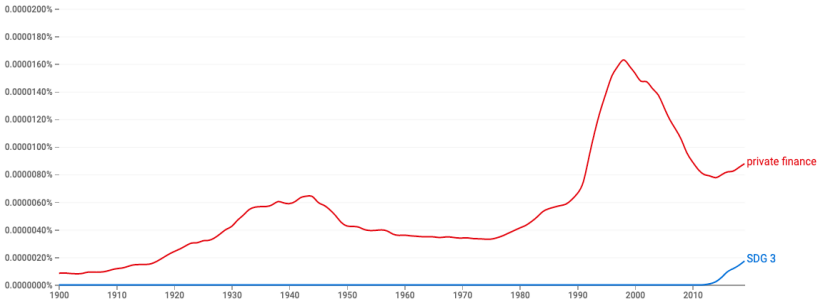


Figure 1.14. Ngram concerning Sustainable Development Goal 3 and Private Finance in 1900-2019 as of 10/07/2021

Source: compiled by authors via Google Books Ngram Viewer https://inlnk.ru/WDYda

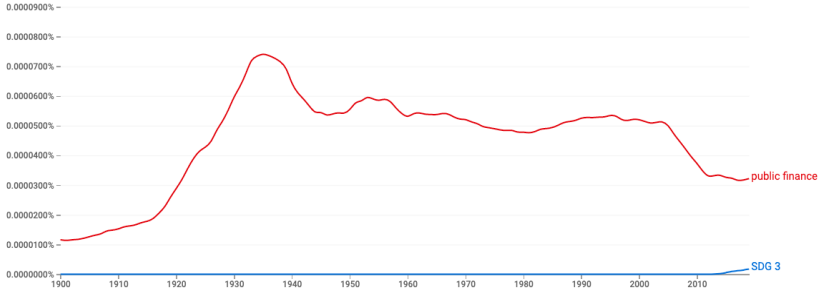


Figure 1.15. Ngram concerning Sustainable Development Goal 3 and Public Finance in 1900-2019 as of 10/07/2021

Source: compiled by authors via Google Books Ngram Viewer https://inlnk.ru/q1MaK

Table 1.17 provides data sets and examples of sources in each research area, generated via Google Public Data Explorer. Sustainable Development Goal 3 and Financing covers more data sets (18) than Sustainable Development Goal 3 and Private and Public Finance (1 and 9 data sets, respectively). This proves the exciting information gap in Internet sources providing information on private finance related to Sustainable Development Goal(s). The most relevant source for all three determined research areas is the World Bank data catalogue, which provides regularly updated information.

Table 1.17. Examples of sources in each research area, generated via Google Public Data Explorer as of 10/07/2021

SDG 3 and Financing (18 data sets found)	SDG 3 and Private Finance (1 data set found)	SDG 3 and Public Finance (9 data sets found)
Data set		Updating
World Bank (2021). Sustainable Development Goals [Dataset]. https://datacatalog.worldbank.org/dataset/sustainable-development-goals		Jul 2, 2021

1.6 Empirical evidence of Sustainable Development Goal 3 implementation and finance: case of Ukrainian companies

The difficult epidemiological situation in Ukraine caused by the global pandemic COVID-19 and the active reform of the health care system contribute to increasing interest in sustainable health in both the scientific community and the real sector of the economy. It was also confirmed by the largest number of CSR cases in the frame of the Sustainable Development Goal 3 (compared to 7 and 9) submitted for participation in the competition of the “CSR Ukraine” (Table 1.18).

Table 1.18. Dynamics of companies' participation in the CSR Case Competition in the context of the Sustainable Development Goal 3 during 2016–2019

Year	2016	2017	2018	2019
Companies that took part in the CSR case competition	- Lenovo Ukraine - M.S.L. - Nebesna krynytsya - Nova poshta - EVA - Jurimex - Lifecell - Travel Professional Group	- Deloitte - Monsanto Ukraine - PJSC "Farmak" - Watsons Ukraine	- M.S.L. - Watsons Ukraine -Nebesna krynytsya	- Datagroup - EVA - PJSC Kyivstar - Nestlé - Prykarpattyaoblenerho - Gudvelli Ukraine - Luxoptika

Source: compiled by the authors according to the CSR Ukraine (2020).

An excellent example of implementing business projects aimed at achieving Sustainable Development Goal 3 is PJSC “Farmak” (Table 1.19). This company takes a leading position in terms of sales of drugs in the pharmaceutical market of Ukraine. The company's portfolio includes about 250 drugs in demand both in the domestic market and abroad. PJSC “Farmak” sells its products in 28 countries.

Table 1.19. Description of the Joint Stock Company “Farmak” activities for Sustainable Development Goal 3 achievement

Parameter	Description
SDG 3 target	3.8: Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all
Criteria	Social, Innovative
Company	FARMAK
Duration	2013–currently

continued Table 1.19

Goals	- Ensure accessibility to treatment with modern and efficient medicines; - Promote a healthy lifestyle and well-being of the public; - Promote research and development of new medicines.
Solution	- Developing effective modern medicines at an affordable price; - Investments in development, production, social and educational projects for young scientists and schoolchildren; - Launch of more than 20 products annually, over 110 products are in the pipeline
Results	- The share of the Governmental Program "Affordable Medicines" is 13.7%. - Project "Eco-school" for schoolchildren of 8-11 grades. - Project "Young Scientist's School" for young scientists.

Source: compiled by authors according to UN Global Compact Network Ukraine (2020, 6)

Based on UN Global Compact Network Ukraine (2020) PJSC "Farmak" actively invests in the development of production facilities, innovations, personnel and social projects aimed at achieving global goals (Table 1.20).

Table 1.20. Directions of investments of PJSC "Farmak" during 2013-2019

Areas of investment	Characteristic
Manufacturing facilities	In 2018, a new manufacturing facility for solid dosage forms was opened with an investment support up to € 20 million. After the new manufacturing facility launch, the Company's annual production output doubled to 3 billion units and almost 100 new jobs were created. There are six workshops" medicines, five state-of-the-art laboratories, and its R&D complex.
Innovations	The Company annually reinvests approximately 95% of its profits in the development (₴3.4 billion in a scientific and technical complex, manufacturing equipment, and R&D). The expansion of the manufacturing facilities over the past five years allowed an increase in production output by 35%

continued Table 1.20

Personnel	The Company has about 2,700 employees, including 150 scientists, 40 employees having an academic degree of Candidate of Science and five employees having an academic degree of Doctor of Science. In 2019, 1,100 Farmak's employees received training, of which 81 received training abroad.
Social Projects	Project "Young Scientist's School": - focuses on our country's scientific potential and aims to become a platform for knowledge exchange between young scientists; - 1,500 participants took part, and over 150 Ukrainian and foreign speakers lectured over the period of this project. Project "Eco-school": - an educational course for schoolchildren of 8-11 grades carried out in Shostka and Kyiv. Over 200 schoolchildren received theoretical and practical knowledge on the sustainable use of natural resources, human impact on the environmental system, social business, project management; - grants for the implementation of 9 environmental projects; - a tailored textbook approved by the Ministry of Education and Science. - online learning platform, where Ukrainian schoolchildren can join the project, gain new knowledge, create a team, develop an environment-related project for their school and win a grant for its implementation (almost 1,000 schoolchildren are registered on the platform).

Source: compiled by authors according to UN Global Compact Network Ukraine (2020)

Another example of business contribution to Sustainable Development Goal 3 achievement is Global Sustainability Programme "Together Towards Zero" of Carlsberg Ukraine (Table 1.21).

Responsible alcohol consumption prevents the negative consequences of its impact on life and health, as well as trauma on the roads. Thus, the development of the soft drink industry contributes to the goals of sustainable development 3.5 and 3.6. The integration of Sustainable Development Goal(s) into the practical activities of economic entities contributes to promoting corporate social responsibility in business, creating practical

mechanisms for implementing sustainable development programs that can serve as an example for other stakeholders and make a significant contribution to achieving global goal.

Table 1.21. Description of the Global Sustainability Programme “Together Towards Zero” of Carlsberg Ukraine for Sustainable Development Goal 3 achievement

Parameter	Description
SDG 3 targets	3.5: Strengthen the prevention and treatment of substance abuse, including harmful use of narcotic drugs and alcohol. 3.6: By 2020, halve the number of global deaths and injuries from road traffic accidents.
Company	Carlsberg Ukraine
Duration	2017 – 2030
Goals	- Zero accidents culture; - Zero irresponsible drinking;
Solution	- 100% responsible drinking messaging through packaging and branding; - expand the offering of alcohol-free brews to 100%; - constant reduction in accidents rate; - annual improvement concerning responsible consumption; - zero lost-time accidents.
Results	- expanding the choice of alcohol-free brews. Since the beginning of the programme, the company's AFBs portfolio has grown by 4%; - annually, Carlsberg Ukraine joins the World Day of Responsible Beer Consumption; - focus on Health&Safety of employees and suppliers (training efforts, ensures the protective equipment for the personnel, and engages with suppliers to promote and support the Health & Safety ambition).

Source: compiled by authors according to UN Global Compact Network Ukraine (2020, 28)

CHAPTER 2 SUSTAINABLE DEVELOPMENT GOAL 7 "AFFORDABLE AND CLEAN ENERGY" FINANCIAL AND RESEARCH GAP

2.1 Sustainable Development Goal 7 and financing: scientific landscape in Scopus by SciVal metrics

Static analysis of Sustainable Development Goal 7 and Financing coverage in literature over the period 2016-2021 (Table 2.1) shows the lack of attention to the financial aspects of Sustainable Development Goal 7 achievement. Among 800K+ publications worldwide, only 50 are related to financing issues and only 7 and 6 to specific aspects like private and public finance, respectively. The situation is even worse for citations: less than 0.01% of citations in Sustainable Development Goal 7 related literature deal with financing.

Table 2.1. Static analysis of Sustainable Development Goal 7 and Financing coverage in literature over the period 2016-2021 as at 10/07/2021

Research area	Topics	Topics cluster	Publications worldwide	Citation worldwide
SDG 7	27447	1397	807876	8523675
SDG 7 Financing	33	22	50	814
SDG 7 and private finance	8	5	7	30
SDG 7 and public finance	6	5	6	96

Source: compiled by authors via SciVal by Elsevier

Dynamic analysis (Table 2.2) shows that this poor situation is getting worse: the number of papers and citations in Sustainable Development Goal 7 literature, in general, is

increasing, but the number of papers and citations in Sustainable Development Goal 3 financial aspects is decreasing during the latest years.

Table 2.2. Dynamic analysis of Sustainable Development Goal 7 and Financing coverage in literature over the period 2016-2021 as at 10/07/2021

	Overall	2016	2017	2018	2019	2020	2021
SDG 7							
Output	807876	121684	134309	148645	165123	163395	74709
Cite	8523675	2387109	2209623	1905074	1347550	614154	60165
SDG 7 AND Financing							
Output	44	2	3	12	10	7	10
Cite	927	418	233	165	59	42	10
SDG 7 AND Public finance							
Output	6	0	1	0	3	1	1
Cite	96	0	68	0	23	2	3
SDG 7 AND Private finance							
Output	9	0	1	2	0	1	5
Cite	104	0	68	10	0	16	10

As a result, only 1 of 10 SDG 7 related paper papers belongs to the Economics subject area (Figure 2.1).

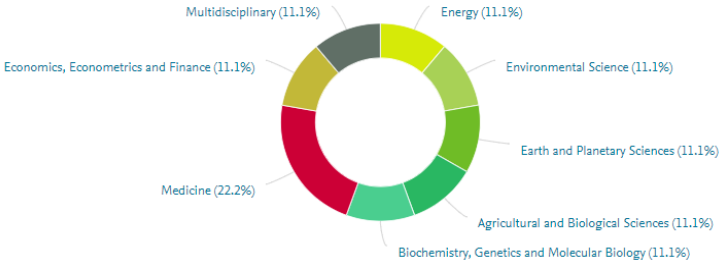


Figure 2.1. Structural analysis by subject area for the case of "Sustainable Development Goal 7"

Most of the papers are concentrated in Medicine and environmental sciences (Table 2.3).

Table 2.3. Top subjects and relevant subject areas of Sustainable Development Goal 7 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 7 and Financing		SDG 7 and Private Finance		SDG 7 and Public Finance	
	Area	%	Area	%	Area	%
1	Environmental Sciences	22.6	Energy	38.5	Medicine	22.2
2	Energy	20.2	Environmental Sciences	23.1	Economics, Econometrics and Finance	11.1
3	Medicine	16.7	Social Sciences	23.1	Energy	11.1
4	Social Sciences	14.3	Earth and Planetary Science	7.7	Multidisciplinary	11.1
5	Economics, Econometrics and Finance	7.1	Medicine	7.7	Environmental Sciences	11.1
6	Business, Management and Accounting	4.8	-	-	Earth and Planetary Science	11.1

continued Table 2.3

7	Other	4.8	-	-	Agriculture and Biological Sciences	11.1
8	-	-	-	-	Biochemistry, Genetics and Molecular Biology	11.1

Research activity is mostly concentrated in academic institutions with few exceptions like the World Health Organization (Table 2.4). The list of top countries includes Switzerland, UK, South Africa and Australia.

Table 2.4. Top institutions (I), countries (C) and sectors (S) of Sustainable Development Goal 7 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 7 and Financing			SDG 7 and Private Finance			SDG 7 and Public Finance		
	I	S	C	I	S	C	I	S	C
1	World Health Organization	G	Switzerland	Australian National University	A	Australia	University of Ibadan	A	Nigeria
2	KTH Royal Institute of Technology	A	Sweden	University of Zurich	A	Switzerland	University of the Witwatersrand	A	South Africa
3	Yonsei University	A	South Korea	Karlsruhe Institute of Technology	A	Germany	South African Medical Research Council	G	South Africa
4	International Institute for Applied Systems Analysis, Luxemburg	A	Austria	University College London	A	United Kingdom	Indian Council of Medical Research	G	India
5	Imperial College London	A	United Kingdom	Catholic University of the Sacred Heart	A	Italy	University of Basel	A	Switzerland

G – Government, A – Academic

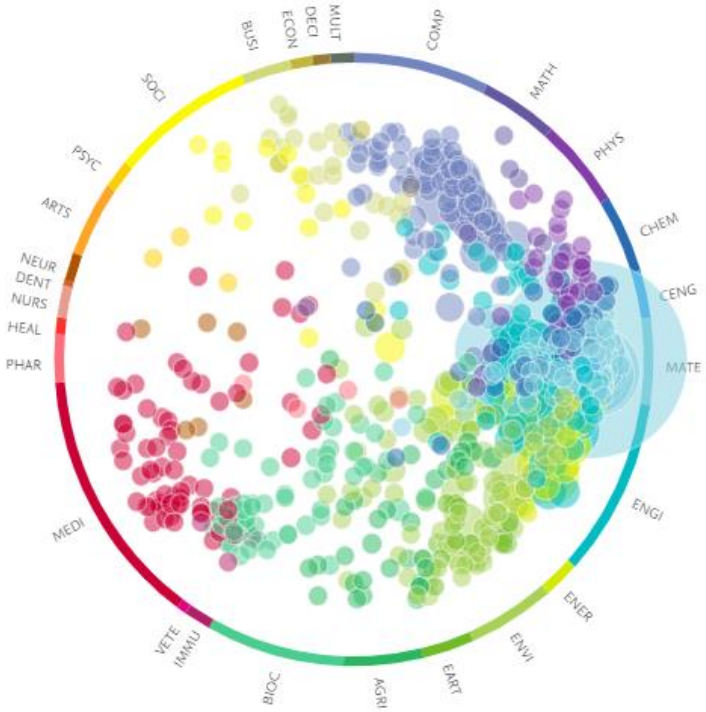
Top Scopus journals in Sustainable Development Goal 7 and Financing mainly belong to the medical sphere and include “The

Lancet", "The Lancet Global Health", "International Journal of health Policy and management" etc. (Table 2.5).

Table 2.5. Top Scopus journals in Sustainable Development Goal 7 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 3 and Financing		SDG 3 and Private Finance		SDG 3 and Public Finance	
	Journal	Output / Citation	Journal	Output / Citation	Journal	Output / Citation
1	The Lancet	2 (360)	The Lancet	1 (16)	The Lancet Global Health	1 (11)
2	The Lancet Global Health	2 (160)	Development Engineering	1 (8)	PLoS ONE	1 (10)
3	World Development	2 (18)	Sustainability	1 (5)	Development Engineering	1 (8)
4	Sustainability	2 (18)	Law and Contemporary Problems	1 (1)	Iranian Journal of Public Health	1 (5)
5	International Journal of health Policy and management	2 (1)	-	-	BMC Public Health	1 (2)

Top 1% Topics for Sustainable Development Goal 7 in 2021 are concentrated in Chemical Engineering and Materials Science (Figure 2.2) with a minor presence in Business, Management and Accounting and Economics, Econometrics and Finance sciences.



Note COMP Computer Science; MATH Mathematics; PHYS Physics and Astronomy; CHEM Chemistry; CENG Chemical Engineering; MATE Materials Science; ENGI Engineering; ENER Energy; ENVI Environmental Science; EART Earth and Planetary Sciences; AGRI Agricultural and Biological Sciences; BIOC Biochemistry, Genetics and Molecular Biology; IMMU Immunology and Microbiology; VETE Veterinary; MEDI Medicine; PHAR Pharmacology, Toxicology and Pharmaceutics; HEAL Health Professions; NURS Nursing; DENT Dentistry; NEUR Neuroscience; ARTS Arts and Humanities; PSYC Psychology; SOCI Social Sciences; BUSI; Business, Management and Accounting ECON Economics, Econometrics and Finance; DECI Decision Sciences; MULT Multidisciplinary.

Figure 2.2. Top 1% Topics for Sustainable Development Goal 7 in 2021

Source: compiled by authors via SciVal by Elsevier

Financial aspects are not present in key phrases from the Sustainable Development Goal 7 related paper. The most popular titles are “Internet of Things”, “Lithium-ion Battery”, “Solar Energy” (Figure 2.3).

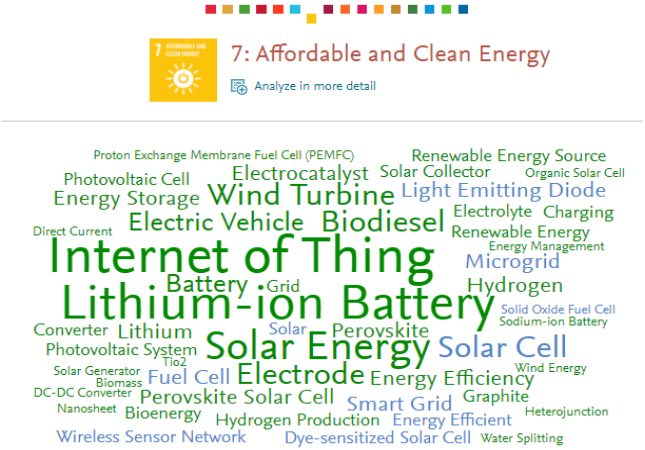


Figure 2.3. Results for key phrases analysis for Sustainable Development Goal 7 2016 to 2021

Source: compiled by authors via SciVal by Elsevier

As a result, among newly emerged Topics for Sustainable Development Goal 7 in 2021, related economic ones are rather exceptions (Figure 2.4).

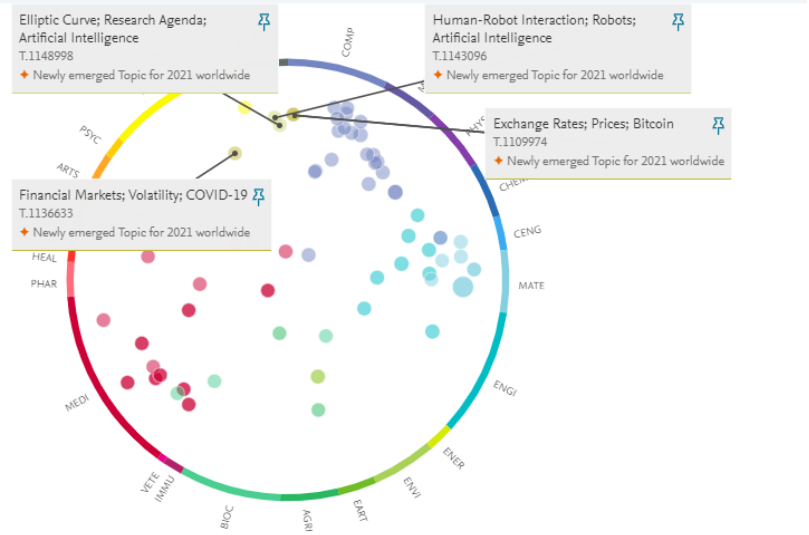


Figure 2.4. Newly emerged Topics for Sustainable Development Goal 7 in 2021

Source: compiled by authors via SciVal by Elsevier

The top research areas cluster by prominence percentile in Sustainable Development Goal 7 and Financing is “Electricity, Energy, Economics” (Table 2.6).

Table 2.6. Top research areas clusters by prominence percentile in Sustainable Development Goal 7 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 7 and Financing		SDG 7 and Private Finance		SDG 7 and Public Finance	
	Cluster	Percentile	Cluster	Percentile	Cluster	Percentile
1	Electricity, Energy, Economics	99.264	Electricity, Energy, Economics	99.264	Electricity, Energy, Economics	99.264

The list of the most relevant papers in Sustainable Development Goal 7 and Financing Coverage based on Scopus and SciVal is presented in Table 2.7.

Table 2.7. The List of the most relevant papers in Sustainable Development Goal 7 and Financing Coverage based on Scopus and SciVal

№	Authors (Year)	Bibliometric	Cite
1	Chirambo, D. (2018)	Towards the achievement of SDG 7 in sub-Saharan Africa: Creating synergies between power Africa, sustainable energy for all and climate finance in order to achieve universal energy access before 2030. Renewable and Sustainable Energy Reviews, 94, pp. 600-608.	31
2	Chiu, I. H. (2021)	Regulating sustainable finance in capital markets: A perspective from socially embedded decentred regulation. Law and Contemporary Problems, 84(1), pp. 75-93.	1
3	Cyrek, M., Cyrek, P. (2021)	Does economic structure differentiate the achievements towards energy SDG(s) in the EU? Energies, 14(8).	0
4	Dagnachew, A. G., Poblete-Cazenave, M., Pachauri, S., Hof, A. F., Van Ruijven, B.,Van Vuuren, D. P. (2019)	Integrating energy access, efficiency and renewable energy policies in sub-Saharan Africa: A model-based analysis. Environmental Research Letters, 15(12).	1
5	Dioha, M. O., Emodi, N. V. (2019)	Investigating the impacts of energy access scenarios in the Nigerian household sector by 2030. Resources, 8(3).	6
6	Falchetta, G., Dagnachew, A. G., Hof, A. F., Milne, D. J. (2021)	The role of regulatory, market and governance risk for electricity access investment in sub-Saharan Africa. Energy for Sustainable Development, 62, pp. 136-150.	2
7	Giwa, A., Alabi, A., Yusuf, A., Olukan, T. (2017)	A comprehensive review on biomass and solar energy for sustainable energy generation in Nigeria. Renewable and Sustainable Energy Reviews, 69, pp. 620-641.	68

continued Table 2.7

8	Khatiwada, D., Purohit, P., Ackom, E. K. (2019)	Mapping bioenergy supply and demand in selected least developed countries (LDCs): Exploratory assessment of modern bioenergy's contribution to SDG 7. Sustainability (Switzerland), 11(24).	2
9	Korkovelos, A., Zerri, H., Howells, M., Bazilian, M., Rogner, H., Nerini, F. F. (2020)	A retrospective analysis of energy access with a focus on the role of mini-grids. Sustainability (Switzerland), 12(5), pp. 1-29.	10
10	Lohani, S. P., Dhungana, B., Horn, H., Khatiwada, D. (2021)	Small-scale biogas technology and clean cooking fuel: Assessing the potential and links with SDG(s) in low-income countries – A case study of Nepal. Sustainable Energy Technologies and Assessments, 46.	0
11	Michaelowa, A., Hoch, S., Weber, A., Kassaye, R., Hailu, T. (2021)	Mobilising private climate finance for sustainable energy access and climate change mitigation in sub-Saharan Africa. Climate Policy, 21(1), pp. 47-62.	3
12	Nedopil Wang, C., Lund Larsen, M., Wang, Y. (2020)	Addressing the missing linkage in sustainable finance: The “SDG finance taxonomy”. Journal of Sustainable Finance and Investment.	1
13	Onabote, A., Jolaade, A., Osabohien, R., Otobo, O., Ede, C., Okafor, V. (2020)	Energy sustainability, energy financing and economic growth in Nigeria. International Journal of Energy Economics and Policy, 11(1), pp. 433-439.	0
14	Panagos, P., Montanarella, L. (2018)	Soil thematic strategy: An important contribution to policy support, research, data development and awareness. Current Opinion in Environmental Science and Health, 5, pp. 38-41.	3
15	Quitzow, R., Thielges, S., Goldthau, A., Helgenberger, S., Mbungu, G. (2019)	Advancing a global transition to clean energy – the role of international cooperation. Economics, 13.	2
16	Rosenthal, J., Quinn, A., Grieshop, A. P., Pillarisetti, A., Glass, R. I. (2018)	Clean cooking and the SDGs: Integrated analytical approaches to guide energy interventions for health and environment goals. Energy for Sustainable Development, 42, pp. 152-159.	79

continued Table 2.7

17	Selvakkumaran, S., Silveira, S. (2019)	Exploring synergies between the intended nationally determined contributions and electrification goals of Ethiopia, Kenya and the democratic republic of Congo (DRC). Climate and Development, 11(5), pp. 401-417.	4
18	Setyowati, A. B. (2021)	Mitigating inequality with emissions? Exploring energy justice and financing transitions to low carbon energy in Indonesia. Energy Research and Social Science, 71.	4
19	Yang, F., Yang, M. (2018)	Rural electrification in sub-Saharan Africa with innovative energy policy and new financing models. Mitigation and Adaptation Strategies for Global Change, 23(6), pp. 933-952.	10

Quitzow et al. (2019) showed that investment towards achieving Sustainable Development Goal 7 is insufficient. The size of the financial gap exceeds $20 bln per year. They recommend promoting investment in clean energy and end support for coal-based energy infrastructure.

Chiu (2021) claimed that achieving Sustainable Development Goal(s) requires mobilizing capital markets for sustainable finance products. To do this, policymakers have to be more proactive in promoting alternative forms of economic behaviour that are socially oriented by making sustainable finance mainstream as investment products. Using financial regulation, policymakers can make it mandatory for conventional investment funds to engage with sustainable finance.

Michaelowa (2021) claims that international market mechanisms and climate finance can be key catalysts for private multibillion-dollar investment in energy access and climate mitigation. Linking international and regional development programmes with the international carbon market might be an option for closing financing gaps while at the same time increasing synergies between climate goals and Sustainable Development Goal(s).

Wang et al. (2020) proposed to use the UNDP Sustainable Development Goal Finance Taxonomy as a unified taxonomy of activities for sustainable finance.

Onabote et al. (2020) examined the long-run relationship between economic growth, sustainable energy and the different financing options for sustainable energy in Nigeria. They found that different types of financing employed in Nigeria have different effects on the economic growth of Nigeria.

Yang and Yang (2018) showed that a private investment-based financial model is the most effective and environmentally friendly in rural electrification for the poorest households in sub-Saharan Africa.

Setyowati (2021) explored Indonesia's efforts to realize its vision of energy justice by mobilizing private finance for renewable rural electrification and concluded that the use of diverse forms of finance is needed.

2.2 Sustainable Development Goal 7 and financing: scientific landscape in WoS by in-built metrics

Analysis of the scientific landscape in WoS by in-built metrics is provided to get additional evidence. Based on dynamic analysis of Sustainable Development Goal 7 and Financing coverage in literature over the period 2015-2021 (Table 2.8), Sustainable Development Goal 7 research interest is not concentrated on financial aspects: neither public nor private finances.

Table 2.8. Dynamic analysis of Sustainable Development Goal 7 and Financing coverage in literature over the period 2015-2021 as at 10/07/2021

	Overall	2015	2016	2017	2018	2019	2020	2021
SDG 7								
Output	122	0	0	5	8	24	47	37
Cite	831	0	0	1	20	88	333	389
SDG 7 AND Financing								
Output	10	0	0	0	2	3	2	3
Cite	62	0	0	0	0	12	25	25
SDG 7 AND Public finance								
Output	3	0	0	0	0	1	1	1
Cite	23	0	0	0	0	5	10	8
SDG 7 AND Private finance								
Output	3	0	0	0	0	0	1	2
Cite	7	0	0	0	0	0	0	7

Structural analysis by research areas for the case of “Sustainable Development Goal 7” confirms these conclusions (Table 2.9). Key research areas are “Environmental Sciences Ecology”, “Science Technology”, “Energy Fuels” (Table 2.10). Business Economics has a share of 14% (3 times lower than “Environmental Sciences Ecology”).

Table 2.9. Structural analysis by research areas for the case of “Sustainable Development Goal 7” over the period 2015-2021 as at 10/07/2021

№	Research areas	SDG 7 publications selected from Web of Science Core Collection	
		Record count	%
1	Environmental Sciences Ecology	53	43.4
2	Science Technology	47	38.5
3	Energy Fuels	36	29.5
4	Engineering	20	16.4
5	Business Economics	17	13.9

Table 2.10. Top relevant research areas of Sustainable Development Goal 7 and Financing over the period 2015-2021 as at 10/07/2021

№	SDG 7 and Financing		SDG 7 and Private Finance		SDG 7 and Public Finance	
	Area	%	Area	%	Area	%
1	Environmental Sciences Ecology	50.0	Environmental Sciences Ecology	66.6	Environmental Sciences	33.3
2	Science Technology	50.0	Energy Fuels	33.3	Environmental Studies	33.3
3	Energy Fuels	30.0	Public Administration	33.3	Multidisciplinary Sciences	33.3
4	Public Administration	10.0	Science Technology	33.3	Public Administration	33.3
5	Public Environmental Occupational Health	10.0	-	-	Public Environmental Occupational Health	33.3

Analysis of regional aspects of Sustainable Development Goal 7 and Financing research activity shows that Germany, the USA and Australia are prevailing (Table 2.11).

Table 2.11. Regional aspect of Sustainable Development Goal 7 and Financing over the period 2015-2021 as at 10/07/2021

№	SDG 7 and Financing		SDG 7 and Private Finance		SDG 7 and Public Finance	
	Country	%	Country	%	Country	%
1	Germany	30.0	Germany	33.3	Germany	66.7
2	USA	30.0	Australia	33.3	USA	66.7
3	Australia	30.0	Ethiopia	33.3	Ethiopia	33.3
4	India	20.0	India	33.3	India	33.3
5	Poland	20.0	Switzerland	33.3	South Korea	33.3

Top publishers in Sustainable Development Goal 7 and Financing are Elsevier, Mdpi and Taylor & Francis (Table 2.12).

Table 2.12. Top publishers in Sustainable Development Goal 7 and Financing over the period 2015-2021 as at 10/07/2021

№	SDG 7 and Financing		SDG 7 and Private Finance		SDG 7 and Public Finance	
	Publisher	%	Publisher	%	Publisher	%
1	Mdpi	40.0	Elsevier	66.7	Mdpi	33.3
2	Elsevier	30.0	Taylor & Francis	33.3	Public Library Science	33.3
3	Taylor & Francis	10.0	-	-	Taylor & Francis	33.3

The list of the most cited papers based on the Bibliometric map of publications concerning Sustainable Development Goal 7 and Financing in WoS database is in Table 2.13.

According to Falchetta et al. (2021), achieving universal electricity access in sub-Saharan Africa – a milestone of Sustainable Development Goal 7 – requires about $30bn annually until 2030. The authors developed the Electricity Access Governance Index, a composite index of energy sector regulatory quality, energy sector governance, and market risk, to allow for a more realistic evaluation of the role of the investment environment in financing energy access.

Chirambo (2018) provided analysis of case studies, research articles, policy briefs and project reports to investigate the policies, strategies and innovations that could increase the progress towards universal energy access before 2030. Energy sectors require new institutions to prevent a “climate finance curse” to fill existing financial gaps. A specific set of financial instruments and institutions called climate finance can be used for these purposes.

Hettiarachchi et al. (2018) proposed to use organic waste buyback programs as additional instruments to achieve Sustainable Development Goal 7 and partially fill existing financial gaps.

Sharma et al. (2019) analysed the case of Nigeria and found that due to insufficient financing and low-income levels of households, Sustainable Development Goal 7 targets cannot be successfully achieved. Therefore, there is a need to explore local and foreign funding sources and a serious need to couple energy access programs in the country with income-generating activities.

Korkovelos et al. (2020) claimed that the achievement of Sustainable Development Goal 7 should be based on multi-stakeholder (planners, regulators, developers, investors, third party actors) collaboration with the active use of locally adaptable, economically sustainable and community compatible mini-grids that can accelerate universal access to electricity.

Setyowati (2021), using Indonesia as an example, showed that it is necessary to design and implement energy policies that holistically address all elements of energy justice and facilitate the use of diverse forms of finance to address energy poverty.

Michaelowa et al. (2021) showed that linking international and regional development programmes with the international carbon market is needed to fill existing financing gaps.

Table 2.13. List of papers based on Bibliometric map of publications concerning Sustainable Development Goal 7 and Financing in WoS database

№	Authors (Year)	Bibliometric	Cite
1	Chirambo, D. (2018)	Towards the achievement of SDG 7 in sub-Saharan Africa: Creating synergies between Power Africa, Sustainable Energy for All and climate finance in order to achieve universal energy access before 2030. *Renewable and Sustainable Energy Reviews*, *94*, pp. 600-608.	24

continued Table 2.13

2	Hettiarachchi, H., Meegoda, J. N., Ryu, S. (2018)	Organic waste buyback as a viable method to enhance sustainable municipal solid waste management in developing countries. *International journal of environmental research and public health*, *15*(11), pp. 24-83.	11
3	Joshi, A., Arora, A., Amadi-Mgbenka, C., Mittal, N., Sharma, S., Malhotra, B., Loomba, M. (2019)	Burden of household food insecurity in urban slum settings. *PLoS One*, *14*(4).	9
4	Dioha, M. O., Emodi, N. V. (2019)	Investigating the impacts of energy access scenarios in the Nigerian household sector by 2030. *Resources*, *8*(3), 127.	6
5	Korkovelos, A., Zerriffi, H., Howells, M., Bazilian, M., Rogner, H., Fuso Nerini, F. (2020)	A retrospective analysis of energy access with a focus on the role of mini-grids. *Sustainability*, *12*(5), 1793.	5
6	Setyowati, A. B. (2021)	Mitigating inequality with emissions? Exploring energy justice and financing transitions to low carbon energy in Indonesia. *Energy Research & Social Science*, *71*.	3
7	Michaelowa, A., Hoch, S., Weber, A. K., Kassaye, R., Hailu, T. (2021)	Mobilising private climate finance for sustainable energy access and climate change mitigation in Sub-Saharan Africa. *Climate Policy*, *21*(1), pp. 47-62.	
8	Falchetta, G., Dagnachew, A. G., Hof, A. F., Milne, D. J. (2021).	The role of regulatory, market and governance risk for electricity access investment in sub-Saharan Africa. *Energy for Sustainable Development*, *62*, pp. 136-150.	
9	Cyrek, M., Cyrek, P. (2021)	Does Economic Structure Differentiate the Achievements towards Energy SDG in the EU? *Energies*, *14*(8), pp. 22-29.	
10	Kryk, B. (2019)	Ensuring sustainable energy as a sign of environmental responsibility and social justice in European Union members. *Ekonomia i Środowisko-Economics and Environment*, *71*(4), pp. 25-25.	

2.3 Sustainable Development Goal 7 and financing: scientific landscape in Google Scholar by Publish or Perish

Results of static analysis of Sustainable Development Goal 7 and Sustainable Development Goal 7 and Financing Queries over the period 2016-2021 based on Google Scholar data using Publish or Perish (Table 2.14) showed minor interest in the topic of private and public finance.

Table 2.14. Static analysis of Sustainable Development Goal 7 and Sustainable Development Goal 7 and Financing Queries over the period 2016-2021 as of 10/07/2021 (among most cited 1000 studies)

№	Metrics	SDG 7		SDG 7 and Financing		SDG 7 and Private Finance	SDG 7 and Public Finance
		Key words	Title and key words	Key words	Title and key words	Title and key words	
1	Papers	860	68	230	29	20	30
2	Citation	34206	304	3805	83	85	102
3	Cites per year	6841.20	60.80	761.0	16.60	17.00	20.40
4	Cites per paper	39.77	4.47	16.54	2.86	4.25	3.4
5	Author paper	3.32	2.51	2.51	2.55	2.55	2.53
6	h-index	78	8	30	4	5	6
7	g-index	148	16	56	9	9	9

Source: compiled by authors via Publish or Perish

Overall, the issue of finance in Sustainable Development Goal 3 is relatively significant. Dynamic analysis of Sustainable Development Goal 7 and Financing coverage in literature over

the period 2016-2021 showed that this interest is increasing in time (Figure 2.5).

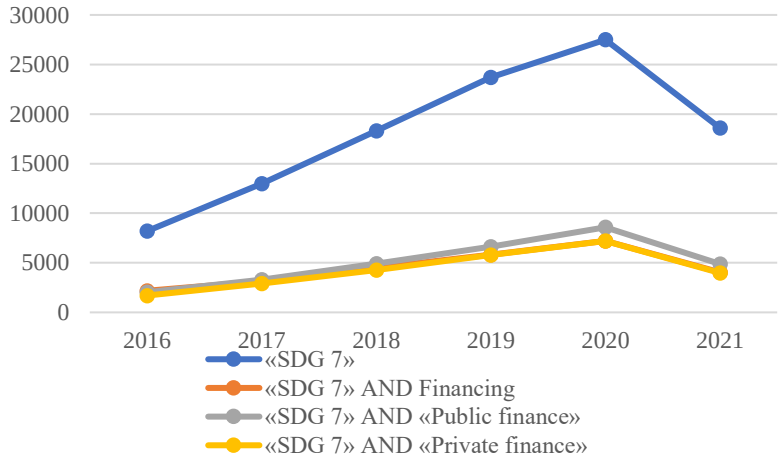


Figure 2.5. Dynamic analysis of Sustainable Development Goal 7 and Financing coverage in literature over the period 2016-2021 as at 10/07/2021

Source: compiled by authors via Google Scholar

The list of the most cited papers in Sustainable Development Goal 7 and Financing Coverage based on Publish or Perish is presented in Table 2.15.

Jagger et al. (2019) discussed the contribution of forests to Sustainable Development Goal 7 achievement and defined four pathways: sustainable use of traditional wood fuels, processed wood fuels, liquid biofuels and biopower.

Ackah (2016) examined the policy interventions in renewable energy in Ghana over the past 20 years and explored the relationship between renewable energy investment and sustainable development.

Elavarasan et al. (2021) investigated impacts in the energy sector on the progress towards sustainability. They concluded that the changes in the energy market, investment preferences and more importantly, the decisions influenced by the political bodies in the post-COVID-world are decisive in achieving the same in a stipulated time frame.

Franco (2020) defined the existing sustainability gaps and introduced case studies from diverse geographical contexts and industries, providing practical recommendations for impact sustainability.

Bruce and Stephenson (2016) explored the existing international legal order (international, regional and bilateral treaties and non-binding instruments) relevant to Sustainable Development Goal 7. They found that specific legal, policy and governance challenges may be encountered when implementing Sustainable Development Goal 7. The list of these challenges does not include financial matters.

Alloisio et al. (2017) showed that Sustainable Development Goal 7 could be considered as an enabling factor for the achievement of other Sustainable Development Goal(s), particularly 6, 8, 9, 11, 12, 13.

Katekar et al. (2020), using Bangladesh as an example, described major issues and challenges, as well as macro and micro initiatives to achieve Sustainable Development Goal 7. Some policy interventions to attain Sustainable Development Goal 7 are provided in this paper, but they do not include financial measures or instruments.

Müller et al. (2021) claimed that the energy justice concept could be helpful to achieve progress in Sustainable Development Goal 7. This concept includes different justice dimensions, but financial aspects were not discussed.

Table 2.15. List of the most cited papers in Sustainable Development Goal 7 and Financing Coverage based on Publish or Perish

№	Authors (Year)	Bibliometric	Cite
1	D. Chirambo (2018)	Towards the achievement of SDG 7 in sub-Saharan Africa: Creating synergies between Power Africa, Sustainable Energy for All and climate finance in order to achieve universal energy access before 2030. Renewable and Sustainable Energy Reviews, 94, pp. 600-608.	48
2	S. Bruce, S. Stephenson (2016)	SDG 7 on Sustainable Energy for All: Contributions of International Law, Policy and Governance Policy and Governance (August 2016).	9
3	I.B. Franco, C. Power, J. Whereat (2020)	SDG 7 affordable and clean energy. In Actioning the Global Goals for Local Impact (pp. 105-116). Springer, Singapore.	8
4	R.M. Elavarasan, R. Pugazhendhi, T. Jamal, J. Dyduch, (2021)	Envisioning the UN SDG(s) through the lens of energy sustainability (SDG 7) in the post-COVID-19 world. Applied Energy, 292.	6
5	I. Alloisio, A. Zucca, S. Carrara (2017)	SDG 7 as an enabling factor for Sustainable Development: the role of technology innovation in the electricity sector. In Processing of the International Conference on Sustainable Development.	5
6	V.P. Katekar, S.S. Deshmukh, (2020)	Assessment and Way Forward for Bangladesh on SDG 7: Affordable and Clean Energy. International Energy Journal, 20(3A).	4
7	I. Ackah (2016)	Policy interventions in renewable energy for Sustainable Development: is Ghana on the right path to achieve SDG 7?	4
8	P. Jagger, R. Bailis, A. Dermawan (2019)	SDG 7: affordable and clean energy–how access to affordable and clean energy affects forests and forest-based livelihoods. Sustainable Development Goal(s), 206.	2
9	G. Nhamo, C. Nhemachena, S. Nhamo (2020)	Projecting Progress and Challenges to Accelerating the Achievement of SDG 7 in South Asia. In SDG 7–Ensure Access to Affordable, Reliable, Sustainable and Modern Energy. Emerald Publishing Limited.	3
10	F. Müller., M. Neumann, C. Elsner, S. Claar (2021)	Assessing African energy transitions: Renewable energy policies, energy justice, and SDG 7. Politics and Governance, 9(1), pp. 119-130.	1

2.4 Sustainable Development Goal 7 and financing: clusterization in VosViewer

A bibliometric map of publications concerning Sustainable Development Goal 7 by keywords based on data from Scopus and SciVal (Figure 2.6) showed the prevalence of "sustainable development" related keywords and almost no mentions in the context of finance.

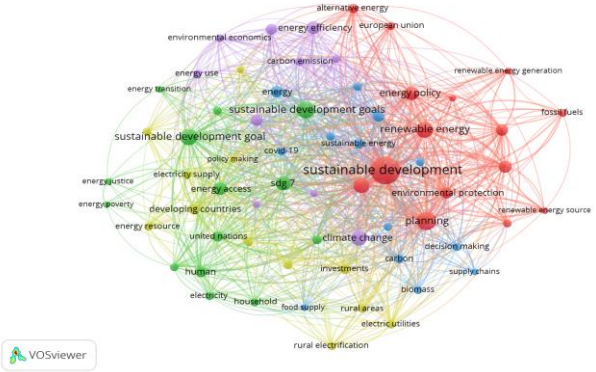


Figure 2.6. Bibliometric map of publications concerning Sustainable Development Goal 7 by keywords (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

Clusters in the bibliometric map of publications concerning Sustainable Development Goal 7 (in order of significance) are in Table 2.16. As can be seen, investment issues are discussed within the yellow (investment) cluster. Specific keywords for this cluster are rural electrification, electric utilities, rural areas. So general aspects of Sustainable Development Goal 7 achievement described by keywords Sustainable Development Goal(s), Sustainable Development Goal 7, energy sustainability,

alternative and renewable energy are discussed in the academic literature without relation to investment.

Table 2.16. Clusters in the bibliometric map of publications concerning Sustainable Development Goal 7 (in order of significance)

№	Cluster	Key words
1	Red (renewables)	Renewable energy, alternative energy, renewable energy resources, renewable energy generation, energy policy
2	Green (energy market parameters)	Energy supply, energy poverty, energy transition, energy justice, sustainable development goals, SDGs, SDG 7
3	Blue (energy sustainability)	Energy sustainability, sustainable energy, supply chains
4	Purple (energy efficiency)	Energy efficiency, climate change, carbon emissions, environmental economics, economic growth
5	Yellow (investment)	Investment, rural electrification, electric utilities, rural areas

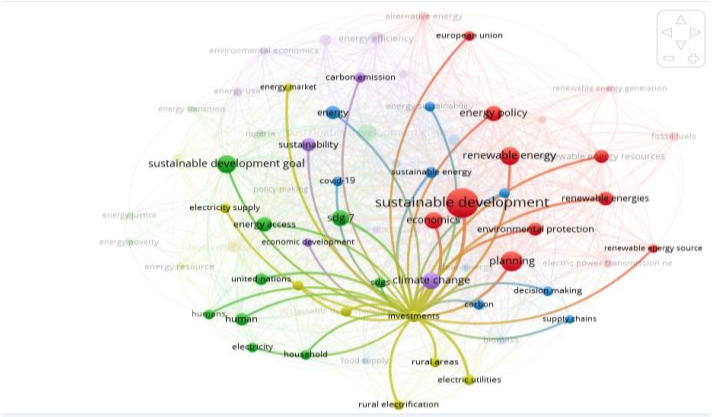


Figure 2.7. Cluster with financial aspects in Sustainable Development Goal 7 bibliometric map of publications by keywords (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

Clusters with financial aspects in Sustainable Development Goal 7 bibliometric map of publications by keywords based on data from Scopus and SciVal are presented in Figure 2.7. Financial aspects are mostly absent. The same conclusions are obtained from the bibliometric map of publications concerning Sustainable Development Goal 7 by keywords based on data from WoS (Figure 2.8).

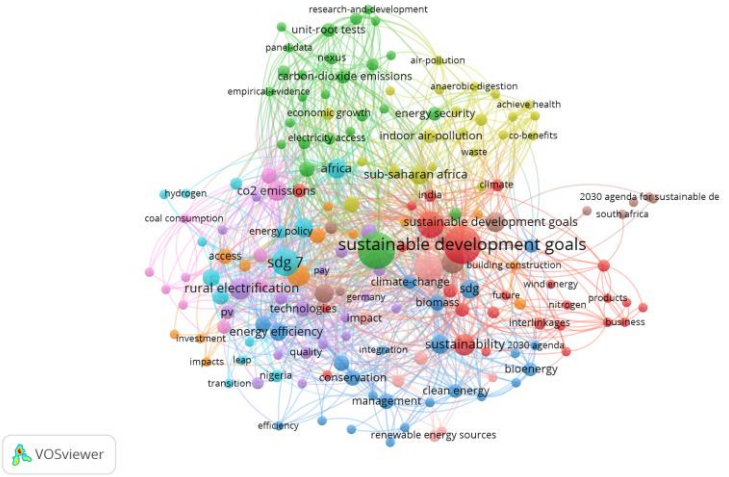


Figure 2.8. Bibliometric map of publications concerning Sustainable Development Goal 7 by keywords (data from WoS)
Source: compiled by authors via VosViewer

The list of the key authors publishing in the sphere of Sustainable Development Goal 7 is presented in the form of a bibliometric map based on Scopus and SciVal (Figure 2.9), WoS (Figure 2.10) and Publish or Perish data (Figure 2.11).

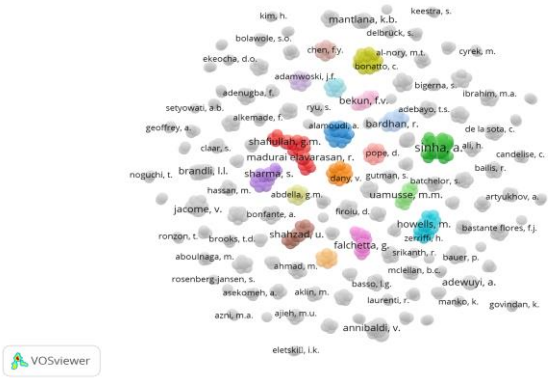


Figure 2.9. Bibliometric map of publications concerning Sustainable Development Goal 7 by authors (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

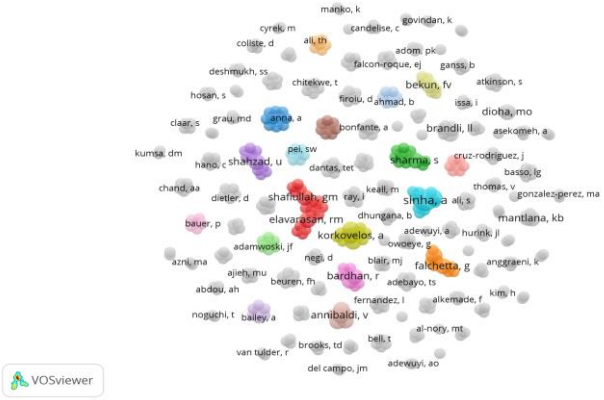


Figure 2.10. Bibliometric map of publications concerning Sustainable Development Goal 7 by authors (data from WoS)

Source: compiled by authors via VosViewer

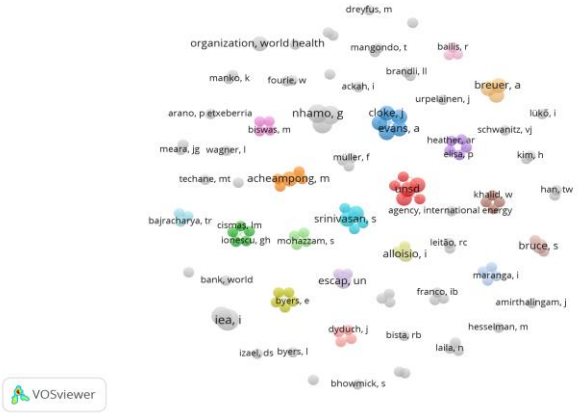


Figure 2.11. Bibliometric map of publications concerning Sustainable Development Goal 7 by authors (data from Publish or Perish)

Harzing, A. W. (2007). Publish or Perish, available from https://harzing.com/resources/publish-or-perish

Source: compiled by authors via VosViewer

Based on these bibliometric maps, we can define the most influencing authors in Sustainable Development Goal 7 sphere.

2.5 Informational support for Sustainable Development Goal 7 and bridging financial gap via Google instruments

Analysis of Internet queries concerning Sustainable Development Goal 7, Private Finance and Public Finance in 2015-2021 shows no tendency in interest to these issues among Internet users (Figure 2.12).

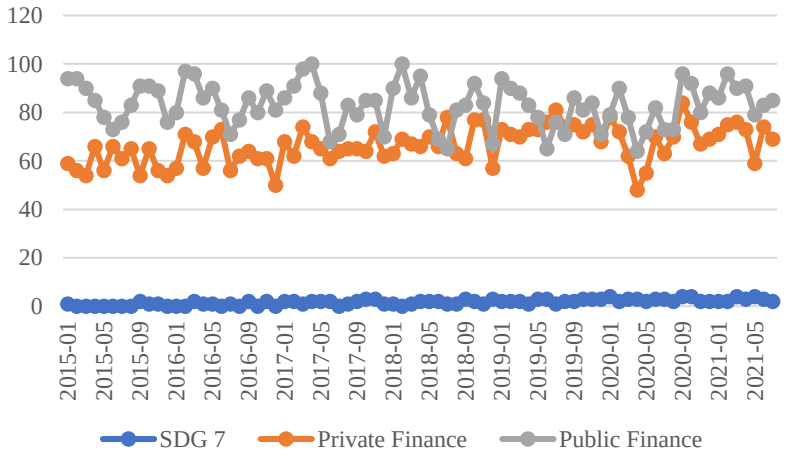


Figure 2.12. Internet queries concerning Sustainable Development Goal 7, Private Finance and Public Finance in 2015-2021 as of 10/07/2021

Source: compiled by authors via Google trends (https://bit.ly/3xkTdoI)

Internet users' interest in search queries concerning Sustainable Development Goal 7, Private Finance and Public Finance in 2015-2021 is the highest in Japan, Germany, USA, UK, Philippines and India (Figure 2.13). Search queries related to public finance dominate in the USA, Japan and Philippines. Private finances are more popular in Germany, UK and India.

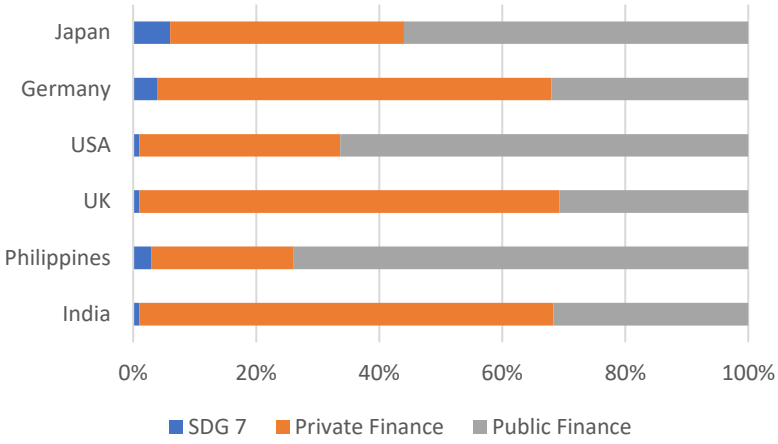


Figure 2.13. The level of Internet users' interest in search queries concerning Sustainable Development Goal 7, Private Finance and Public Finance in 2015-2021: top 5 countries, % as of 10/07/2021

Source: compiled by authors via Google trends (https://bit.ly/3xkTdoI)

According to Ngram there has been a strong negative tendency in the interest to private financing since 1955 (2.7) and since 1976 to public financing (1976). So partially, the lack of attention in the academic sphere nowadays might be explained by the overall tendency (Figure 2.14-2.15).

Figure 2.14. Ngram concerning Sustainable Development Goal 9 and Private Finance in 1900-2019 as of 10/07/2021

Source: compiled by authors via Google Books Ngram Viewer https://bit.ly/36Ycp0x

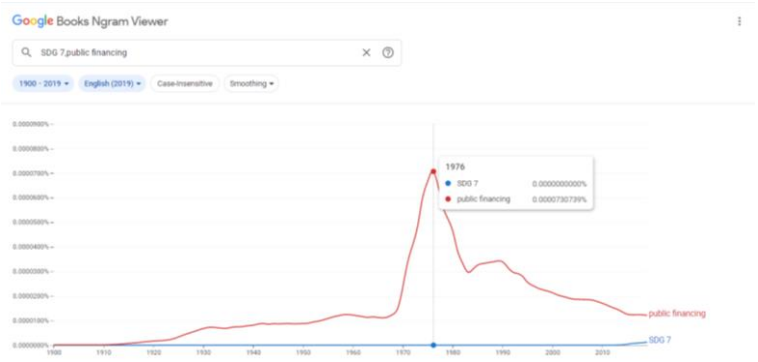


Figure 2.15. Ngram concerning Sustainable Development Goal 9 and Public Finance in 1900-2019 as of 10/07/2021

Source: compiled by authors via Google Books Ngram Viewer https://bit.ly/36Ycp0x

Examples of sources in each research area, generated via Google Public Data Explorer, are in Table 2.17.

Table 2.17. Examples of source in each research area, generated via Google Public Data Explorer as of 10/07/2021

SDG 7 and Financing (9 data sets found)		SDG 7 and Private Financing (2 data sets found)	SDG 7 and Public Financing (1 data set found)
Data set	Updating	Data set	Updating
UN DESA Statistics Division (2020). Indicator 7.a.1: International financial flows to developing countries for support of clean energy research and development and renewable energy production, including in hybrid systems (millions of constant 2017 United States dollars) [Dataset]. https://www.sdg.org/datasets/086d631bf5ef4a96aedb07238346e343	Aug 17, 2020	World Bank (2021). Sustainable Development Goals [Dataset]. https://datacatalog.worldbank.org/dataset/sustainable-development-goals	Jul 2, 2021

2.6 Empirical evidence of Sustainable Development Goal 7 implementation and finance: case of Ukrainian companies

The practical aspect of implementing the Sustainable Development Goal 7 "Affordable and Clean Energy" in the Ukrainian companies' activities in the case study of the "CSR Ukraine" in 2016-2019 was not presented.

However, in the non-financial reports of the largest Ukrainian companies, there are 41 mentions of indicators, projects, and progress within the Sustainable Development Goal 7.

Analysing the practices of corporate social responsibility to achieve the Sustainable Development Goal(s) of Ukrainian companies in 2016-2019, presented in the reports, it should be noted that specific to Sustainable Development Goal 7

“Affordable and clean energy” are projects regarding using renewable energy sources.

In particular, Ukrgasbank, as one of the best known for its initiatives in the sustainable development of Ukrainian banks, has developed its Concept of Sustainable Finance. Environmental Management System (EMS), which includes “green” financing, reducing the negative impact of the bank's activities, and assessing and monitoring borrowers' environmental and social risks. This system is directly related to ensuring progress in achieving the Sustainable Development Goal(s) 7, 8, 9, 12 and 13. (Ukrgasbank Sustainability Report 2019, pp. 22–24).

PJSC “Carlsberg Ukraine” in 2017 declared its progress towards the Sustainable Development Goal 7, which is integrated into the new strategy of sustainable development of the parent company Carlsberg Group until 2022 and 2030, and within the program “4 zeros” provides for zero-carbon should. (Social report Carlsberg Ukraine (2019), 4).

In particular, within the project, Global sustainability programme “Together towards Zero” (2017-2030), Carlsberg Ukraine persuade two targets of Sustainable Development Goal 7 (7.2: By 2030, increase substantially the share of renewable energy in the global energy mix and 7.3: By 2030, double the global rate of improvement in energy efficiency).

Company targets implemented on corporate strategy level were divided in 2022 and 2030:

1) 2022: 50% reduction in carbon emissions at our breweries; 100% electricity from renewable sources at our breweries; ZERO coal use at our breweries;
2) 2030: ZERO carbon emissions at our breweries 30% reduction in beer-in-hand carbon footprint.

To achieve these targets in 2019 company had reached such an indicator: 11% of natural gas was replaced by biogas,

extracted at treatment plants from our wastewater before it is discharged into the public sewer. UN Global Compact Network Ukraine (2020) Voluntary business progress review of achieving Sustainable Development Goal(s) in Ukraine. 42 p. (p. 28)

Kernel under the project "Practical experience in implementing solutions on combating climate change and land protection" in 2015 -2020 concentrated on targets of Sustainable Development Goal 7: 7.2: By 2030, increase the share of renewable energy in the global energy mix substantially.

More than $170 million invested in renewable energy projects in 2018-2021 (construction of commercial plants at Kernel's facilities for generating the renewable heat and electricity from biomass) (UN Global Compact Network Ukraine (2020), 27)

The complete description of the DTEK Renewables project, which aims to make significant progress in Sustainable Development Goals 7 (Table 2.18), is given in UN Global Compact Network Ukraine (2020).

Table 2.18. Description of the project "Development of renewable energy in Ukraine"

Parameter	Description
Project	Development of renewable energy in Ukraine
SDG 7 target	7.3: Increase the share of generation from renewable energy sources (RES) in the national energy balance, in particular through the introduction of additional capacity at RES facilities
Criteria	Social, Environmental
Company	DTEK Renewables
Number of partners	Over 50
Area	Regions of DTEK
Duration	2008-2020

continued Table 2.18

Goals	- increase the share of energy from renewable sources to meet the goals of the Energy Strategy of Ukraine; - the strategy foresees a significant increase in the share of green electricity by 2035 (25% of Ukraine's total primary energy supply shall derive from renewable energy sources).
Solution	Construction and operation of renewable energy facilities in Ukraine by DTEK Renewables: - DTEK Renewables has invested more than €1 billion in the construction of solar and wind power plants and engaged the world's best equipment manufacturers to its projects that decrease 2.6 million tons of greenhouse gases (CO2-eq) annually. Almost 1,000 hectares of reclaimed land, unsuitable for agriculture were used to install solar panels.
Results	- 2.5 billion KWH DTEK RES' projected annual green electricity supply is sufficient to provide electricity to more than 1.2 million households; - Botievska WPP and Primorska WPP are the most powerful wind power plants in Ukraine; - Pokrovska SPP and the Nikopolska SPP are among the five largest solar parks in Europe; - 5.2 million tons of CO2 avoided due to the operation of company's wind and solar power plants during the eight years

Source: compiled by authors according to UN Global Compact Network Ukraine (2020), 16)

DTEK RES is one of the largest investors in the green energy sector in Ukraine. Each company project contributes to achieving the global goal of the country - the decarbonization of the economy. More than 307 million UAH DTEK invested into infrastructure modernisation with renewable energy installations.

CHAPTER 3 SUSTAINABLE DEVELOPMENT GOAL 9 "INDUSTRY, INNOVATION AND INFRASTRUCTURE" FINANCIAL AND RESEARCH GAP

3.1 Sustainable Development Goal 9 and financing: scientific landscape in Scopus by SciVal metrics

During the covered period of 2016-2021 years, static analysis of Sustainable Development Goal 9 and Financing presented in the scientific literature (Table 3.1) indicates poor attention to the financial aspects of Sustainable Development Goal 9 achievement. Among 600K+ publications worldwide, only five are related to financing issues. The situation is even worse for private and public finance: only 4 and 3 papers respectively. This problem is also proved by the number of citations in Sustainable Development Goal 9 related literature dealing with financing worldwide.

Table 3.1. Static analysis of Sustainable Development Goal 9 and Financing coverage in A literature over the period 2015-2021 as at 10/07/2021

Research area	Topics	Topics cluster	Publications worldwide	Citation worldwide
SDG 9	443 35	1 466	623 621	6 784 904
SDG 9 Financing	5	5	5	10
SDG 9 and private finance	4	4	4	23
SDG 9 and public finance	3	3	3	20

Source: compiled by authors via SciVal by Elsevier

Dynamic analysis of Sustainable Development Goal 9 and Financing coverage in literature over the period 2016-2021

indicates weak tendencies in financing issues (Table 3.2). The overall number of published papers has positive dynamics, but the number of citations is steadily decreasing. For financial coverage, tendencies are poorly stable: mostly presented with one paper annually during the last three years. The most active citation in financing coverage related to Sustainable Development Goal 9 corresponds to the 2019 year.

Table 3.2. Dynamic analysis of Sustainable Development Goal 9 and Financing coverage in A literature over the period 2015-2021 as at 10/07/2021

	Overall	2015	2016	2017	2018	2019	2020	2021
SDG 9								
Output	623661	51850	58585	66552	75095	87039	94341	42823
Cite	6784904	786148	807447	770054	707894	508536	264507	31543
SDG 9 AND Financing								
Output	5	0	0	0	0	1	1	3
Cite	10	0	0	0	0	8	1	1
SDG 9 AND Public finance								
Output	3	0	0	0	0	2	1	0
Cite	20	0	0	0	0	19	1	0
SDG 9 AND Private finance								
Output	4	0	0	0	1	1	1	1
Cite	23	0	0	0	0	8	15	0

Such slightest interest in the financial issues related to Sustainable Development Goal 9 could be explained by the fact that Sustainable Development Goal 9 is mostly presented in such subject areas as Engineering (22.8%), Computer science (11.4%), Materials science (8.7%) and other related spheres (Figure 3.1).

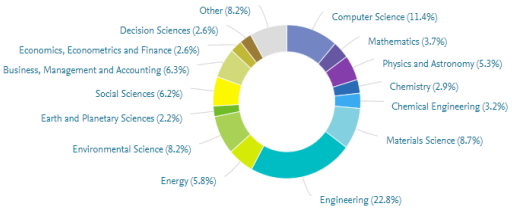


Figure 3.1. Structural analysis by subject area for the case of "Sustainable Development Goal 9"

A different picture can be seen from analysing the top subjects and relevant subject areas of Sustainable Development Goal 9 and Financing (Table 3.3). The financial coverage of Sustainable Development Goal 9 is mainly related to Economics, Econometrics and Finance area, which possesses first place in all three mentioned directions.

Table 3.3. Top subjects and relevant economic subject areas of Sustainable Development Goal 9 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 9 and Financing		SDG 9 and Private Finance		SDG 9 and Public Finance	
	Area	%	Area	%	Area	%
1	Economics, Econometrics and Finance	26.7	Economics, Econometrics and Finance	22.0	Economics, Econometrics and Finance	25.0
2	Business, Management and Accounting	20.0	Social Sciences	22.0	Engineering	25.0
3	Engineering	20.0	Engineering	11.0	Social Sciences	12.5
4	Social Sciences	13.3	Business, Management and Accounting	11.0	Business, Management and Accounting	12.5
5	Computer Sciences	6.7	Computer Sciences	11.0	Computer Sciences	12.5

continued Table 3.3

6	Environmental sciences	6.7	Medicine	11.0	Medicine	12.5
7	Energy	6.7	-	-	-	-

The analysis of top institutions, countries and sectors (Table 3.4) claims the incising role of Chinese government institutions, which contributed to the financing coverage of Sustainable Development Goal 9. As for Sustainable Development Goal 9 and public/private finance, top institutions are from India, United States and Switzerland.

Table 3.4. Top institutions (I), countries (C) and sectors (S) of Sustainable Development Goal 9 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 9 and Financing			SDG 9 and Private Finance			SDG 9 and Public Finance		
	I	S	C	I	S	C	I	S	C
1	Chinese Academy of Sciences	G	China	Jadavpur University	A	India	Jadavpur University	A	India
2	Ministry of Education, China	G	China	University of California at Berkeley	A	United States	University of Basel	A	Switzerland
3	CNRS	G	France	Covenant University	A	Nigeria	World Health Organization	G	Switzerland
4	Tsinghua University	A	China	Datta Meghe Institute of Medical Sciences	A	India	Swiss Tropical and Public Health Institute	G	Switzerland
5	University of Chinese Academy of Sciences	A	China				University of California at Berkeley	A	United States

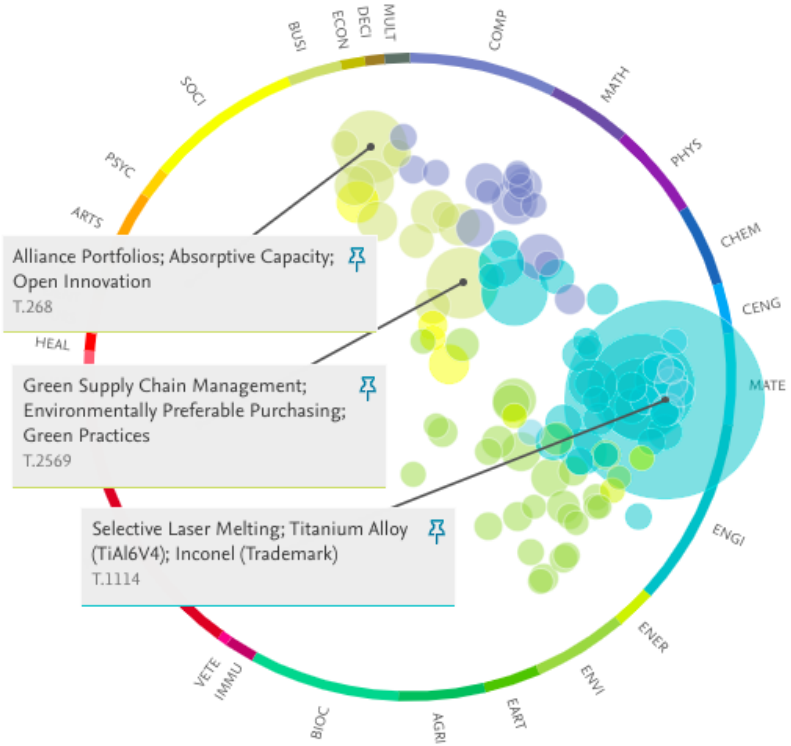
G – Government, A – Academic

An exciting finding was obtained from the analysis of the list of top journals (Table 3.5). Sustainable Development Goal 9 and Financing topics are explored by journals “The Lancet” and “The Lancet Global Health”, most typical for health-related topics. This indicates the interrelation among different research areas.

Table 3.5. Top Scopus journals in Sustainable Development Goal 9 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 9 and Financing		SDG 9 and Private Finance		SDG 9 and Public Finance	
	Journal	Output / Citation	Journal	Output / Citation	Journal	Output / Citation
1	Journal of Cleaner Production	1 (0)	The Lancet	1 (15)	The Lancet Global Health	1 (11)
2	Technological and Economic Development of Economy	1 (1)	Banks and Bank Systems	1 (0)	Development Engineering	1 (8)
3	Banks and Bank Systems	1 (0)	Development Engineering	1 (8)	Innovations for Metropolitan Areas	1 (1)
4	Development Engineering	1 (8)	Society of Petroleum Engineers - SPE	1 (0)	-	-
5	Innovations for Metropolitan Areas	1 (1)	-	-	-	-

The highest publication Share for Sustainable Development Goal 9 in 2021 (Figure 3.2) are presenting such topics as “Selective Laser Melting; Titanium Alloy; Inconel” (with a publication share of more than 87%).



Note COMP Computer Science; MATH Mathematics; PHYS Physics and Astronomy; CHEM Chemistry; CENG Chemical Engineering; MATE Materials Science; ENGI Engineering; ENER Energy; ENVI Environmental Science; EART Earth and Planetary Sciences; AGRI Agricultural and Biological Sciences; BIOC Biochemistry, Genetics and Molecular Biology; IMMU Immunology and Microbiology; VETE Veterinary; MEDI Medicine; PHAR Pharmacology, Toxicology and Pharmaceutics; HEAL Health Professions; NURS Nursing; DENT Dentistry; NEUR Neuroscience; ARTS Arts and Humanities; PSYC Psychology; SOCI Social Sciences; BUSI; Business, Management and Accounting ECON Economics, Econometrics and Finance; DECI Decision Sciences; MULT Multidisciplinary.

Figure 3.2. Top 1% Topics for Sustainable Development Goal 9 in 2021

Source: compiled by authors via SciVal by Elsevier

The word cloud showing the top 50 keywords and key phrases for this research area indicate the lack of special economic academic literature publications for Sustainable Development Goal 9 (Figure 3.3).

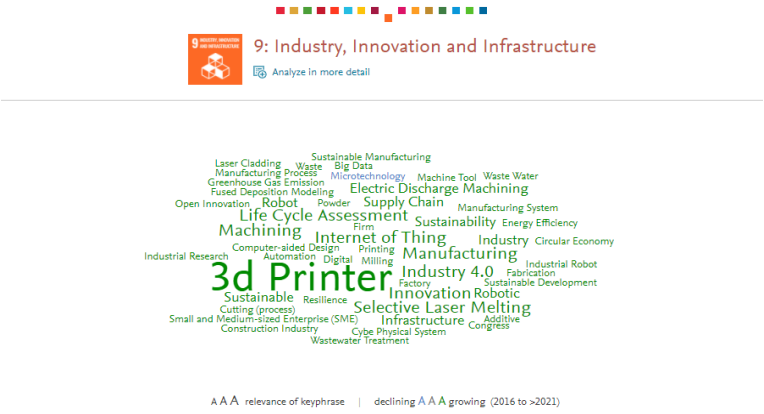


Figure 3.3. Results for key phrases analysis for Sustainable Development Goal 9 2016 to 2020

Source: compiled by authors via SciVal by Elsevier

There are some positive changes in the financing coverage of Sustainable Development Goal 9 detected from the analysis of newly emerged topics for Sustainable Development Goal 9 in 2021 (Figure 3.4). The analysis showed that publications in economic journals for Sustainable Development Goal 9 are presented in terms of Financial Markets; Volatility; COVID-19, Exchange rates; Prices etc.

Figure 3.4. Newly emerged Topics for Sustainable Development Goal 9 in 2021

Source: compiled by authors via SciVal by Elsevier

Table 3.6 presents top research areas cluster by prominence percentile for financing coverage in the case of Sustainable Development Goal 9. The highest publication shares and scholarly output for Sustainable Development Goal 9 and Financing presented by the topic cluster “Electricity, Energy, Economics”. The same is relevant for the case of Sustainable Development Goal 9 and Public Finance. Sustainable Development Goal 9 and Private Finance is mostly presented

within the topic cluster Ozonization; Degradation; Wastewater Treatment.

Table 3.6. Top research areas clusters by prominence percentile in Sustainable Development Goal 9 and Financing over the period 2016-2021 as at 10/07/2021

№	SDG 9 and Financing		SDG 9 and Private Finance		SDG 9 and Public Finance	
	Cluster	%	Cluster	%	Cluster	%
1	Electricity; Energy; Economics	99.264	Ozonization; Degradation; Wastewater Treatment	99.064	Electricity; Energy; Economics	99.264
2	Ozonization; Degradation; Wastewater Treatment	99.064	Health; Delivery of Health Care; Women	81.003	Ozonization; Degradation; Wastewater Treatment	99.064
3	Industry; Innovation; Entrepreneurship	98.997	Carbon Capture; Shale; Storage (Materials)	75.251	Health; Delivery Of Health Care; Women	81.003
4	Poverty; Inequality; Development	42.609	Environmental Impact Assessment; Environmental Assessment; Strategic Environmental Assessment	35.719	-	-
5	Environmental Impact Assessment; Environmental Assessment; Strategic Environmental Assessment	35.719	-	-	-	-

The list of the most relevant papers in Sustainable Development Goal 9 and Financing Coverage based on Scopus and SciVal is presented in Table 3.7.

Table 3.7. List of the most relevant papers in Sustainable Development Goal 9 and Financing Coverage based on Scopus and SciVal

№	Authors (Year)	Bibliometric	Cite
1	Bocken, N.M.P., Short, S.W. (2021)	Unsustainable business models – Recognising and resolving institutionalised social and environmental harm. *Journal of Cleaner Production*, 312.	0
2	Amadi, A., Adetiloye, K., Babajide, A., Amadi, I. (2021)	Banking system stability: A prerequisite for financing the sdg(s) in Nigeria. *Banks and Bank Systems*, 16(2), pp. 103-118.	0
3	Ziolo, M., Bak, I., Cheba, K. (2021)	The role of sustainable finance in achieving SDG(s): Does it work *Technological and Economic Development of Economy*, 27(1), pp. 45-70.	1
4	Da Costa, L. C., Popović, T. (2020)	Financing sustainable infrastructures in a smart cities context -innovative concepts, solutions and instruments. *Innovations for metropolitan areas: Intelligent solutions for mobility, logistics and infrastructure designed for citizens*, pp. 229-243.	1
5	Mire, R., Depraz, S., Collacott, B., Collins, A. (2018)	Sustainable development goal(s) atlas. *Paper presented at the Society of Petroleum Engineers - SPE International Conference and Exhibition on Health, Safety, Security, Environment, and Social Responsibility*.	0

Bocken & Short (2021) identified unsustainable business model types in different sectors and their influence on the progress of the Sustainable Development Goal(s). The potential business solutions were suggested according to each archetype of the listed unsustainable business model.

Amadi et al. (2021) studied the influence of the banking system stability on the achievement of Sustainable Development Goal(s), in particular Sustainable Development Goal 9. The

study suggests that this influence is interconnected. This means that providing loans for sustainable enterprises and Sustainable Development Goal(s) development will enhance banking system stability.

Ziolo et al. (2021) estimated the connection between sustainable finance and Sustainable Development Goal(s) achievement. The study findings indicate that the finance models must also be more sustainable to enhance the implementation of Sustainable Development Goal(s). A good connection between the sustainable finance model and social, environmental and economic sustainability was found.

Mire et al. (2018) concentrated their attention on the possible contribution of the oil and gas industry to Sustainable Development Goal(s) implementation. Based on Mire et al. (2018) incorporation of Sustainable Development Goal(s) into business, developing partnerships with governments, civil society, the private sector and other stakeholders will ensure the Sustainable Development Goal(s) achievement.

3.2 Sustainable Development Goal 9 and financing: scientific landscape in WoS by in-built metrics

The analysis of Sustainable Development Goal 9 and Financing coverage in the scientific literature through WoS in-built metrics gives additional evidence of poor diapason of finance issues in this field. Based on the dynamic analysis of Sustainable Development Goal 9 and Financing coverage in literature over the period 2015-2021 (Table 3.8), only two papers are concentrated on the financial aspects of Sustainable Development Goal 9.

Table 3.8. Dynamic analysis of Sustainable Development Goal 9 and Financing coverage in literature over the period 2015-2021 as at 10/07/2021

	Overall	2015	2016	2017	2018	2019	2020	2021
SDG 9								
Output	46	0	0	1	3	3	22	17
Cite	228	0	0	0	0	0	80	148
SDG 9 AND Financing								
Output	2	0	0	0	0		1	1
Cite	0	0	0	0	0	0	0	0
SDG 9 AND Public finance								
Output	0	0	0	0	0	0	0	0
Cite	0	0	0	0	0	0	0	0
SDG 9 AND Private finance								
Output	0	0	0	0	0	0	0	0
Cite	0	0	0	0	0	0	0	0

Structural analysis by research areas for the case of “Sustainable Development Goal 9” (Table 3.9) provides key research areas: “Science Technology” “Environmental Sciences Ecology” (41.3% and 39.1% respectively). Business Economics has a share of only 15.2%.

Table 3.9. Structural analysis by research areas for the case of “Sustainable Development Goal 9” over the period 2015-2021 as at 10/07/2021

№	Research areas	SDG 9 publications selected from Web of Science Core Collection	
		Record count	%
1	Science Technology	19	41.3
2	Environmental Sciences Ecology	18	39.1
3	Engineering	14	30.4
4	Business Economics	7	15.2
5	Energy Fuels	4	8.7
6	Materials Science	4	8.7

The financing coverage of Sustainable Development Goal 9 in WoS database is presented by two papers (Table 3.10), which shows the existing research gap in this field.

Table 3.10. List of papers based on Bibliometric map of publications concerning Sustainable Development Goal 9 and Financing

№	Authors (Year)	Bibliometric	Cite
1	Ulbrych, M. (2020)	Progress in Achieving Sustainable Industrial Development–the Case of the Czech Republic and Poland. *Comparative Economic Research. Central and Eastern Europe*, 23(4), pp. 109-128.	0
2	Labbate, R., Silva, R. F., Rampasso, I. S., Anholon, R., Quelhas, O. L. G., Leal Filho, W. (2021)	Business models towards SDGs: the barriers for operationalizing Product-Service System (PSS) in Brazil. *International Journal of Sustainable Development & World Ecology*, 28(4), pp. 350-359.	0

The list of papers based on a Bibliometric map of publications concerning Sustainable Development Goal 9 and Financing in WoS database covers the Czech Republic, Poland and Brazil.

Thus, Ulbrych (2020) investigated issues of sustainable industrial development and estimated the progress in Sustainable Development Goal 9 targets achievement in the Czech Republic and Poland over the period 2000–2018. The author claimed that promoting inclusive and sustainable industrialisation will support a competitive economy, decrease unemployment and protect the environment.

Labbate et al. (2021) analysed the barriers observed in implementing product-service systems business models in Brazil. Obtained results indicated that among main barriers in Brazil can be mentioned: resistance to change to innovative business models and lack of necessary management skills to operate such models.

3.3 Sustainable Development Goal 9 and financing: scientific landscape in Google Scholar by Publish or Perish

Static analysis of Sustainable Development Goal 9 and its financing coverage in Google Scholar over the period 2016-2021 showed great interest in the financial issues related to Sustainable Development Goal 9. The number of papers related to Sustainable Development Goal 9 and financing covers more than 80% of the available number of papers within the frames of Sustainable Development Goal 9 topic. The number of citations for financial aspects of Sustainable Development Goal 9 is five times less than the overall Sustainable Development Goal 9 query. This indicates the need for further development of the studies in this field. This fact is also proven by the number of cites per paper, h- and g-indices.

The researcher's attention to such specific aspects of financing like private and public finance is almost equal and presented in the scientific literature deficiently (Table 3.11).

Table 3.11. Static analysis of Sustainable Development Goal 9 and Sustainable Development Goal 9 and Financing Queries over the period 2016-2021 as of 10/07/2021 (among most cited 1000 studies)

№	Metrics	SDG 9		SDG 9 and Financing		SDG 9 and Private Finance	SDG 9 and Public Finance
		Key words	Title and key words	Key words	Title and key words	Title and key words	
1	Papers	940	21	780	11	12	14
2	Citation	37404	40	7001	29	28	29
3	Cites per year	7480.80	20.00	1400.20	14.50	14	14.50
4	Cites per paper	39.79	1.90	8.98	2.64	2.33	2.07

continued Table 3.11

5	Author paper	3.40	2.43	2.45	2.27	2.00	2.21
6	h-index	82	3	40	2	2	2
7	g-index	152	6	68	5	5	5

Source: compiled by authors via Publish or Perish

Dynamic analysis of Sustainable Development Goal 9 and Financing coverage in scientific literature based on Google Scholar Data over the period 2016-2021 concludes the increase of the interest in the Sustainable Development Goal 9 in general and its financial aspects in particular (Figure 3.5). However, research activity in financing issues of Sustainable Development Goal 9 is less than ⅓ of an overall number of Sustainable Development Goal 9 related studies.

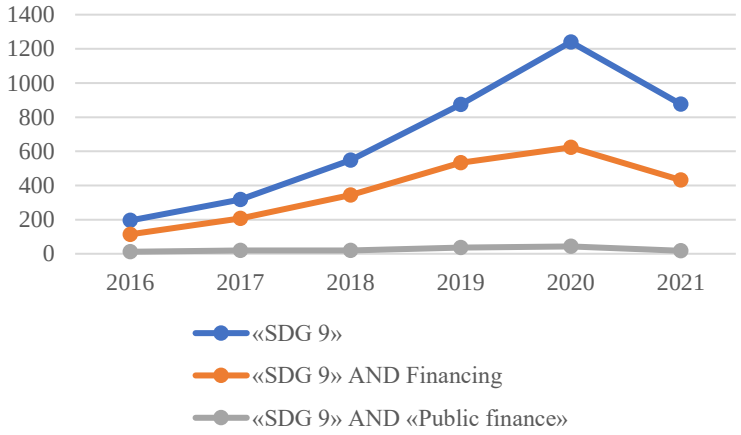


Figure 3.5. Dynamic analysis of Sustainable Development Goal 9 and Financing coverage in a literature over the period 2016-2021 as at 10/07/2021

Source: compiled by authors via Google Scholar

A list of the papers in Sustainable Development Goal 9 and Financing Coverage based on Publish or Perish is in Table 3.12.

Table 3.12. List of the most relevant papers in Sustainable Development Goal 9 and Financing Coverage based on Publish or Perish

№	Authors (Year)	Bibliometric	Cite
1	P. Kynčlova, S. Upadhyaya, T. Nice (2020)	The composite index to achieve Sustainable SDG 9 industry-related targets: The SDG-9 index. *Applied Energy, 265*.	22
2	S. Saha, P. Shaw (2019)	Revisiting Industrialisation and Innovation in India: Roadmap for SDG 9. In *2030 Agenda and India: Moving from Quantity to Quality*. Springer, Singapore, pp. 41-64.	1
3	A. J. Baita, H. H. Suleiman (2021)	Sukuk and SDG 9 "Industry, Innovation and Infrastructure" in Sub-Saharan Africa: Achievements, Challenges and Opportunities. *Springer Books*, pp. 599-620.	0
4	I. B. Franco, F. G. Arduz, J. A. Buitrago (2020)	SDG 9 Industry, Innovation, and Infrastructure. In *Actioning the Global Goals for Local Impact.* Springer, Singapore, pp. 135-151.	0
5	S. Mujalde, M. S. Bairagi (2019)	Analysis of Infrastructure Building Policies in India: Meeting SDG 9.	0
6	S. Castle, D. Bornman (2021)	Exploring Leadership Capabilities in a Multi-Sector Road Infrastructure and Innovation (SDG 9) Partnership (SDG 17) in South Africa. In *Sustainable Development Goals for Society Vol. 1*, Springer, Cham, pp. 107-120.	0
7	K. McDave, A. Hackman-Aidoo (2021)	Africa and SDG 9: Toward a Framework for Development Through Intellectual Property. *US-China L. Rev., 18*, 12.	0

Kynčlova et al. (2020) suggested the approach based on an index to measure progress towards Sustainable Development Goal 9 achievement. The study covers 128 countries over the period 2000–2016. This approach measures the level of a country's industrialization and promotes social inclusiveness and decreasing environmental impacts.

Saha & Shaw (2019) and Mujalde & Bairagi (2019) studied Sustainable Development Goal 9 in the Indian context. Saha & Shaw (2019) proposed the redirection of industrialisation in India through developing knowledge capacities to implement fast-moving industrial borders, taking into account urgent priorities and prospects. The research indicated that indicators relevant to Sustainable Development Goal 9 would act as a framework to enhance the measurement of the progress on industrialisation in India.

Mujalde & Bairagi (2019) analysed the infrastructure building and growth of highways in India and the influence of Sustainable Development Goal 9 introduction on these processes. Authors concluded that Sustainable Development Goal(s) introduction stimulated a significant increase in the Indian highways, financed equally from private and public sources.

Franco et al. (2020) investigated the nature and importance of small-scale mining in terms of Sustainable Development Goal 9 achievement. The scholars presented a capacity-building roadmap for small-scale mining for a Bolivian case study.

Sustainable Development Goal 9 in case studies in Africa were explored by many scholars (Baita & Suleiman, 2021; Castle & Bornman, 2021; McDave & Hackman-Aidoo, 2021).

Baita & Suleiman (2021) analysed the role of the Islamic bond instrument (sukuk) in delivering Sustainable Development Goal 9 in sub-Saharan Africa. The authors claimed that public financing of Sustainable Development Goal(s) is insufficient and that funding needs to introduce alternative financing instruments. Sukuk could be used to cut the financial gap in Sustainable Development Goal 9 in sub-Saharan Africa. Castle & Bornman (2021) focused on leadership theories, which enabled the successful implementation of a multi-sector partnership linking to Sustainable Development Goal 9 in South

Africa. McDave & Hackman-Aidoo (2021) dedicated their study to the comprehensive analysis of Sustainable Development Goal 9 targets achievement through developing of an efficient intellectual property system.

3.4 Sustainable Development Goal 9 and financing: clusterization in VosViewer

Based on Scopus and SciVal data, a bibliometric map by keywords related to Sustainable Development Goal 9 was created (Figure 3.6). As can be seen, keywords are grouped in four clusters: economics, economic development, economic and social effects etc. There is no mention concerning financing, public or private financing. This evidence favours a lack of attention to these aspects in the academic literature on Sustainable Development Goal 9.

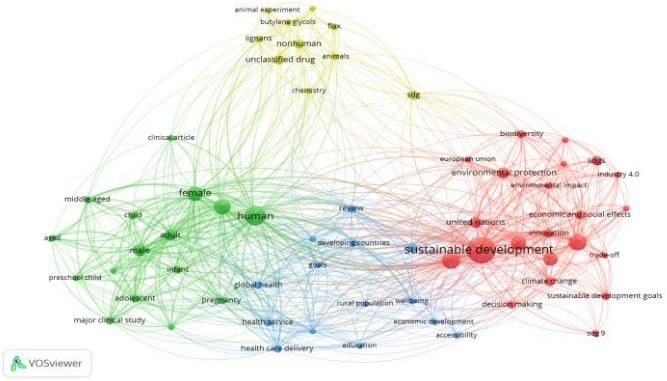


Figure 3.6. Bibliometric map of publications concerning Sustainable Development Goal 9 by keywords (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

Relevant clusters in the bibliometric map of publications concerning Sustainable Development Goal 9 (in order of significance) are in Table 3.13. As can be seen, the central cluster Red (Sustainable Development Goal – environmental) has no keywords related to financing or investment. This is indirect evidence in favour of the ignorance of the financial gap in Sustainable Development Goal 9 academic research

Table 3.13. Relevant clusters in the bibliometric map of publications concerning Sustainable Development Goal 9 (in order of significance)

№	Cluster	Key words
1	Red (SDG - environmental)	Sustainable development, sustainable development goals, industry 4.0, environmental protection, environmental impact
2	Blue	Economic development, well-being, developing countries, accessibility

Other clusters (green and yellow) are irrelevant for Sustainable Development Goal 9 investigation by the most frequent keywords.

The bibliometric map of publications concerning Sustainable Development Goal 9 and financial coverage by keywords (Figure 3.7) shows an interconnection within the economic context of the determined research question. Keywords are grouped in two clusters with a central point in planning and sustainable development.

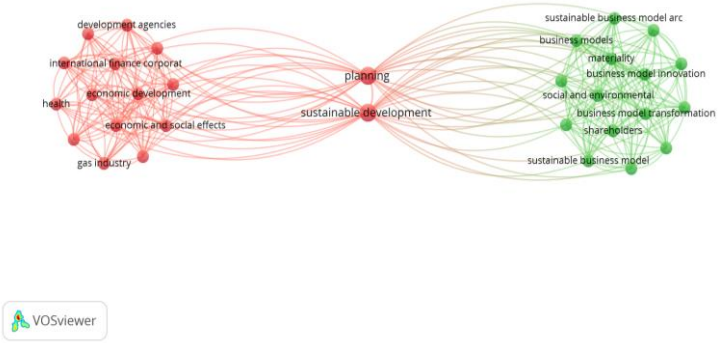


Figure 3.7. Bibliometric map of publications concerning Sustainable Development Goal 9 and Financial Coverage by keywords (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

A bibliometric map of publications concerning Sustainable Development Goal 9 by keywords based on data from WoS presents a different picture (Figure 3.8). Obtained results indicate the existence of many small clusters with a weak connection between them. There is also no mention concerning public or private financing in the bibliometric map of publications built on WoS data.

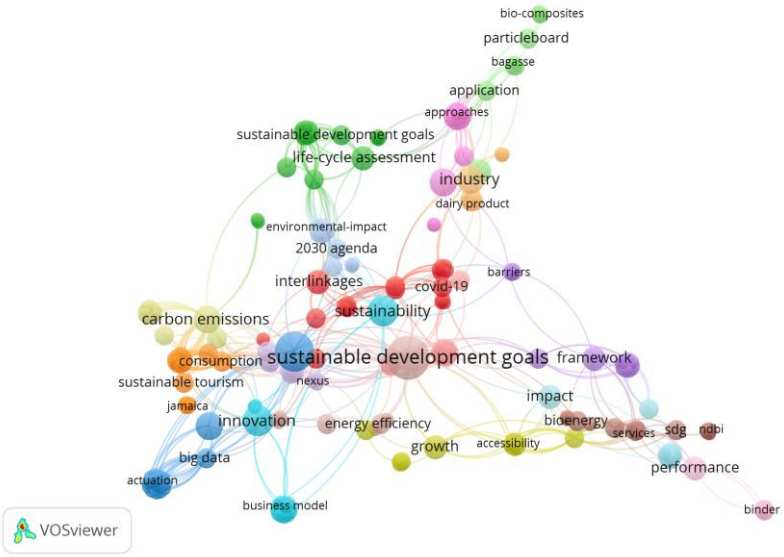


Figure 3.8. Bibliometric map of publications concerning Sustainable Development Goal 9 by keywords (data from WoS)
Source: compiled by authors via VosViewer

Bibliometric map of Sustainable Development Goal 9 related publications by authors provides the key names in this sphere based on Scopus and SciVal (Figure 3.9), WoS (Figure 3.10) and Publish or Perish data (Figure 3.11).

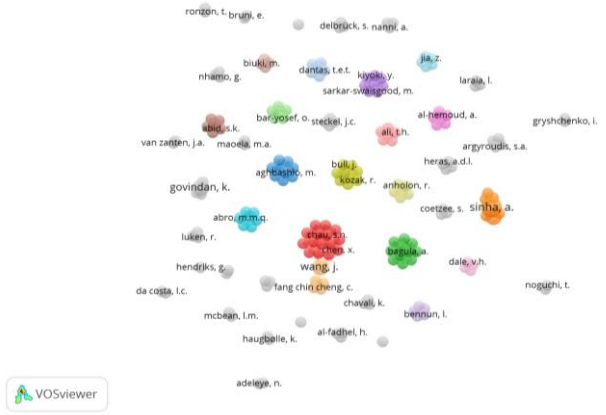


Figure 3.9. Bibliometric map of publications concerning Sustainable Development Goal 9 by authors (data from Scopus and SciVal)

Source: compiled by authors via VosViewer

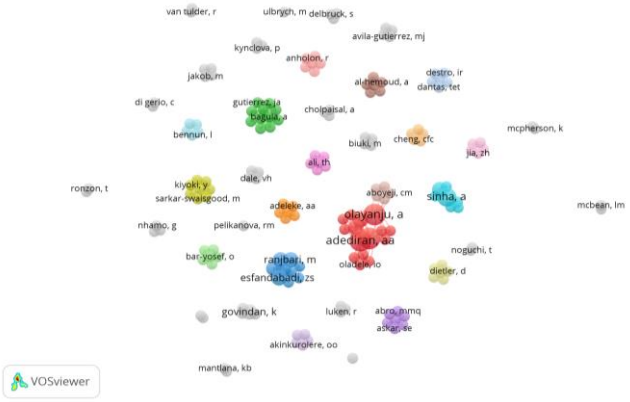


Figure 3.10. Bibliometric map of publications concerning Sustainable Development Goal 9 by authors (data from WoS)

Source: compiled by authors via VosViewer

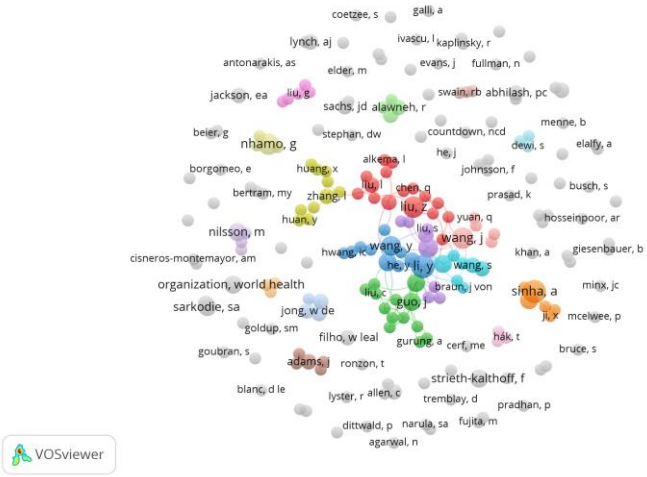


Figure 3.11. Bibliometric map of publications concerning Sustainable Development Goal 9 by authors (data from Publish or Perish)

Harzing, A. W. (2007). Publish or Perish, available from https://harzing.com/resources/publish-or-perish

Source: compiled by authors via VosViewer

3.5 Informational support for Sustainable Development Goal 9 and bridging financial gap via Google instruments

Internet queries concerning Sustainable Development Goal 9, Private Finance and Public Finance in 2015-2021 show no tendency in interest to these issues among Internet users (Figure 3.12).

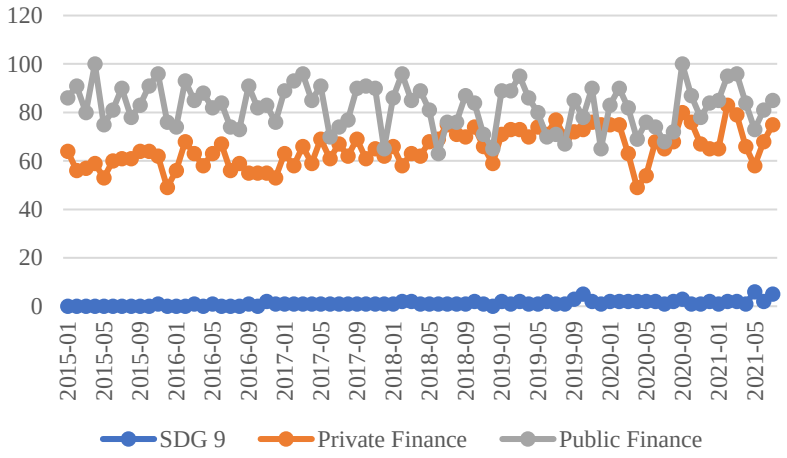


Figure 3.12. Internet queries concerning Sustainable Development Goal 9, Private Finance and Public Finance in 2015-2021 as of 10/07/2021

Source: compiled by authors via Google trends (https://bit.ly/3wrTq8I)

Internet users' interest in search queries concerning Sustainable Development Goal 9 analysed by countries (Figure 3.13) indicates a poor interest in Sustainable Development Goal 9. Internet users from India are more interested in private finance, users from the Philippines and United States are concentrated on public finance. The search queries concerning Sustainable Development Goal 9 are mostly presented in the Philippines and Netherlands.

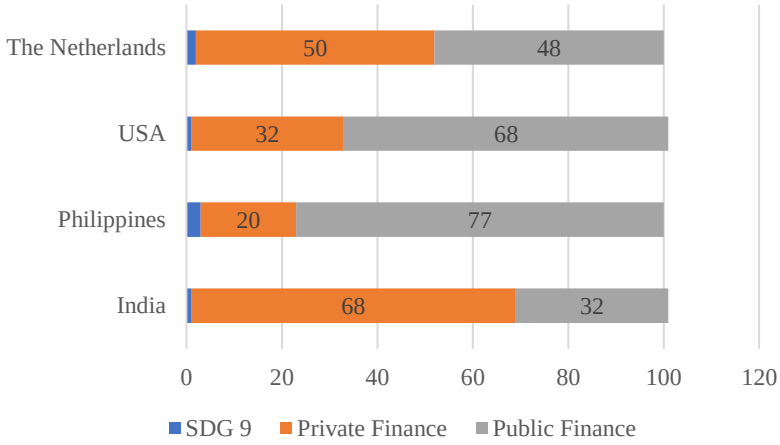


Figure 3.13. The level of Internet users' interest in search queries concerning Sustainable Development Goal 9, Private Finance and Public Finance in 2015-2021: top 5 countries, % as of 10/07/2021

Source: compiled by authors via Google trends (https://bit.ly/3wrTq8I)

The overall number of Internet queries concerning Sustainable Development Goal 9 is much lower than public and private finance. It can be explained by the time of adoption of Sustainable Development Goal(s) (2015). This assumption is confirmed by the Ngrams concerning Sustainable Development Goal 9 and Private Finance (Figure 3.14) and Public Finance in 1900-2019 (Figure 3.15).

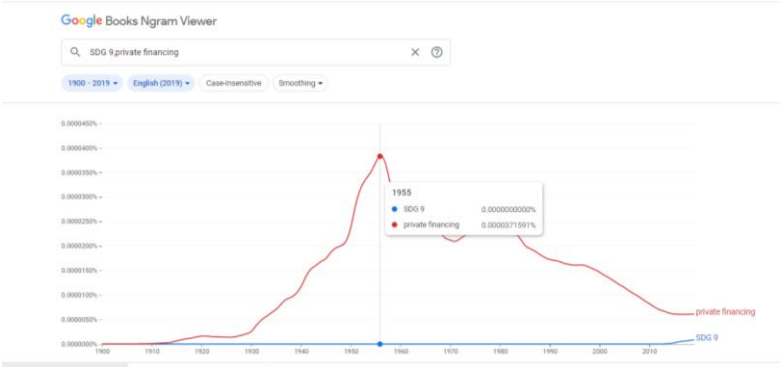


Figure 3.14. Ngram concerning Sustainable Development Goal 9 and Private Finance in 1900-2019 as of 10/07/2021

Source: compiled by authors via Google Books Ngram Viewer https://bit.ly/3i0wMPu

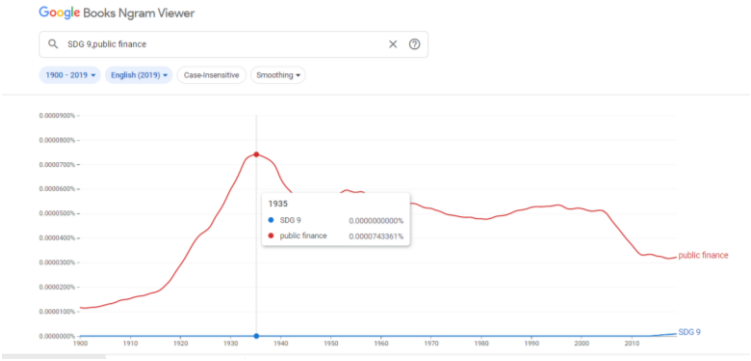


Figure 3.15. Ngram concerning Sustainable Development Goal 9 and Public Finance in 1900-2019 as of 10/07/2021

Source: compiled by authors via Google Books Ngram Viewer https://bit.ly/3xwWphC

Table 3.14 provides examples of sources in each research area, generated via Google Public Data Explorer. There are only 3 data sets available for Sustainable Development Goal 9 and Financing, and only 1 data set was found for public and private finance for Sustainable Development Goal 9. Information on last data updating indicates that these sources present the actual information concerning financing issues of Sustainable Development Goal 9.

Table 3.14. Examples of sources in each research area, generated via Google Public Data Explorer as of 10/07/2021

SDG 9 and Financing (3 data sets found)		SDG 9 and Private Finance (1 data set found)	SDG 9 and Public Finance (1 data set found)
Data set	Updating	Data set	Updating
UN DESA Statistics Division (2020). Indicator 9.3.2: Proportion of small-scale industries with a loan or line of credit (percent) [Dataset]. https://www.sdg.org/datasets/750c539296f64ca3b37b89818ad0392a	Aug 17, 2020	United Nations Environment Programme (2021). World Environment Situation Database [Dataset]. https://knoema.com/UNEPWESD2021/world-environment-situation-database	May 6, 2021

3.6 Empirical evidence of Sustainable Development Goal 9 implementation and finance: case of Ukrainian companies

Sustainable Development Goal 9 “Industry, Innovation and Infrastructure” was presented by 1 case at the “CSR Ukraine” competition in 2016–2019.

In the non-financial reports of the largest Ukrainian companies, there are 48 mentions of these companies' indicators, projects, and progress within the Sustainable Development Goal 9.

Analysing the practices of corporate social responsibility to achieve the Sustainable Development Goal(s) by Ukrainian companies in 2016-2019, presented in the reports, it should be noted that specific to Sustainable Development Goal 9 “Industry, Innovation and Infrastructure” are projects for the development of social and sports infrastructure and competitions of innovative ideas.

In particular, within the Concept of Sustainable Development, Ukrgasbank directs its activities to support the development of Ukraine's economy by promoting the development of strategic sectors of the economy, as well as small and medium-sized businesses, while declaring the achievement of Sustainable Development Goals 9 and 8.

Detailed descriptions of projects for implementing the Sustainable Development Goal 9 (Table 3.15) are presented in UN Global Compact Network Ukraine (2020).

Table 3.15. Description of the projects towards progress in Sustainable Development Goal 9 “Industry, Innovation and infrastructure”

Parameter	Case 1	Case 2
Project	Increase access to high-speed mobile internet and telecommunication technologies in Ukraine	Experience in implementing energy-efficient solutions for reducing the use of natural resources and atmospheric emissions
SDG 9 target	9.1: Develop quality, reliable, sustainable and resilient infrastructure with regional and transborder infrastructure, to support economic development and human well-being.	
	9.c: Significantly increase access to information and communications technology to provide universal and affordable access to the Internet in the least developed countries by 2020.	-
Criteria	Social	Social, Environmental

continued Table 3.15

Company	Kyivstar	-
Number of partners	More than 10	More than 1000
Area	Ukraine	Caparol Ukraina SE
Duration	2015- present	2015-2020
Goals	Increase access to information and communications technologies and provide high-speed mobile Internet all over Ukraine.	Reducing the use of natural resources and atmospheric Emissions.
Solution	Since 2015, the company has been implementing 3G, and 4G technologies to provide data transfer services based on a wide range of mobile technologies.	- Long-term project "Warm. Beautiful.Reliable": - optimizes the supply chain to the consumer; - stimulate other players in the manufacturing industry of materials for insulation systems to increase intra-branch standards; - promotes the creation of energy-efficient buildings and constructions in the country.
Results	- Since 2015, the volume of mobile Internet usage in Kyivstar network has increased from 21 to 649 Petabytes with a tendency to its doubling each year. - As of April 2020, 4G network of the national telecom operator Kyivstar covers more than 11,000 settlements (79% of the population of Ukraine lives).	- Shortened the supply chain to ensure the availability of solutions for facades insulation of buildings and constructions, as a part of complex thermal modernization; - Implementation of the investment project to launch new production facilities for the manufacture of dry mixes for façade insulation systems in Ukraine (24 products were introduced for facade insulation systems); - up to 20% increase the efficiency properties of systems

Source: compiled by authors according to (UN Global Compact Network Ukraine. 2020, pp. 20-21)

At the same time, the considered cases and projects of companies regarding Sustainable Development Goal(s) 9, 3 and

7 indicate a lack of business attention to the Sustainable Development Goal(s) and their targets in their activities.

Lack of academic, methodological and financial support for incorporating Sustainable Development Goal(s) (primarily 3, 7 and 9) into corporate strategy and operational management of companies hinders progress towards these goals and requires a radical rethinking of approaches to the implementation of corporate social responsibility.

In particular, the active integration of the Sustainable Development Goal(s) at all levels of corporate governance, in our opinion, involves, first, the development of detailed indicators of progress for each of the relevant Sustainable Development Goal, accountability mechanisms and monitoring of their achievement in close connection with strategic guidelines and mission of the company.

The integration of the Sustainable Development Goal(s) is also needed at the level of supply – production – consumption chains of the company and operating industries with the intensification of efforts and partnerships of stakeholders (academia, government, financial and real sectors).

CONCLUSIONS

Achievement of 17 Sustainable Development Goal(s) (SDGs) and their 169 targets by 2030 is a task of extreme importance both on global and national levels. It allows us to solve the most crucial issues of humanity like global food and sanitary challenges, improving health care systems, irreversible climate change, poverty and gender inequality.

In 2020 because of COIVD-19 pandemic special attention is paid to Sustainable Development Goal 3 "Ensure healthy lives and promote welfare for all at all ages". Inability of national healthcare systems to contradict pandemic reveals serious problems in Sustainable Development Goal 3 progress (United Nations, 2020a, p. 28). One of the key reasons for this is the lack of financial resources. The size of existing investment gap is measured by hundreds of billions of dollars.

Monograph shows that one of the possible reasons for this failure is the absence of adequate academic support to provide theoretical, methodological and analytical background to solve the problem of Sustainable Development Goal 3 financing. To do this a meta-analysis of Sustainable Development Goal 3 and investment literature are provided. Using SciVal Elsevier, VosViewer, Google trends and Google Books Ngram Viewer academic literature over the period 2016-2021 on Sustainable Development Goal 3 and investment is analysed. Based on static, dynamic and cluster analysis of publication activity related to the Sustainable Development Goal 3 there is significant interest in academic literature to the Sustainable Development Goal 3, but it is concentrated on medical aspects. Economic part, including investment, is very poorly represented. This leads to the absence of theoretical support and proper empirical evidence to solve the issue of the lack of financial

resources as a part of wider problem in Sustainable Development Goal 3 achievement.

It can be clearly deduced that there is a research deficit in this economically relevant policy field, which must be made up for to counter the problems. Without viable solutions in the area of financing and investment, there is a risk that the Sustainable Development Goal 3 targets will not be achieved on a large scale, which will particularly affect the population in low- and medium-income countries (Nabukalu et al. 2020; United Nations 2020a, 31). To close the financial gaps and thereby trigger the achievement of Sustainable Development Goal 3, non-governmental sources of funding are needed in addition to public finance (Cerf 2019; United Nations 2019, 32).

A very limited number of papers (less than 0.01% of paper devoted to Sustainable Development Goal 3) discusses the issue of investment and related dimensions. To fill these and other gaps academics should shift the focus of research activity on investment and responsible investment as key elements on the way to Sustainable Development Goal 3 achievement. The most prominent objects of future research are financial and investment instruments to be used (green and energy bonds, ESG-related ETFs etc), efficiency estimations, new financial products and technologies, specifics of investment process and many others which are unexplored yet in the academic literature.

Sustainable Development Goal 7 “Affordable and Clean Energy” is one of the most important among 17 Sustainable Development Goal(s). Timing to achieve these goals is very tough, and the situation has been complicated because of the pandemic and financial gap measured by trillions of dollars. Because financial and investment flows were redirected to solve COVID-19 caused problems.

In addition, the investment support of Sustainable Development Goal 7, especially with the use of responsible

investment instruments is an insufficiently studied topic in academic literature too. The activity of search queries is primarily higher in terms of responsible investing and investment gap, rather than Sustainable Development Goal 7, as well as the representation of this topic in Google Books sources. At the same time, the information and analytical support of Google Public Data Explorer is broader for Sustainable Development Goal 7, than for its investment support.

This situation has negative impact not only on development of scientific approaches to substantiate the most rational investment instruments, including responsible for Sustainable Development Goal 7, but also on the decision-making process of investors and regulators in the energy sector in the context of post-pandemic economic recovery and increased investment in climate-neutral energy technologies.

Bridging the investment gap in achieving Sustainable Development Goal 7 by 2030 is in the field of selection, prioritization, development of a methodology for evaluating the effectiveness of investment instruments in Sustainable Development Goal 7 and econometric modelling of sufficient volume of such responsible investments.

Green bonds, including sovereign ones, are a promising area of responsible investment in Sustainable Development Goal 7. According to UNDP, green bonds not only make it possible to achieve energy or climate targets, but also allow investors to generate income (UNDP (2020). They can be financed at both national and supranational levels from private or public sources.

Using a meta-analysis of Sustainable Development Goal 7 it was found that there is significant interest in academic literature to the Sustainable Development Goal 7 and its achievement: the number of published papers exceeds 1.2 mln, but this interest is extremely narrow from the point of Sustainable Development Goal 7 and investment (less than 0.01% of these papers touches

the issue of financial gap in Sustainable Development Goal 7 achievement).

Static, Dynamic and Structural analysis based on SciVal shows the prevalence of engineering and pure technical issues related to energy generation, distribution etc. Among 50 keywords related to Sustainable Development Goal 7 “investment” or “investment support” are not present at all. Cluster analysis based on In-built Bibliometric map of Sustainable Development Goal 7 related publications showed that investment is situated on the periphery of academic research. Google Trends, Google Books Ngram, and Google Public Data Explorer analysis showed that academic interest in Sustainable Development Goal 7 and investment is increasing over the recent years.

Overall, less than 100 papers among 1 200 000+ Sustainable Development Goal 7 related to the issue of financial gap coverage is a total academic failure. There is no appropriate academic support for the problem measured by trillions of dollars and is one of the key instruments for the Sustainable Development Goal 7 achievement. This paper is the first attempt to activate the academic community to pay more attention to Sustainable Development Goal 7 and investment aspects. The most promising fields and topics include the choice of instruments to fill existing financial gaps (new investment products like green and energy bonds, ESG ETFs, blockchain based instruments and technologies), methodological and empirical support, including econometric models and their efficiency etc.

Sustainable Development Goal 9 “Industry, innovation and infrastructure” is presented in the scientific literature, but indicates poor attention to the financial aspects of Sustainable Development Goal 9 achievement. It was found that among 600K+ publications worldwide, only five are related to

financing issues. The situation is even worse for private and public finance: only 4 and 3 papers respectively.

Such slightest interest in the financial issues related to Sustainable Development Goal 9 could be explained by the fact that Sustainable Development Goal 9 is mostly presented in such subject areas as Engineering, Computer science, Materials science and other related spheres. Unfortunately, the financing coverage of Sustainable Development Goal 9 in WoS database is presented by two papers, which again shows the existing research gap in this field.

On the contrary, static analysis of Sustainable Development Goal 9 and its financing coverage in Google Scholar over the period 2016-2021 showed great interest in the financial issues related to Sustainable Development Goal 9. The number of papers related to Sustainable Development Goal 9 and financing covers more than 80% of the available number of papers within the frames of Sustainable Development Goal 9 topic. The number of citations for financial aspects of Sustainable Development Goal 9 is five times less than the overall Sustainable Development Goal 9 query. This indicates the need for further development of the studies in this field.

Overall, Sustainable Development Goal 9 were explored by many scholars (Baita & Suleiman, 2021; Castle & Bornman, 2021; McDave & Hackman-Aidoo, 2021). It was analysed in case of the role of the bond instrument (Baita & Suleiman (2021), and other alternative financing instruments, developing of an efficient intellectual property system (McDave & Hackman-Aidoo (2021) to cut the financial gap in Sustainable Development Goal 9.

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Bridging the financial and academic gap in key Sustainable Development Goal(s): comprehensive bibliometric analysis

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