D. Amirbekova, PhD, assoc. professor[1]
M. Kussaiyn*, c.e.s., researcher[1]
G. Gafu, PhD, postdoctoral scholar, senior researcher[2]
T. Narbaev, PhD, professor[1]
Kazakh British Technical University, Almaty, Kazakhstan[1]
Nazarbayev University, Astana, Kazakhstan[2]
* – main author (author for correspondence)
e-mail: m.kusaiyn@kbtu.kz

UNIVERSITY SCIENCE AND ECONOMIC GROWTH: REVIEW OF KAZAKHSTAN'S UNIVERSITY SCIENCE PUBLICATIONS IN THE SCOPUS DATABASE IN 1991-2022

This article describes the science publications activity of Kazakhstan's universities and its role in country's economic growth in 1991-2022. The topic of the articlereveals the relevance of government financing related to science and the role of universities to reach stable economic development. In this study, the authors used descriptive statistics method to analyze the publication activity of universities in Kazakhstan. This method contains two steps as data collection and descriptive analysis which describes the research methodology in details. Study found that more than 90% of scientific papers are published by university researchers in Kazakhstan. The data was collected from the Scopus database and official statistical database to analyze the publication activity of universities in Kazakhstan. It includes the number of articles published in 1991-2022 affiliated with Kazakhstan, the top 5 authors with h-index and citation in each 26 subject areas, qualifications of researchers, costs for R&D, GDP, GDP share during 1991-2022 also were analyzed.

According to the results of the study, appropriate conclusions are drawn. The major outcomes of the research indicate that number of publications had increased 190 times in 2022 in comparison to 1991. This has a positive relationship to the GDP spendings on research.

Keywords: science publications, university science, government financing, publication activity, science productivity, qualification of researchers, top authors, cost for Research and Development (R&D), gross domestic product (GDP).

Кілт сөздер: ғылыми басылымдар, университет ғылымы, мемлекеттік қаржыландыру, басылым белсенділігі, ғылым өнімділігі, зерттеушілердің біліктілігі, жетекші авторлар, ғылыми-зерттеу және тәжірибелік-конструкторлық жұмыстарға (ҒЗТКЖ) шығындар, жалпы ішкі өнім (ЖІӨ).

Ключевые слова: научные публикации, университетская наука, государственное финансирование, публикационная активность, продуктивность науки, квалификация исследователей, ведущие авторы, затраты на исследования и разработки (НИОКР), валовой внутренний продукт (ВВП).

Introduction. Economic development of countries is strongly associated with the level of development of education, science and innovative activities. In this regard, the focus on university and university's science as a driving force for economic development was growing. Several developed countries distinguish the role of universities and government financing related to science as a main contributor for not only science development but also stable economic growth. In the Kazakhstan context the major reforms happened since joining the Bologna process, transformation in the requirements for doctoral Ph.D. degrees, requirements for researchers to publish research in the peer-reviewed journals indexed in the Scopus database. However, the issues related to the economic growth and scientific outputs as results of scientific activities should be studied more extensively. There are debates that highlight the complex and multifaceted nature of the role universities play advancing science. With the shift to knowledge economy, the conception of a university as knowledge producers has proliferated. This understanding has mainly been influenced by the successful model of US Research University that occupy top places in world league tables (Chankseliani et al. 2022). Government policies that specifically highlight the importance of science such as «The concept of development of higher education and science in the Republic of Kazakhstan for 2023-2029» focuses on the further development of science, scientific potential and conditions created for new knowledge generation that can be impactful for economic growth through potential commercialization and spin-offs at universities.

Literature review. The focus on university science as a driver of research potential and economic growth has been studied and investigated for several decades through several viewpoints.

Agasisti et al. (2019) explored the role of university science through the economic development and knowledge spillovers that are related to research papers published in peer-reviewed journals. In this regard, universities provide human capital that is skilled to drive economic development. The strategic role of

universities is considered as a contributor to a regional development though shared vision for economic success (Aranguren and Margo, 2020). Strong emphasis on universities bring attention to the relationship that exits for generating innovations and competitive advantage with the critical role of university. In these relationships, universities and academics need to play more active role for alignment in terms of economic growth. Moreover, Brekke (2021) defines universities as centers for knowledge creation and diffusion which makes them a key stakeholder in the process of research development for the needs of society and economic growth. Chaves et al. (2015) investigated innovation system in Brazil that included universities, research institutes and firms. It was identified that universities play a big role in success of any collaborations for the research. Thomas et al. (2021) evaluated innovation systems and identified universities as «orchestrators» for the economic development. In this case, universities take leadership position in building research network that contributes to the economic success. In study by Marozau et al. (2021) countries including Kazakhstan were examined to identify the role of universities for economic development. It was identified that universities have several missions: teaching, research and entrepreneurial. Research showed that human capital that is created at universities contribute and have significant positive effect on economic development. Pastor et al. (2018) explored the contribution of universities to the GDP in European Union countries. This study confirmed that role of universities is critical for research and development, technology transfer, knowledge accumulation and economic development.

There are various national cases that demonstrate government's focus on universities as centers of excellence and innovation. For example, China's remarkable economic growth and emergence as a global technological powerhouse have been closely tied to the expansion of its research universities. Over the past few decades, China's investment in higher education and research has played a significant role in its economic transformation (Bai et al. 2020). Similarly, Singapore has strategically invested in higher education and research to transition into a knowledge-based economy. Their research-intensive universities output and partnerships with industries have contributed significantly to Singapore's economic growth by attracting multinational corporations, encouraging startups, and fostering a culture of innovation (Wong et al. 2007). In Europe, German and Finnish cases of their governments' emphasis on education and innovation has played a crucial role in their economic development too (Markkula & Lappalainen, 2009; Sternberg, 2013). These examples underscore the dynamic relationship between universities, research, and economic development. In each case, strategic investments in education, research, and collaboration with industries have been pivotal in propelling these countries' economic growth and technological advancement.

For post-Soviet countries, including Kazakhstan, universities were teaching centers until after the dissolution of the Soviet Union in 1991 when universities under the pressure of their national economies shift towards knowledge society started transforming and internalizing research mission to predominantly be 'internationally legitimate' in the global knowledge race (Chankseliani et al. 2022). For Kazakhstan, in the way to become a competitive innovation- driven middle-income economy, there have been several important reforms to foster research capacity of universities. One such reform aimed at enhancing university research was shift to research commercialization and the creation of technoparks and business incubators (Radosevic & Myrzakhmet, 2006). Despite other mechanisms implemented at the university level to foster research productivity, there are still shortcomings such as low funding, fragmented university-industry nexus at this aspect of university research development, to name a few.

Another policy emphasis toward increasing university research was a push toward international peer-reviewed publications. Along with this policy imperative, there has been an increasing scholarly focus on exploring publication activities of Kazakhstani researchers conducted by various authors from different perspectives. Some of these identified overall research trends and productivity (Narbayev & Amirbekova, 2021); main trends and factors influencing the increase in scientific productivity at universities (Kudaibergenova et al. 2022); research performance assessment issues as an important aspect of research management and research quality (Alibekova et al., 2021); and problems of integration of Kazakhstani scientists into the global scientific community (Moldashev, Tleuov & Radko, 2018). For example, one of the recent studies by Kudaibergenova et al. (2022) indicate that the scale of the university impacts the research productivity as well as affiliation of the university with international faculty and international co-authorship (p.20).

At the same time, the previous research also suggests that despite the positive trends in the publication activity of Kazakhstani researchers, there still are concerns remaining about the quality and impact of the publications. Moreover, notwithstanding the ongoing policy reforms in Kazakhstan to improve its research environment, scholars argue that the existing challenges such as high teaching and service load, limited access to resources and databases, weak English competency (OECD, 2017), coupled with the lack of

indexing status of local journals, poor research education leading to the lack of research capacity and limited publishing experience hinder the research output of local researchers.

This might indeed be another aspect that does not fully support the argument of the university being a knowledge center in the Kazakh context. As such, the research output or publications in international journals by university research staff remains low positioned 85th among 218 countries by number of publications and citations (108th) (MES cited in Kuzhabekova, 2022). Nevertheless, Kazakhstan's very recent new development agenda, the Concept of Development of Higher Educationa and Research for 2023-2029, still prioritizes university research output in the form of non-zero international impact-factor publications.

The main part. To analyze the publication activity of universities in Kazakhstan, we used descriptive statistics. Table 1 describes the key steps, actions, and results of our study. In Step 1 of the research methodology, we collected the information about the qualification of researchers from official statistical data on education and science [stat.gov.kz] and collected articles published in English language in journals. All those collected articles were published in 1991-2022 and affiliated with Kazakhstan. The Scopus function for the advanced search «AFFILCOUNTRY(KAZAKHSTAN)» and filters as the year of publication (1991-2022), document type (article and review), source type (journal), and language (English) were applied. The search resulted in 27 subject areas and 33,643 articles. We analyzed the total number of publications for each subject area and each year from 1991 to 2022. Then the top 5 authors were identified for each subject area for the period from 1991 till 2022 affiliated with universities in Kazakhstan.

Table 1

Outline of the research approach*

Steps	Actions and Results
1. Data collection	Action: a) in Scopus, source journal articles and reviews with author affiliations as "Kazakhstan", published during 1991-2022, in English; b) in Scopus, source the top 5 authors in journal articles and reviews for each subject area from 1991 till 2022; c) In stat.gov.kz collected data about qualifications of researchers and GDP during 1991 -2022; Results: a) 33,643 records in 27 subject areas; b) the top 5 authors with h-index, number of publications and citation in each 27 subject area; c) qualifications of researchers, costs for R&D and GDP during 1991-2022;
2. Descriptive analysis	Action: a) Analyze distribution by the number of articles for each year separately from 1991 till 2022, in Scopus, source journal articles and reviews with author affiliations as "Kazakhstan", published in 1991 (then 1992 till 2022), in English and select each subject area separately. b) Analyze distribution by the top 5 authors indicating h-index, number of publications and citation for each subject area from 1991 till 2022, in Scopus, source journal articles and reviews with author affiliations as "Kazakhstan", published during 1991-2022, in English. c) Interpret the qualifications of researchers, analyze the relationship of costs for R&D, GDP and the number of publications from 1991 till 2022 Results: a) The distribution of the articles by each subject area for each year from 1991 till 2022 b) The distribution of the top 5 authors with h- index, number of publications and citation for each subject area for each year c) Researchers' qualifications, costs for R&D, GDP, GDP share during 1991-2022;

* Compiled by the authors based on the data

In Step 2, we conducted a descriptive analysis in order to identify the publication activity of Kazakhstan in different subject areas. Articles were analyzed by the number of publications for every 27 subject area from 1991 to 2022 and was identified the top authors of each subject area. The top authors were selected by the criteria of working only at the universities. Descriptive analysis was used to describe the basic characteristics of the collected data and summarize the information about the publication activity of Kazakhstan.

To analyze the publication activity of Kazakhstan, the total number of publications and number of publications in various scientific areas of Kazakhstan from 1991 to 2022 were identified (figure 1). A study of the dynamics of Kazakhstan publications in Scopus database over more than twenty-year period compared shows an annual increase in their number. In the first 10 years, an average increase of 1.5 times. In subsequent years, there has been an increase in the pace of research activity. The total number was 26 publications in 1991 and this indicator reached 4944 publications published in 2022, increased more than 190 times, compared to 1991. Data for the number of publications also was presented in terms of subject areas.

An important characteristic of globalization processes in science is the distribution of publications by language. Publishing articles in English language, allows researchers reach wider research community that contributes to the use of research results and it will help to develop the their recognition. We analyzed the publications of Kazakhstan researchers in English language from 1991 till 2022 to identify the publication activity and their productivity in science. Figure 1 demonstrates overall dynamics of publication activity in Kazakhstan in 1991-2022.
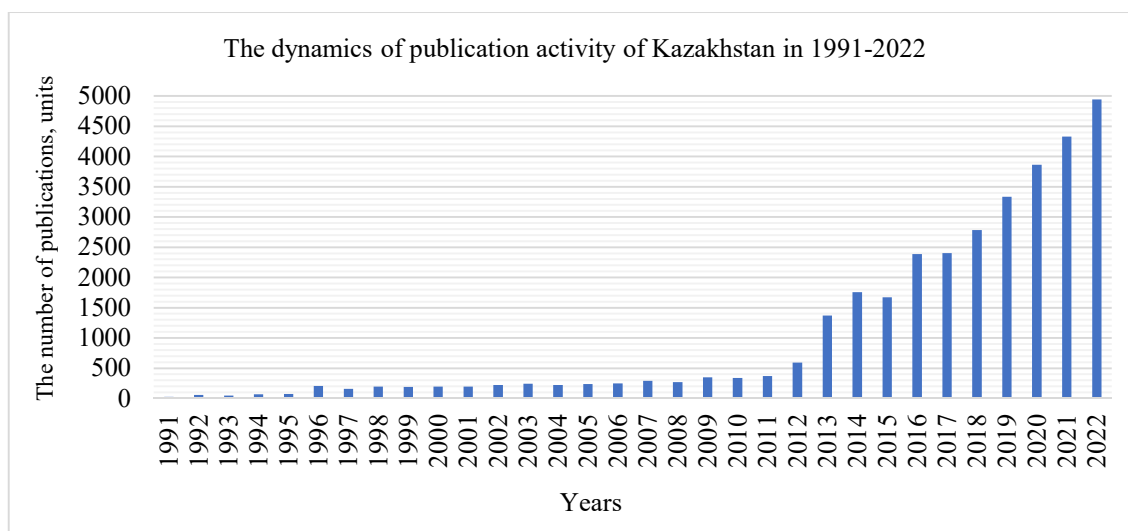

Figure 1. **The dynamics of publication activity of Kazakhstan in 1991-2022***
* Compiled by the authors based on the basis of data from Scopus database

The quality and productivity of scientific research is determined not only by the number of publications, content and methods of conducting and implementing research results, but also by the qualifications of a scientist. The qualification metrics among researchers as Doctor of Science, Doctor by profile, PhD and Candidates of Science were identified to analyze the professional characteristics of the scientists and were presented in Figure 2 below. According to the figure 2 the positive dynamics in the number of highly qualified staff was noted only among PhD doctors from 2010 to 2022 compared to other qualification, the number was increased from 59 till 2462. While dynamics of Doctor by profile qualification was decreased from 1486 in 2011 to 96 in 2022. Since Kazakhstan joined the Bologna process, the higher education system shifted towards Master's of Science and Ph.D. degrees. As shown in the figure, the proportion of candidates of science for the entire period of the study is about more than 40% from the total number of personnel qualification. A significant contribution to the development of science in Kazakhstan is made by scientific qualified personnel, the increase of qualified researchers is essential for the science productivity of Kazakhstan.
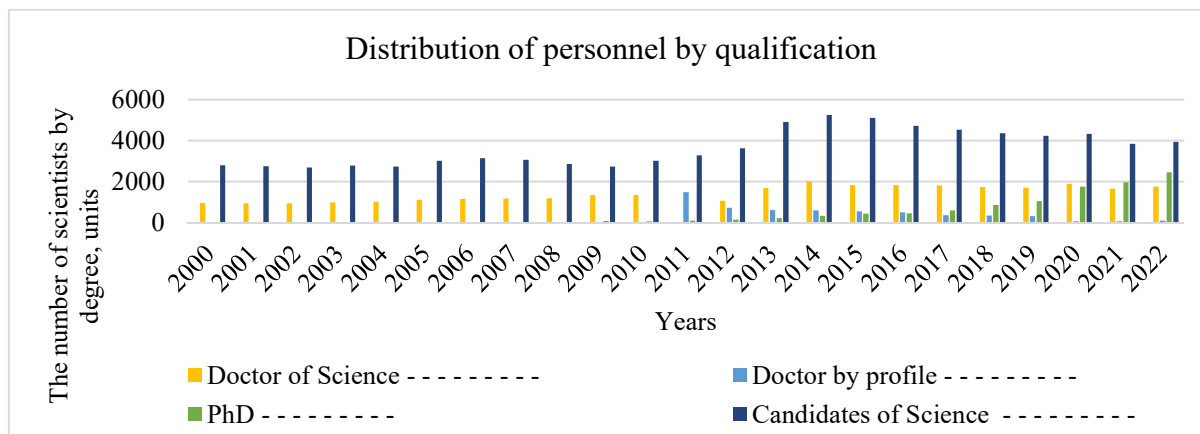
Figure 2. **The distribution of personnel by qualification***
* Compiled by the authors based on the basis of of statistical data, Source: stat.gov.kz

The publication array of Kazakhstan is affiliated with universities and research institutes. More than 90% of scientific papers or publications published by university researchers, only the authors from universities were included in the analysis. In this way the top authors in 26 subject areas and their affiliations were identified from 1991 to 2022. Out of 27 subject areas Multidisciplinary subject area was excluded from research as it includes authors from all areas, so 26 subject areas were analyzed by top authors.

The list of top authors in 26 subject areas with affiliation to Kazakhstan university are given in Table 2 below:

Table 2

The list of top authors with affiliation to Kazakhstan university*

Physics and Astronomy						
1	**2**	**3**	**4**	**5**	**6**	**7**
1	Top authors	Ramazanov T.S.	Zhautykov B.O.	Zhusupbekov A.	Hashmi M.S.	Ibrayev N.Kh
2	Affilations	Al Farabi Kazakh National University	Satbayev University	L.N. Gumilyov Eurasian National University	Nazarbayev University	Buketov Karagandy University
3	Publications	159	144	133		
4	h-index	28	42	9	22	12
5	Citation	3,031	7,157	318	1,538	626
Chemistry						
1	Top authors	Bakenov, Z.	Nurkenov, O. A.	Mustafin, E. S.	Mun, G.A.	Abilov, Zh A
2	Affilations	Nazarbayev University	Karaganda ndustrial University	Buketov Karagandy University	Al Farabi Kazakh National University	Al Farabi Kazakh National University
3	Publications	86	63	62	55	51
4	h-index	38	7	3	27	10
5	Citation	5,66	306	76	2,262	478
Materials Science						
1	Top authors	Bakenov Z.	Mun G.A.	Nurkeeva Z.S.	Shlimas D.I.	Kudaibergenov S.E.
2	Affilations	Nazarbayev University	Al Farabi Kazakh National University	Al Farabi Kazakh National University	L.N. Gumilyov Eurasian National University	Satbayev University
3	Publications	97	77	60	51	49
4	h-index	38	27	24	16	24
5	Citation	5,66	2,262	1,743	934	2,492
Engineering						
1	Top authors	Issakhov A.A.	Tosi D.	Memon S.A.	Bakenov Z.	N/A
2	Affilations	Kazakh-British Technical University	Nazarbayev University	Nazarbayev University	Nazarbayev University	

1	2	3	4	5	6	7
3	Publications	91	59	46	45	
4	h-index	34	28	41	38	
5	Citation	4,175	3,133	5,024	5,66	
	Chemical Engineering					
1	Top authors	Bakenov Z.	Issakhov A.A.	Baikenov M.I.	Sasykova L.R.	Kairbekov Z.
2	Affilations	Nazarbayev University	Kazakh-British Technical University	Buketov Karagandy University	Al Farabi Kazakh National University	Al Farabi Kazakh National University
3	Publications	77	35	33	28	28
4	h-index	38	34	5	15	5
5	Citation	5,66	4,175	109	629	79
	Pharmacology, Toxicology and Pharmaceutics					
1	Top authors	Sasykova L.R.	Datkhaev U.M.	Abilov Zh.A.	Kovaleva A.Y.	Sakipova Z.B.
2	Affilations	Al Farabi Kazakh National University	Kazakh National Medical University	Al Farabi Kazakh National University	M. Auezov South Kazakhstan University	Kazakh National Medical University
3	Publications	17	14	12	12	11
4	h-index	15	8	10	3	9
5	Citation	629	174	478	29	265
	Mathematics					
1	Top authors	Suragan D.	Issakhov A.A.	Oinarov R.	Kulpeshov B.S.	Yeshkeyev A.R.
2	Affilations	Nazarbayev University	Kazakh-British Technical University	L.N. Gumilyov Eurasian National University	Kazakh-British Technical University	Buketov Karagandy University
3	Publications	85	44	39	36	27
4	h-index	17	34	9	8	7
5	Citation	954	4,175	276	218	139
	Biochemistry, Genetics and Molecular Biology					
1	Top authors	Tosi D.	Igissinov N.	Abilov Zh.A.	Zhumadilov Zh.	Ramankulov Y.
2	Affilations	Nazarbayev University	Astana Medical University	Al Farabi Kazakh National University	Nazarbayev University	Nazarbayev University
3	Publications	27	25	24	22	21
4	h-index	28	11	10	23	26
5	Citation	3,133	382	478	1,822	2,194
	Agricultural and Biological Sciences					
1	Top authors	Atazhanova G.A.	Turdybekov K.M.	Konuspayeva G.S.	Morgounov A.	Burasheva G.Sh
2	Affilations	Karaganda Medical University	Buketov Karagandy University	Al Farabi Kazakh National University	Saken Seifullin Kazakh Agrotechnical University	Al Farabi Kazakh National University
3	Publications	36	34	33	28	23
4	h-index	9	8	16	27	7
5	Citation	271	354	1,063	2,855	163
	Immunology and Microbiology					
1	Top authors	Sansyzbai Abylai	Tabynov K.	Ramankulov E.	Konuspayeva G.S.	Kushugulova A.K.
2	Affilations	Kazakh National Agrarian Research University	Kazakh National Agrarian Research University	Nazarbayev University	Al Farabi Kazakh National University	Nazarbayev University
3	Publications	20	19	16	11	11
4	h-index	12	11	26	16	10
5	Citation	384	292	2,194	1,063	1,037
	Earth and Planetary Sciences					
1	Top authors	Pourafshary P.	Nurmukhanbetova D.E.	Sherov K.	Sikhimbayev M.	Madani N.

1	2	3	4	5	6	7
2	Affilations	Nazarbayev University	Narxoz University	Saken Seifullin Kazakh Agrotechnical University	Karaganda University of Kazpotrebsoyuz	Nazarbayev University
3	Publications	24	19	19	19	18
4	h-index	26	5	8	7	14
5	Citation	2,282	86	203	125	520
	Computer Science					
1	Top authors	Razaque A.	Issakhov A.A.	Jamwal P.K.	Maham B.	Do T.D.
2	Affilations	International Information Technology University	Kazakh-British Technical University	Nazarbayev University	Nazarbayev University	Nazarbayev University
3	Publications	27	24	21	20	19
4	h-index	18	34	20	24	20
5	Citation	1,27	4,175	1,599	2,388	2,279
	Medicine					
1	Top authors	Gaipov A.E.	Davletov K.	Zhumadilov Zh	Terzic M.M.	Poddighe D.
2	Affilations	Nazarbayev University	Kazakh National Medical University	Nazarbayev University	Nazarbayev University School of Medicine,	University Medical Center
3	Publications	58	46	43	41	39
4	h-index	22	44	23	16	24
5	Citation	2,595	45,447	1,822	978	1,567
	Social Sciences					
1	Top authors	Buribayev Y.A.	Khamzina Zhanna A.	Kuzhabekova A.	Balta N.	Karaca F.
2	Affilations	Abai Kazakh National Pedagogical University	Abai Kazakh National Pedagogical University	Nazarbayev University	Suleyman Demirel University, Kaskelen	Nazarbayev University
3	Publications	33	31	28	27	19
4	h-index	16	16	12	7	23
5	Citation	389	394	386	260	2,181
	Environmental Science					
1	Top authors	Issakhov A.A.	Karaca F.	Lee W.	Torkmahalleh M. Amouei	Guney M.
2	Affilations	Kazakh-British Technical University	Nazarbayev University	Nazarbayev University	Nazarbayev University	Nazarbayev University
3	Publications	44	32	28	21	19
4	h-index	34	23	37	21	18
5	Citation	4,175	2,181	4,282	1,082	1,136
	Energy					
1	Top authors	Issakhov A.A.	Pourafshary P.	Baikenov M.I.	Bakenov Z.B.	Messerle V.E.
2	Affilations	Kazakh-British Technical University	Nazarbayev University	Buketov Karagandy University	Nazarbayev University	Al Farabi Kazakh National University
3	Publications	44	35	34	33	28
4	h-index	34	26	5	38	16
5	Citation	4,175	2,282	109	5,66	894
	Business, Management and Accounting					
1	Top authors	Mahmood M.	Omarova A.T.	Davis P.J.	Buribayev Y.A.	Aimurzina B.T.
2	Affilations	Info KIMEP University	Buketov Karagandy University	Kazakh-British Technical University	Abai Kazakh National Pedagogical University	Astana International University

1	2	3	4	5	6	7
3	Publications	24	16	15	14	14
4	h-index	19	5	6	16	5
5	Citation	1,035	73	136	389	60
Economics, Econometrics and Finance						
1	Top authors	Balli F.	Turekulova D.M.	Buribayev Y.A.	Omarova A.T.	Khamzina Z.A.
2	Affilations	Al Farabi Kazakh National University	Esil University	Abai Kazakh National Pedagogical University	Buketov Karagandy University	Abai Kazakh Nationa Pedagogical University
3	Publications	24	20	18	16	15
4	h-index	23	3	16	5	16
5	Citation	1,755	30	389	73	394
Psychology						
1	Top authors	Samekin A.	Hernández-Torrano D.	Rima D.	Kustubayeva A.M.	Almukhambetova A.
2	Affilations	Narikbayev KAZGUU University	Nazarbayev University	Al Farabi Kazakh National University	Al Farabi Kazakh National University	Nazarbayev University
3	Publications	17	11	9	5	4
4	h-index	15	14	3	7	7
5	Citation	622	688	45	232	174
Veterinary						
1	Top authors	Tabynov K.K.	Sansyzbay A.R.	Konuspayeva G.S.	Kiyan V.	Abdrakhmanov S.K.
2	Affilations	Kazakh National Agrarian Research University	Kazakh National Agrarian Research University	Al Farabi Kazakh National University	Nazarbayev University	Saken Seifullin Kazakh Agrotechnical University
3	Publications	13	10	9	7	5
4	h-index	11	12	16	5	6
5	Citation	292	384	1,063	79	98
Nursing						
1	Top authors	Cruz J.P.	Almazan J.U.	Nurgozhin T.S.	Colet Paolo C.	Zhumadilov Zh
2	Affilations	Nazarbayev University	Nazarbayev University School of Medicine	Kazakh National Medical University	Nazarbayev University School of Medicine	Nazarbayev University
3	Publications	22	10	6	6	5
4	h-index	22	14	13	13	23
5	Citation	1,302	513	580	563	1,822
Health Professions						
1	Top authors	Balashkevich N.A.	Sabyrbek Zh.	Fakhradiyev I.	Jamwal P.K.	Kazymbet P.
2	Affilations	Semey Medical University	Al Farabi Kazakh National University	Info Kazakh National Medical University	Nazarbayev University	Astana Medical University
3	Publications	5	4	3	3	3
4	h-index	2	2	10	20	5
5	Citation	12	13	618	1,606	72
Neuroscience						
1	Top authors	Blank D.A.	Tokay T.	Ramankulov Y.	Zhumadilov Zh	Sandygulova A.
2	Affilations	Al Farabi Kazakh National University	Nazarbayev University	Nazarbayev University	Nazarbayev University	Nazarbayev University
3	Publications	6	5	4	4	4
4	h-index	61	14	26	23	13
5	Citation	14,798	760	2,194	1,822	430

1	2	3	4	5	6	7
			Decision Sciences			
1	Top authors	Post T.	Gussenov Barkhudar	Kuralbayev A.	Kassen Maxat	Mynbayev K.T.
2	Affilations	Nazarbayev University Graduate School of Business	Zhetysu State University named after I. Zhansugurov	Khoja Akhmet Yassawi International Kazakh-Turkish University	Nazarbayev University	Kazakh-British Technical University
3	Publications	5	5	5	4	4
4	h-index	24	4	3	10	5
5	Citation	1,848	22	35	522	65
			Dentistry			
1	Top authors	Issakhov A.A.	Temurov F.T.	Akimbekov N.S.	Altynbekov K.	Zhartybaev Rahmed
2	Affilations	Kazakh-British Technical University	Khoja Akhmet Yassawi International Kazakh-Turkish University	Al Farabi Kazakh National University	Kazakh National Medical University	Kazakh National Medical University
3	Publications	4	2	1	1	1
4	h-index	34	0	9	2	2
5	Citation	4,175	0	213	63	51
			Arts and Humanities			
1	Top authors	Mazhitayeva Shara	Nurysheva G.G.	Naimanbayev B.R.	Orazakynkyzy F.	Manan S.A.
2	Affilations	Buketov Karagandy University	Al Farabi Kazakh National University	South Kazakhstan State Pedagogical University	Al Farabi Kazakh National University	Nazarbayev University
3	Publications	17	10	10	9	8
4	h-index	4	1	2	4	10
5	Citation	39	5	22	34	359

* Compiled by the authors based on the basis of data from Scopus database, Source: scopus.com

The table 2 shows that the absolute leader among higher educational institutions by the number of top authors is Nazarbayev University in Environmental Science, Nursing and Neuroscience subject areas. The 4 out of 5 top authors are related to Nazarbayev University in these subject areas. This university is also leading by the other indicators such as h-index and citation rate. Engineering, Biochemistry, Genetics and Molecular Biology, Computer Science and Medicine has 3 top authors from Nazarbayev University. The next subject areas are Immunology and Microbiology, Earth and Planetary Sciences, Social Sciences, Energy, Psychology and Decision Sciences where Nazarbayev University have 2 top authors and indicators. Chemistry, Materials Science, Chemical Engineering, Mathematics, Veterinary, Health Professions and Arts and Humanities are less popular for authors from Nazarbayev University and only 1 top author is affiliated to this university. Despite the fact, that other subject areas do not have authors from Nazarbayev University, it still remains the most productive research university in 21 subject areas.

The next well-known university among all subject areas followed by Nazarbayev University is Al Farabi Kazakh National University. As can be seen from the table, the top 2 authors are related to Chemistry, Materials Science, Chemical Engineering, Pharmacology, Toxicology and Pharmaceutics, Agricultural and Biological Sciences, Psychology, and Arts and Humanities subject areas. Less papers (1 out of 5) are published by Al Farabi Kazakh National University authors in Biochemistry, Genetics and Molecular Biology, Immunology and Microbiology, Energy, Economics, Econometrics and Finance, Veterinary, Health Professions, Neuroscience and Dentistry research areas. In contrast to this, Engineering, Mathematics, Earth and Planetary Sciences, Computer Science, Medicine, Social Sciences, Environmental Science, Business, Management and Accounting, Nursing and Decision Sciences subject areas have no top researchers from Al Farabi Kazakh National University.

According to the table 2, Kazakh-British Technical University has a strong research. This university has 9 top authors in all subject areas and 2 of them are related to Mathematics field. However, other subject

areas as Engineering, Chemical Engineering, Computer Science, Environmental Science, Energy, Business, Management and Accounting, Decision Sciences and Dentistry has only 1 top author.

Buketov Karagandy University is also one of the leading universities for research doing. It has 1 top researcher in these subject areas: Physics and Astronomy, Chemistry, Chemical Engineering, Mathematics, Agricultural and Biological Sciences, Energy, Business, Management and Accounting and Economics, Econometrics and Finance.

It can be seen from table 2 that the authors with high h-index indicator are Nazarbayev University (97), Al Farabi Kazakh National University (61), Kazakh National Medical University (44) and Kazakh-British Technical University (34) in Materials Science, Neuroscience, Medicine and Environmental Science subject areas respectively. Then the top 3 universities or subject areas with highest citation rate also was identified. The first one is Satbayev University with 7,157 citation rate in Physics and Astronomy field, the second one is Nazarbayev University with 4,282 documents citation in Environmental Science and the third popular one is Kazakh-British Technical University with 4,175 citation rate in Dentistry area.

The gross domestic product (GDP) of a country can influence various aspects of education, science, including publication activity of the university. The relationship between GDP and university publishing activity depends on many factors. Gross domestic product may reflect the health of a country's economy. People can use GDP in order to identify whether an economy is growing or falling down. Higher GDP can help affect the process of increasing the research funding. Universities with higher budgets can invest more in research and development, which can increase publishing activity. A high level of GDP may allow universities to invest in modern equipment and infrastructure needed for scientific research. This may encourage researchers to become more active in publications. According to Amirbekova et al. (2022) the relationship between the GDP and the publication activity was positive, this article describes that the GDP spending can explain the significant performance variance in publication numbers. Higher GDP can create a more favorable economic environment, which can attract researchers and faculty to universities and can help increase publishing productivity. Moreover, Amirbekova et al. (2022) defines that increased funding, training for researchers, and partnership with foreign researchers will give more opportunities to local researchers to publish high quality research papers. A strong economy can make it easier for universities to participate in international research projects and partnerships. This can facilitate the exchange of knowledge and experience, which can influence the motivation of researchers at universities to publish. There are also other factors, such as the quality of education, scientific infrastructure, scientific leadership and research support policies, that can strongly influence the publishing activity in universities.

According to the Strategic Development Plan of the Republic of Kazakhstan until 2025 the strategic goal is to achieve high-quality and sustainable economic growth leading to improving the standard of living of people on the basis of increasing competitiveness business and human capital, technological modernization and improvement of the institutional environment, which compliance with the UN Sustainable Development Goals. The table 3 below illustrates the relationship between costs for R&D and GDP on number of publications between the 2000 and 2021 at 20-year interval:

Table 3

The relationship between costs for R&D and GDP and Number of Publications*

Years	Costs for R&D in billion tenge	GDP in billion tenge	GDP Share	Expenditure on Education Spending (% of GDP)	Number of Publications
1	2	3	4	5	6
2000	4,7	2 599,9	0,18%		197
2001	7,2	3 250,6	0,22%		198
2002	9,6	3 776,3	0,25%	14.76%	221
2003	11,6	4 612,0	0,25%	10.61%	244
2004	14,6	5 870,1	0,25%	10.61%	221
2005	21,5	7 590,0	0,28%	10.29%	239
2006	24,8	10 213,7	0,24%	13.27%	250
2007	26,8	12 849,8	0,21%	11.94%	292
2008	34,8	16 052,6	0,22%	13.65%	272
2009	39,0	17 007,6	0,23%	13.04%	347
2010	33,5	21 815,5	0,15%	16.93%	341
2011	43,4	28 243,1	0,15%	18.10%	368

1	2	3	4	5	6
2012	51,3	31 015,2	0,17%	19.25%	594
2013	61,7	35 999,0	0,17%	17.96%	1370
2014	66,3	39 675,6	0,17%	17.32%	1755
2015	69,3	40 884,1	0,17%	12.19%	1670
2016	66,6	46 971,1	0,14%	13.84%	2389
2017	68,9	54 378,9	0,13%	11.42%	2403
2018	72,2	61 819,5	0,12%	13.88%	2783
2019	82,3	69 532,6	0,12%	14.11%	3336
2020	89,0	70 649,0	0,13%	18.60%	3863
2021	109,3	83 951,6	0,13%	20.34%	4332

* Compiled by the author on the basis of data from Scopus database, Stat.gov and data source from World Bank

The Sustainable Development Goals (SDGs) are a call of sorts to action from all countries. Goal 9 calls on governments to create sustainable infrastructure to promote industrialization and innovation through increasing spending on R&D and increasing the number of researchers. The table 3 presents data showing that in 2021 there was an increase in R&D spending carried out in Republic of Kazakhstan, from 89.0 to 109.3 billion tenge. However, the increase in costs by more than 20 billion tenge did not affect the science intensity of GDP, which in 2021 remained at the level of 0.13%. So despite the increase in R&D spending, the science intensity of GDP has not changed, remaining at the level of 0.13%. Whereas the number of publications in that period increased rapidly from 197 in 2000 to 4332 in 2021 which is 22 times more. It means that the increase in costs for R&D positively affects the number of articles. The next economic indicator, which affects the publication activity is the expenditure on education. According to table 3, the education spending is increasing stable in last 5 years, reaching 20.34% in 2021 a 8,92% increase from 2017. In this period the publication productivity is also increased 1.8 times in 2021 compared to 2017. So it can be explained by that if costs for R&D and expenditure on education system rises each year the number of articles increases each year. It will help to improve the research productivity of universities and authors, which affects positively in developing the economy of our country.

Higher education institutions are the subjects of the economic system of the country and consumers of resources of the country. The above mentioned universities are play important role in producing educational and science services.

The funding is one of the key indicators that affect the state of the system of providing educational services. Availability of funding universities and education system in whole makes it possible to ensure high quality labor, conditions for teachers and researchers, information and other types of resources that meet international standards. This convenience will motivate researchers to publish actively and attract new researchers in education system. The main task of the state in the field of science is to increase educational institutions funding as mentioned in Strategic Development Plan of the Republic of Kazakhstan until 2025. According to statistical data the funding of science is increased 3 times in last four years. In 2020 it was 50.1 billion tenge, in 2021 it was 71,6 billion tenge, in 2022 it was 70,2 billion tenge and in 2023 it reached 158,5 billion tenge. If it continues at this rate each year, we will increase the share of science funding in the gross domestic product. UNESCO guidelines defined that the financing of higher education of the country should be at least 6-7% of GDP. So increase in funding the educational and science sector will positively affect the publication activity of university scientists. It may increase the publication activity in top-rated international journals and the development of international scientific cooperation which is also has great impact on economic growth of the country.

Conclusion. The results demonstrate the growth of publications over years which is positively related to the reforms that were strategically changing scientific landscape in the country. The major outcomes of the research indicate that number of publications had increased 190 times in 2022 in comparison to 1991. This has a positive relationship to the GDP spendings on research. The results showed that if the economic factors as costs for R&D, expenditure on the education system and the funding of the universities goes up steady every year, the publication activity of researchers will also increase steadily. Moreover, the increasing role of universities as a contributor to the science is demonstrated by the output of universities in the total number of publications that are affiliated with universities.

Since publication activity is one of the main indicator of the effectiveness of scientific work, a top authors' in subject areas identify leading positions of universities. In terms of top authors in the Scopus database Nazarbayev University has a position of a leading research university in Kazakhstan. It has a strong

research direction in 21 out of 26 subject areas. The data shows that 45 top researchers are from the Nazarbayev university. Al-Farabi Kazakh National University becomes a second top university with 24 top researchers affiliated with the university. It is one of the oldest and largest universities in Kazakhstan which has a strong research focus in different research areas. The next university with the strong research is Kazakh-British Technical University (KBTU) that has 11 top authors from all subject areas. Buketov Karagandy University is also one of highly publishing universities in Kazakhstan and has 9 top researchers. Kazakh National Medical University has 7 top researchers, followed by Abai Kazakh National Pedagogical University and Kazakh National Agrarian Research University which have 5 top researchers. The analysis demonstrate positive trends in Kazakhstan science both from government spendings on research, qualified staff and research output of university. However, the further research is needed to evaluate the specific factors that had contributed to the certain environmental conditions that boost research output in universities.

REFERENCES

1. Sternberg R. University-industry relationships in Germany and their regional consequences. In Regional Innovation, Knowledge and Global Change. Routledge. – 2013. – P. 89-120.

2. Markkula M., Lappalainen P. New openings in university-industry cooperation: Aalto University as the forerunner of European University Reform // European Journal of Engineering Education. – 34(3). – 2009. – P. 251-262.

3. Bai X., Sun X., Chiu Y.H. Does China's higher education investment play a role in industrial growth? Technology in Society. – 101332. – 2020. – P. 63.

4. Wong P.K., Ho Y.P., Singh A. Towards an «entrepreneurial university» model to support knowledge-based economic development: the case of the National University of Singapore. World Development. – 35(6). – 2007. – P. 941-958.

5. Agasisti T., Barra C., Zotti R. Research, knowledge transfer, and innovation: The effect of Italian universities' efficiency on local economic development 2006-2012 [Electronic resource] // Journal Regional Science. – 59. – 2019. – P. 819-849. – URL: https://onlinelibrary.wiley.com/doi/full/10.1111/jors.12427.

6. Aranguren M.J. and Magro E. How can universities contribute to regional competitiveness policy-making?, Competitiveness Review. – 30(2). – 2020. – P. 101-117. – URL: https://doi.org/10.1108/CR-11-2018-0071.

7. Brekke T. What Do We Know about the University Contribution to Regional Economic Development? A Conceptual Framework. International Regional Science Review. – 44(2). – 2021. – P. 229-261. – URL: https://doi.org/10.1177/0160017620909538.

8. Thomas E., Faccin K., Asheim B.T. Universities as orchestrators of the development of regional innovation ecosystems in emerging economies Growth and Change. – 52. – 2021. – P. 770-789.

9. Marozau R., Guerrero M., Urbano D. Impacts of Universities in Different Stages of Economic Development // J Knowl Econ 12. – 2021. – P. 1-21. – URL: https://doi.org/10.1007/s13132-016-0359-7.

10. Alibekova G., Özçelik S., Satybaldin A., Bapiyeva M. and Medeni, T. Research Performance Assessment Issues: The Case of Kazakhstan. Scholarly Assessment Reports. – 3(1). – 2021. – P.5. – URL: https://doi.org/10.29024/sar.37.

11. Кудайбергенова Р., Смагулов К., Омиралиев А.Г., Ұзақбай С. Наукометрический анализ публикационной активности университетов Казахстана. Вестник КазНУ. – S. l. – v.72. – n. 3. – 2022. – P. 4-22. – URL: https://doi.org/10.26577/JES.2022.v72.i3.01.

12. Молдашев К., Тлеуов А., Радько Н. Экономика публикационного режима и проблемы интеграции казахстанских ученых в глобальное научное сообщество. Central Asian Economic Review (CAER). – 4 (122). – 2018. – С. 127-138.

13. Narbaev T., Amirbekova D. Research Productivity in Emerging Economies: Empirical Evidence from Kazakhstan, Publications. – 9(4). – 2021. – P.51. – URL: https://doi.org/10.3390/publications9040051.

14. Pastor J.M., Peraita C., Serrano L., Soler A. Higher education institutions, economic growth and GDP

per capita in European Union countries, European Planning Studies. – 26:8. – 2018. – P. 1616-1637. – DOI: 10.1080/09654313.2018.1480707.

15. Amirbekova D., Narbaev T., Kussaiyn M. The research environment in a Developing economy: Reforms, Patterns, and Challenges in Kazakhstan, Publications. – 10(4). – 2022. – P. 37. – URL: https://www.mdpi.com/2304-6775/10/4/37/pdf.

REFERENCES

1. Sternberg R. University-industry relationships in Germany and their regional consequences. In Regional Innovation, Knowledge and Global Change. Routledge. – 2013. – P. 89-120.

2. Markkula M., Lappalainen P. New openings in university-industry cooperation: Aalto University as the forerunner of European University Reform // European Journal of Engineering Education. – 34(3). – 2009. – P. 251-262.

3. Bai X., Sun X., Chiu Y.H. Does China's higher education investment play a role in industrial growth? Technology in Society. – 101332. – 2020. – P. 63.

4. Wong P.K., Ho Y.P., Singh A. Towards an «entrepreneurial university» model to support knowledge-based economic development: the case of the National University of Singapore. World Development. – 35(6). – 2007. – P. 941-958.

5. Agasisti T., Barra C., Zotti R. Research, knowledge transfer, and innovation: The effect of Italian universities' efficiency on local economic development 2006-2012 [Electronic resource] // Journal Regional Science. – 59. – 2019. – P. 819-849. – URL: https://onlinelibrary.wiley.com/doi/full/10.1111/jors.12427.

6. Aranguren M.J. and Magro E. How can universities contribute to regional competitiveness policy-making?, Competitiveness Review. – 30(2). – 2020. – P. 101-117. – URL: https://doi.org/10.1108/CR-11-2018-0071.

7. Brekke T. What Do We Know about the University Contribution to Regional Economic Development? A Conceptual Framework. International Regional Science Review. – 44(2). – 2021. – P. 229-261. – URL: https://doi.org/10.1177/0160017620909538.

8. Thomas E., Faccin K., Asheim B.T. Universities as orchestrators of the development of regional innovation ecosystems in emerging economies Growth and Change. – 52. – 2021. – P. 770-789.

9. Marozau R., Guerrero M., Urbano D. Impacts of Universities in Different Stages of Economic Development // J Knowl Econ 12. – 2021. – P. 1-21. – URL: https://doi.org/10.1007/s13132-016-0359-7.

10. Alibekova G., Özçelik S., Satybaldin A., Bapiyeva M. and Medeni, T. Research Performance Assessment Issues: The Case of Kazakhstan. Scholarly Assessment Reports. – 3(1). – 2021. – P.5. – URL: https://doi.org/10.29024/sar.37.

11. Kudaibergenova R., Smagulov K., OmiralievA G., Uzakhbay S. Naukometricheskiy analiz publikatsionnoy aktivnosti universitetov Kazakhstana. Vestnik KazNU. – S. l. – v.72. – n. 3. – 2022. – P. 4-22. – URL: https://doi.org/10.26577/JES.2022.v72.i3.01 [in Russian].

12. Moldashev K., Tleuov A., Radko N. Ekonomika publikatsionnogo rezhima i problemy integratsii kazakhstanskikh uchenykh v global'noye nauchnoye soobshchestvo. Central Asian Economic Review (CAER). – 4 (122). – 2018. – P. 127-138 [in Russian].

13. Narbaev T., Amirbekova D. Research Productivity in Emerging Economies: Empirical Evidence from Kazakhstan, Publications. – 9(4). – 2021. – P.51. – URL: https://doi.org/10.3390/publications9040051.

14. Pastor J.M., Peraita C., Serrano L., Soler A. Higher education institutions, economic growth and GDP per capita in European Union countries, European Planning Studies. – 26:8. – 2018. – P. 1616-1637. – DOI: 10.1080/09654313.2018.1480707.

15. Amirbekova D., Narbaev T., Kussaiyn M. The research environment in a Developing economy: Reforms, Patterns, and Challenges in Kazakhstan, Publications. – 10(4). – 2022. – P. 37. – URL: https://www.mdpi.com/2304-6775/10/4/37/pdf.

Амирбекова Д.К., Құсайын М.Ж., Ғафу Г., Нарбаев Т.С.

УНИВЕРСИТЕТ ҒЫЛЫМЫ ЖӘНЕ ЭКОНОМИКАЛЫҚ ӨСУ: 1991-2022 ЖЫЛДАРДА SCOUS ДЕРЕКТЕР БАЗЫНДА ҚАЗАҚСТАН УНИВЕРСИТЕТТЕРІНІҢ ҒЫЛЫМ БАСЫЛЫМДАРЫНА ШОЛУ

Аңдатпа

Бұл мақалада Қазақстандағы жоғары оқу орындарының ғылыми баспа қызметі және оның 1991-2022 жылдардағы елдің экономикалық өсуіндегі рөлі сипатталған. Мақаланың тақырыбы ғылымды мемлекеттік қаржыландырудың өзектілігін және экономиканың тұрақты дамуына қол жеткізудегі университеттердің рөлін анықтайды. Бұл зерттеуде авторлар Қазақстандағы жоғары оқу орындарының басылым қызметін талдау үшін сипаттамалық статистика әдісін пайдаланды. Бұл әдіс екі кезеңнен тұрады: мәліметтерді жинау кезеңі және зерттеу әдістемесін егжей-тегжейлі сипаттайтын талдау кезеңі. Зерттеу көрсеткендей, ғылыми еңбектердің 90%-дан астамы Қазақстандағы жоғары оқу орындарының ғылыми қызметкерлерімен жарияланады. Қазақстандағы жоғары оқу орындарының жариялау қызметінің белсенділігін талдау үшін Scopus және ресми статистикалық деректер базасынан деректер жиналды. Оған 1991-2022 жылдары жарияланған Қазақстанға тиісті мақалалар саны, жоғары индексі бар үздік 5 автор және әрбір 26 тақырып бойынша дәйексөздер кіреді, сондай-ақ, 1991-2022 жылдардағы зерттеушілердің біліктілігі, ҒЗТКЖ шығындары, ЖІӨ және ЖІӨ-нің үлесі талданды.

Зерттеу нәтижелері бойынша тиісті қорытындылар жасалды. Зерттеудің негізгі нәтижелері 1991 жылмен салыстырғанда 2022 жылы басылымдар саны 190 есе өскенін көрсетеді. Бұл ЖІӨ-нің зерттеулерге жұмсалған шығындарымен оң байланысы бар екенін көрсетеді.

Амирбекова Д.К., Құсайын М.Ж., Ғафу Г., Нарбаев Т.С.

УНИВЕРСИТЕТСКАЯ НАУКА И ЭКОНОМИЧЕСКИЙ РОСТ: ОБЗОР НАУЧНЫХ ПУБЛИКАЦИИ УНИВЕРСИТЕТОВ КАЗАХСТАНА В БАЗЕ SCOPUS ЗА 1991-2022 ГГ.

Аннотация

В данной статье описывается научно-публикационная деятельность вузов Казахстана и ее роль в экономическом росте страны в 1991-2022 гг. Тема статьи раскрывает актуальность государственного финансирования науки и роль университетов в достижении стабильного экономического развития. В данном исследовании авторы использовали метод описательной статистики для анализа публикационной активности вузов Казахстана. Этот метод состоит из двух этапов: сбора данных и описательного анализа, который подробно описывает методологию исследования. Исследование показало, что более 90% научных работ публикуются исследователями университетов Казахстана. Данные были собраны из Scopus и официальной статистической базы данных для анализа публикационной активности вузов Казахстана. Он включает количество статей, опубликованных в 1991-2022 годах, аффилированные Казахстаном, топ-5 авторов с индексом Хирши и цитируемостью в каждой 26 предметной области, также были проанализированы квалификация исследователей, затраты на НИОКР, ВВП, доля ВВП за 1991-2022 годы.

По результатам исследования были сделаны соответствующие выводы. Основные результаты исследования показывают, что количество публикаций увеличилось в 190 раз в 2022 году по сравнению с 1991 годом. Это имеет положительную связь с расходами ВВП на исследования.