BLOCKCHAIN RESEARCH AND ITS SIGNIFICANCE IN THE NATIONAL TECHNOLOGY INITIATIVE

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Abstract

The National Technology Initiative of Türkiye, which it has been putting into action over the past several years, has enabled the country to make significant advancements in domestic production and Türkiye's momentum in this sector is obvious among nations that are on the same level as Türkiye. The accomplishments in sectors of the national defense industry are particularly noteworthy. However, attempts to increase production on a national and domestic scale were not confined to only one domain; rather, they were dispersed throughout multiple sectors, including health, education, transportation and informatics. Blockchain technology which is now one of the most emerging topics in the context of new technologies has already demonstrated itself as one of Türkiye's strategic national technological priorities. A large number of works have also been published in Türkiye addressing the significance of blockchain technology, which has found application in various areas of the country's economy, most notably in the fields of banking, business and information technology. At this point, the importance of a study that will explain the position of the world and Türkiye in the context of blockchain with a comparative scholarly literature growth analysis to be made in Web of Science (WoS) databases has also increased. This chapter examines the R&D and scientific policies of countries from the viewpoint of blockchain research in the context of national and international literature. According to the result of the analyses carried out in the databases of scientific literature, the research and application areas of blockchain technology in Türkiye are comparable to those that exist in developed nations. Moreover, another result of analyses scanning the world's scientific literature shows that Asian nations have more scientific works pertaining to blockchain technology. The number of applications and patents also filed by companies is the highest in Asia. On the other hand, the universities in Türkiye have recently begun to include coursework on blockchain technology in their programs. In addition, particularly the institutions in the country's financial and banking system the public institutions and private companies of Türkiye have focused on the country's national technology initiative and thus technology is continuing to develop on a daily basis. Despite the fact that interest in and utilization of this technology on a sectoral level in Türkiye catch up partially with its global level, it is important to focus more on blockchain technology in terms of resource allocation and prioritization.

Keywords

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1. Introduction

Nations need to acquire the skills necessary for technical progress for the sake of their economic and social prosperity. The ability to participate in scientific research activities in the sphere of new technologies is a critical indicator due to its significance. While there is no consensus on the fundamental principles and scope of emerging technologies as a growing study topic (Daniele et al., 2015), nations are competing to do scientific research in this area. One of the most significant reasons for this is that new technologies have profound effects on both international politics and national scientific agendas (Daim and Yalcin, 2022). For instance, blockchain technology, which has been discussed in the scientific literature since the emergence of cryptocurrencies, has popped up as a formidable yet advantageous challenge to the centralization of data. Thus, countries have started a race to utilize blockchain and comparable new technologies to expand their infrastructure in numerous industries, particularly banking and to protect their national data (U.S. National Defense Authorization Act, 2019, p. 2793; Cornella et al., 2020).
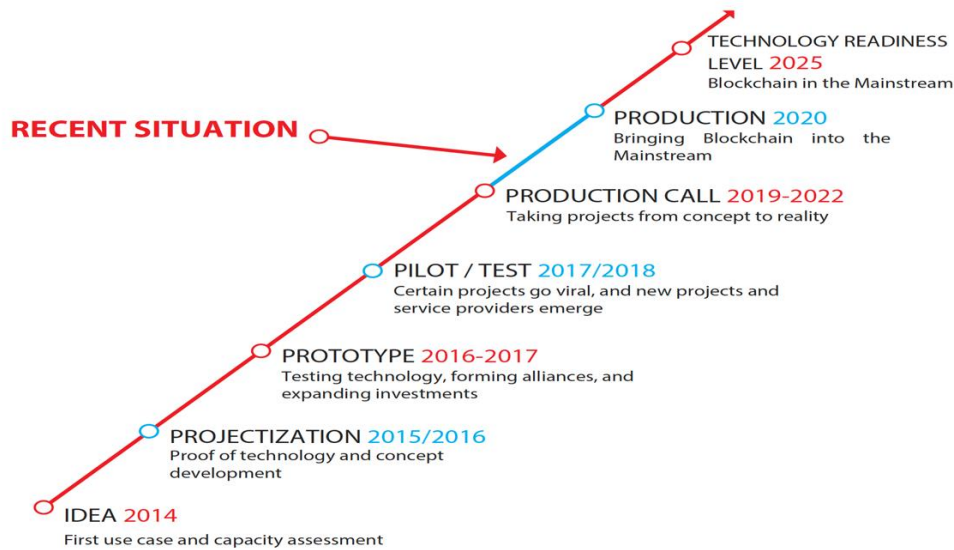

Figure 1. *Development phases of blockchain technology in the world (Miraz and Ali, 2018; Takaoğlu et al., 2019, p. 263)*

Blockchain technology has shown to be significant among emerging technologies since it is still on its way to widespread application in the military and cybersecurity industries to reach advanced national security goals (Mohsen and Gunasekaran, 2018; Lele, 2018). In fact, nations such as the United States, China and Russia have begun to dedicate significant financial resources to successfully exploit this technology, even in the defense business (Doğrul and Erğurum, 2021). Following all these processes, there has been a considerable surge in scientific research on blockchain technology in disciplines such as informatics, banking, business, transportation and the military (Yalcin and Daim, 2021). Thus, assessing this globally expanding knowledge has become capable of providing thoughts about countries' technical aspirations and orientations.

2. Literature Growth Analysis of the Blockchain Technology

Cryptocurrencies have just touched our lives and may be seen in a variety of settings practically every day. Blockchain technology is also the driving force behind cryptocurrencies. This technology is an invention that has begun to be utilized in a variety of industries. However, people and communities are just now becoming acquainted with novel applications of blockchain technology (Casino et al., 2019). Blockchain technology, which has a multidisciplinary feature and scientific characteristic, is steadily increasing its presence and impact in scientific literature as a subject that requires elucidation in several areas. The importance of knowledge and its management in every field has made bibliometrics, which is an important scientific tool in the evaluation of scientific knowledge, become a more frequently used method since the 1970s, (Yalcin and Daim 2021). The bibliometric analysis that will be performed at the time of making sense of this scientific information is critical for revealing the positions and levels of the nations (Daim et al., 2020). In fact, the research results from all academic databases of WoS[1] throughout the world and in Türkiye were scaled in figures 2 and 3 and it was understood that the literature grew linearly between 2012 and 2022. In other words, the blockchain's literature tends to expand by the same amount at each time step.
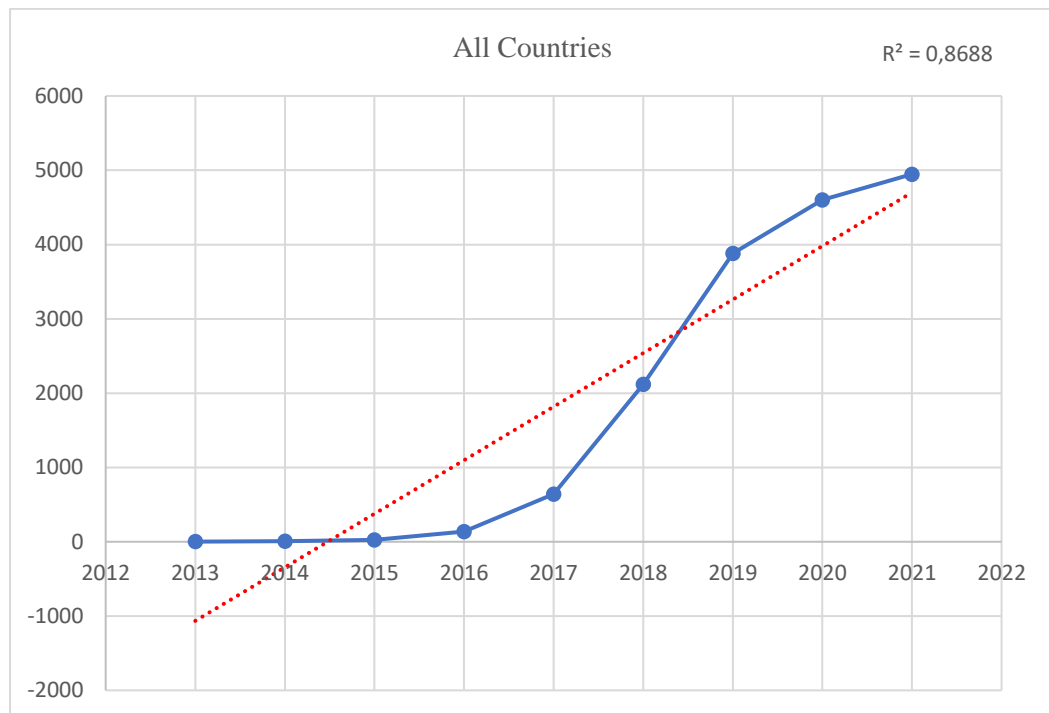
Figure 2. *Growth in literature for all countries focusing on blockchain technology*

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[1] The criteria and scales of the analyzes: The criteria and scales of the Analyzes: TS=blockchain, Web of Science Core Collection, Editions = A&HCI, BKCI-SSH, BKCI-S, ESCI, CPCI-SSH, CPCI-S, SCI-EXPANDED, SSCI.
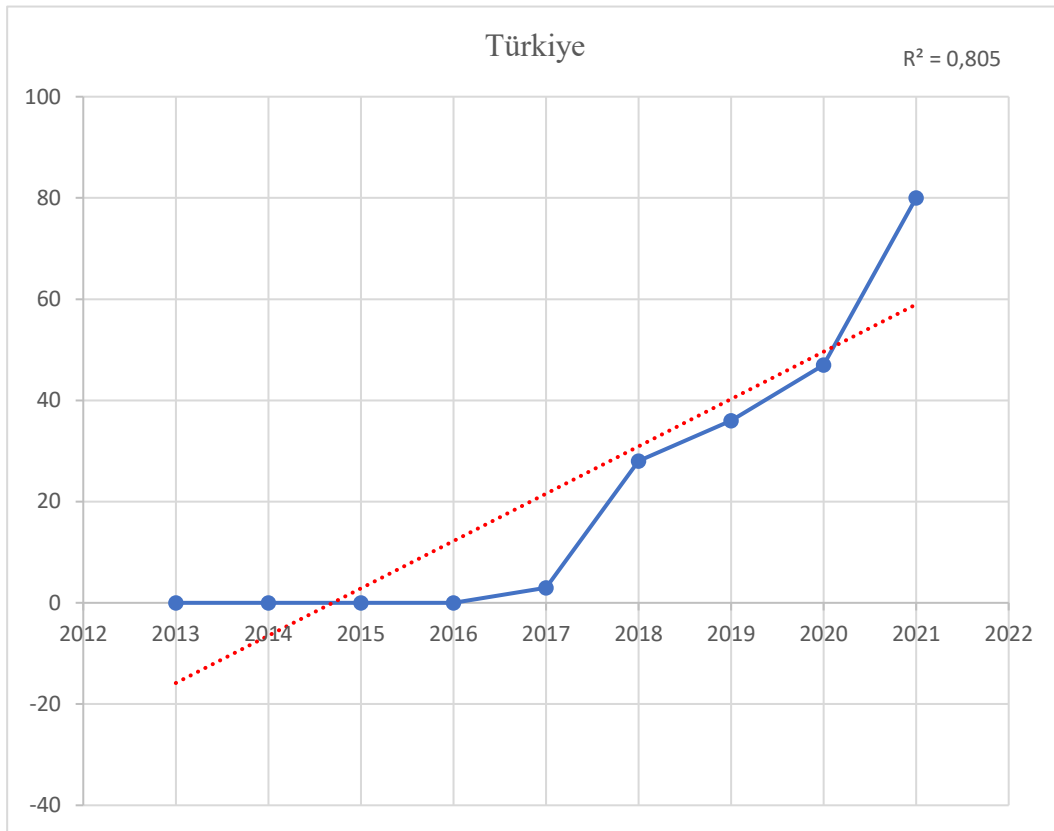
Figure 3. *The growth of the Türkiye based Literature on blockchain technology*

It can be noted that the increase in Türkiye-based publications (R^2=0.805) lags somewhat behind the worldwide growth (R^2=0.868) in terms of the rate of rising in publications. However, whereas global scientific publication growth appears to have returned to a relatively static level in 2020, Türkiye addressed publications show a more vertical increase.

Table 1 shows the number of publications and citations by nations in the findings from the literature analyses research done with a global focus. According to the statistics, China (11.122 publications) had the most publications per country, followed by the United States (5316 publications). Despite the numerical disparity in the number of publications between these two nations, it is notable that US-based articles obtain more citations than China-based publications, implying that they have higher impact values. While Türkiye is ranked 24th with 418 publications, the impact value of these articles is lower than the number of publications.

Table 1. *Publication/Citation/Impact Values by Country*

| #	Country	Citation sum within h-core	All citations	All articles	h-index
1	PEOPLES R. CHINA	34012	132760	11122	130
2	USA	36308	96221	5316	130
3	INDIA	10108	28107	3171	73
4	UK	15643	36827	2190	87
5	AUSTRALIA	12019	28032	1657	79
6	SOUTH KOREA	6936	15989	1497	54
7	ITALY	6397	13773	1302	56
8	GERMANY	8427	17119	1231	53
9	CANADA	7691	16635	1205	63
10	SAUDI ARABIA	3451	8059	904	44
11	RUSSIA	2431	4521	894	31
12	FRANCE	6223	10502	871	54
13	SPAIN	3661	7085	787	38
14	JAPAN	4268	7217	732	42
15	TAIWAN	3135	6612	715	36
16	PAKISTAN	3168	6322	639	37
17	SWITZERLAND	3717	6180	526	35
18	SINGAPORE	6866	10624	515	45
19	BRAZIL	2435	3843	511	32
20	PORTUGAL	1092	2385	506	22
21	U ARAB EMIRATES	3909	7061	472	39
22	MALAYSIA	2348	4396	438	35
23	NETHERLANDS	3048	5158	421	34
24	**TÜRKİYE**	**1177**	**2472**	**418**	**23**
25	GREECE	2359	3949	379	30

When the publications on blockchain technology are reviewed on the basis of universities, it is clear that the Chinese Academy of Sciences ranks first in the world (table 2). It is also worth noting that nearly all of the 25 universities on the list are Chinese. The fact that Türkiye's institutions are not among the top 25 on the list highlights a point that has to be addressed.

Table 2. *Global Publication, Citation and Impact Values for Universities*

#	Universities / World	Citation sum within h-core	All citations	All articles	h-index
1	CHINESE ACAD SCI	2666	4009	333	31
2	BEIJING UNIV POSTS & TELECOMMUN	3789	5416	322	37
3	UNIV ELECT SCI & TECHNOL CHINA	4313	5838	256	36
4	XIDIAN UNIV	1858	2951	250	28
5	KING SAUD UNIV	2436	3772	211	34
6	NANYANG TECHNOL UNIV	3280	4088	180	38
7	HONG KONG POLYTECH UNIV	2868	3853	178	32
8	TSINGHUA UNIV	1486	2088	166	25
9	BEIHANG UNIV	771	1288	165	17
10	SUN YAT SEN UNIV	5655	6301	162	26
11	BEIJING INST TECHNOL	1993	2566	158	29
12	SHANGHAI JIAO TONG UNIV	1897	2472	155	27
13	UNIV TEXAS SAN ANTONIO	2960	3722	142	35
14	UNIV CHINESE ACAD SCI	1283	1662	141	19
15	HUAZHONG UNIV SCI & TECHNOL	916	1344	139	21
16	WUHAN UNIV	1583	2122	131	25
17	QATAR UNIV	1291	1785	131	21
18	CSIRO	3252	4094	127	32
19	NANJING UNIV POSTS & TELECOMMUN	913	1291	118	18
20	NORTHEASTERN UNIV	372	710	117	14
21	KING ABDULAZIZ UNIV	676	1041	115	19
22	BEIJING JIAOTONG UNIV	925	1180	114	14
23	ASIA UNIV	1153	1645	113	25
24	UCL	1867	2275	109	24
25	PEKING UNIV	623	875	108	16

Looking at the entire international publications, we can see that cryptocurrency, digital continuity, the environment, e-government, business, e-signature and encryption (Figure 4) are of prominent concepts. Thus, the keywords can be grouped. The variety of these topics and concepts reflects the technology's diverse applications and interdisciplinary character.
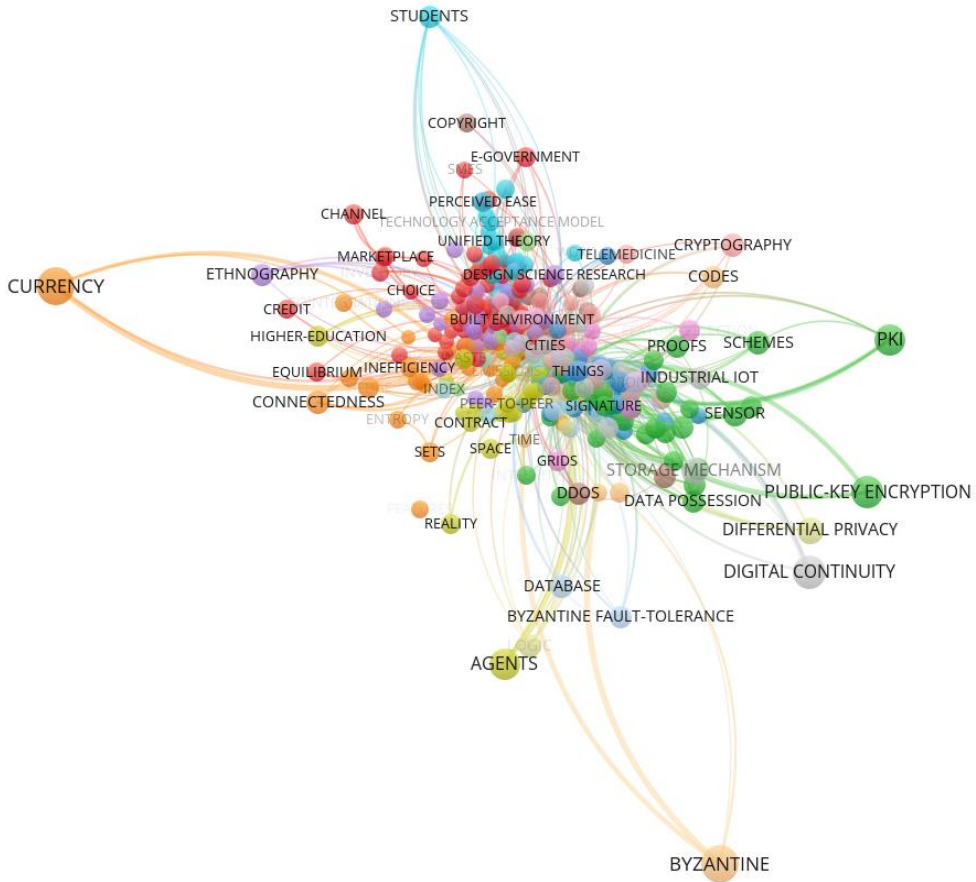
Figure 4. *Prioritized concepts in world literature*

If a concept analysis of blockchain-focused publications (Table 3) is carried out, it can be shown that the leading five concepts are "Challenges", "Management", "Framework", "Internet," and "Technology," and that the literature focus on these themes. According to the same table, the significance of "Personalization", "Paradigm", "Mac Protocol", "Consensus" and "Data-Security" is going to increase in importance, while "Management", "Challenges", "Framework", "Big Data" and "Technology" is losing significance. In other words, these concepts have attained maturity.

***Table 3.*** *Keyword/Concept Analysis and Publication Intensity Levels*

All Degree Partition	Betweenness centrality	Low Total Constraints-LAC	High Total Constraints-HAC
Challenges	Management	Personalization	Management
Management	Challenges	Paradigm	Challenges
Framework	Framework	Mac Protocol	Framework
Internet	Internet	Consensus	Big Data
Technology	Technology	Data-Security	Technology
Model	Big Data	Data Privacy	Model
Big Data	Bitcoin	Decision-Making Method	Internet
Logistics	Model	Ecosystem	Blockchain
System	Blockchain	Homomorphic Encryption	Systems
Blockchain	Plant	Vote	Information
Information	Volatility	Integrating Technology	Future
Impact	System	ICT	Logistics
Future	Design	Internet-Of-Things	System
Security	Security	Electricity Theft	Design
Traceability	Systems	Distributed Storage	Traceability
Adoption	Supply Chain	Codes	Impact
Design	Blockchain Technology	Policy	Adoption
Things	Impact	Homes	Performance
Performance	Future	Rural Electrification	Selection
Systems	Information	Infrastructure	Industry 4.0
Sustainability	Adoption	Online Courses	Of-The-Art
Selection	Selection	Persistence	Supply Chain
Technologies	Logistics	Sustainable Development	Industry
Supply Chain	Energy	Neural-Networks	Trust

The global map of blockchain-related publications and international collaboration is essential for comprehending the relationship between nations and organizations. As seen in Figure 5, despite the significant contact between Chinese and American institutions, European and Southeast Asian nations also participate in this interaction to some extent.

Figure 5. *International partnerships on blockchain publications*

Figure 6 depicts the clustering of patents pertaining to blockchain technology. When we investigate the technological domains that resulted from the patent examination, we find that "H04L-Transmission of Digital Information" and "E.G. Telegraphic Communication" are the most prominent classes of blockchain technologies. On the other hand, the classes "G06F- Electrical Digital Data Processing" and "G06Q50/01-Systems or techniques uniquely fitted for specific commercial sectors, such as utilities or tourism," are believed to dominate the patent areas.

Figure 6. *Global patent clusters on blockchain*

3. Literature Analysis with a Focus on Türkiye

Following analyzing the growth trend, concepts and significant scientific institutions of the global blockchain literature, the present position and direction of blockchain research in Türkiye may be examined. While the country's technological advancement in many sectors has only lately been mirrored in blockchain technology, the development rate of blockchain literature in Türkiye has lagged below the global average. While articles on blockchain in Türkiye focus mostly on "data security," the research keywords are presented in figure 7. Also included in this research are "cryptocurrencies", "new technologies", "decision-making processes", "cloud systems", "distributed storage", "the internet of things" and "5G".
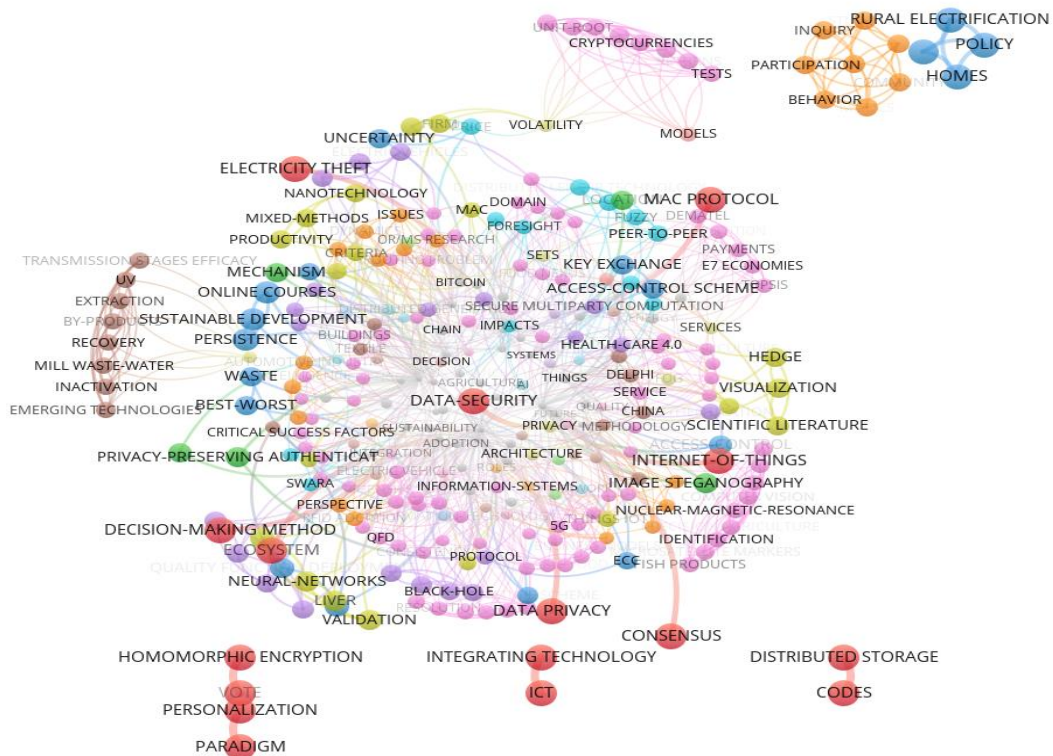
Figure 7. *Keyword-based clustering of blockchain-related articles in Türkiye*

Table 4 compares the concepts mentioned in publications written specifically on the blockchain. The benefits and drawbacks of technology in Türkiye and throughout the world are analyzed separately. It is concluded that Türkiye's scientific works handle security issues less frequently than those geared at the rest of the world. It has also been observed that Türkiye focuses a stronger emphasis on blockchain technology in terms of logistics, banking and commercial applications, whilst overseas publications are more interested in the technology's systemic and software components. There is an overlap in comparisons of concepts other than this one.

***Table 4.*** *Conceptual Comparisons between World and Turkish Literature*

Degree		Arasındalık Merkeziliği		LAC		HAC	
Türkiye	World	Türkiye	World	Türkiye	World	Türkiye	World
Challenges	Internet	Management	Internet	Personalization	Byzantine Generals Problem	Management	Investment
Management	Management	Challenges	Management	Paradigm	Currency	Challenges	Behavior
Framework	Blockchain	Framework	Blockchain	Mac Protocol	Digital Continuity	Framework	Policy
Internet	Challenges	Internet	Technology	Consensus	Public-Key Encryption	Big Data	Competition
Technology	Framework	Technology	Challenges	Data-Security	Agents	Technology	Growth
Model	Technology	Big Data	Framework	Data Privacy	Pki	Model	Blockchain Technology
Big Data	Model	Bitcoin	Security	Decision-Making Method	Storage Mechanism	Internet	Market
Logistics	Security	Model	Model	Ecosystem	Differential Privacy	Blockchain	Time
System	System	Blockchain	System	Homomorphic Encryption	Sensor	Systems	Information-Technology
Blockchain	Systems	Plant	Systems	Vote	Logic	Information	Impact
Information	Impact	Volatility	Impact	Integrating Technology	Schemes	Future	Risk
Impact	Things	System	Things	Ict	Cryptography	Logistics	Consumption
Future	Performance	Design	Big Data	Internet-Of-Things	Connectedness	System	Quality
Security	Future	Security	Performance	Electricity Theft	Database	Design	Strategies
Traceability	Architecture	Systems	Design	Distributed Storage	Ethnography	Traceability	Price
Adoption	Design	Supply Chain	Future	Codes	Signature Scheme	Impact	Innovation
Design	Information	Blockchain Technology	Information	Policy	Byzantine Fault-Tolerance	Adoption	Models
Things	Trust	Impact	Architecture	Homes	Privacy-Preserving Authentication	Performance	Power
Performance	Privacy	Future	Networks	Rural Electrification	Ddos	Selection	Strategy
Systems	Networks	Information	Trust	Infrastructure	Data Possession	Industry 4.0	Demand
Sustainability	Iot	Adoption	Bitcoin	Online Courses	Industrial Iot	Of-The-Art	Uncertainty
Selection	Big Data	Selection	Privacy	Persistence	Iot Applications	Supply Chain	Determinants
Technologies	Scheme	Logistics	Scheme	Sustainable Development	Proofs	Industry	Performance
Supply Chain	Bitcoin	Energy	Iot	Neural-Networks	Students	Trust	Efficiency

Türkiye's universities with the most publications on the blockchain are shown in table 5. Near East University published the most articles on blockchain technology and it has followed by Bogazici University. Since the world's leading universities have at least 5,000 publications on this subject, it is evident that the quantity and quality of Türkiye-based publications must be increased. Obviously, the rise in the quantity and quality of publications on this topic is dependent on the use and spread of blockchain technology.

Table 5. *Publication/Citation/Impact Values for Turkish Universities on Blockchain*

#	Universities / Türkiye	Citation sum within h-core	All citations	All articles	h-index
1	NEAR EAST UNIV	212	245	20	8
2	BOGAZICI UNIV	140	149	18	6
3	ANKARA YILDIRIM BEYAZIT UNIV	130	137	15	7
4	SAKARYA UNIV	39	42	13	5
5	DOKUZ EYLUL UNIV	63	64	13	2
6	KOC UNIV	115	124	12	5
7	HACETTEPE UNIV	22	31	10	3
8	YASAR UNIV	117	117	9	6
9	YILDIZ TECH UNIV	56	59	9	4
10	ISTANBUL TECH UNIV	27	36	9	4
11	MIDDLE EAST TECH UNIV	58	62	9	3
12	BAHCESEHIR UNIV	28	38	8	4
13	ABDULLAH GUL UNIV	57	61	8	3
14	ANKARA UNIV	19	22	8	2
15	ATILIM UNIV	108	113	7	3
16	EGE UNIV	22	23	7	2
17	GUMUSHANE UNIV	73	76	6	4
18	KAFKAS UNIV	1	2	5	1
19	PIRI REIS UNIV	1	2	5	1
20	TRAKYA UNIV	4	5	5	1
21	BILKENT UNIV	83	83	4	4
22	GALATASARAY UNIV	9	11	4	3
23	GEBZE TECH UNIV	61	61	4	3
24	MEF UNIV	9	10	4	2

Figure 8 shows Türkiye's Universities and Institutions working on blockchain technology collaboratively. Institutions that collaborate with universities (TÜBİTAK, Republic of Türkiye Defense Industry Presidency, etc.) are the key stakeholders in Türkiye's national technological initiatives. The significance of these clustering and collaboration maps lies in the fact that they demonstrate that blockchain technology is also a focus of Türkiye's National Technology Initiative.
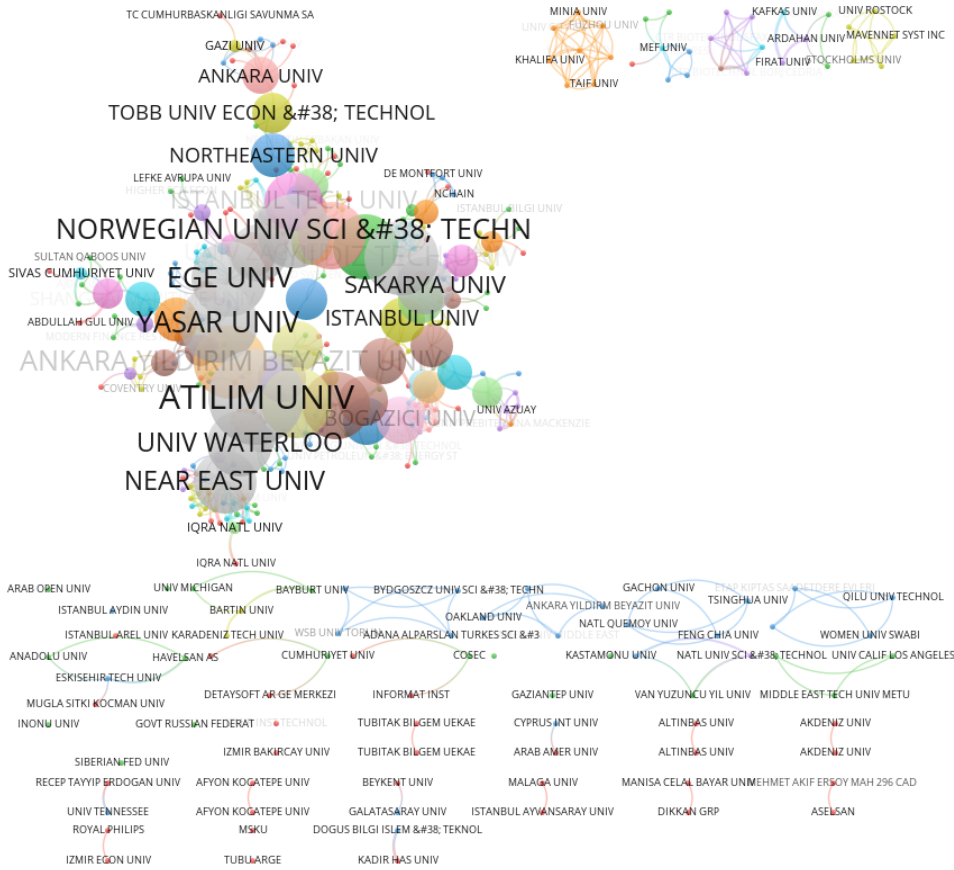
Figure 8. *Collaboration and clustering map of academia and institutions in Türkiye on blockchain technology*

4. Practices in Sectors in Türkiye

Cryptocurrencies have made blockchain technology known in Türkiye too and growing attention to the technology's technical structure and industry applications has emerged (Turkishtime, 2018). In industries such as banking, logistics and business, blockchain technology has already begun to be used in Türkiye (Topcu and Sargül, 2020). The Blockchain Türkiye Platform (BCTR) was formed on June 8, 2018, at the initiative of the Turkish Informatics Foundation and it maintains its regular reporting on several themes ranging from law to health (BCTR, 2022). The Interbank Card Center (BKM), a consortium of public and private institutions, has begun using blockchain technology (BKM, 2018). Akbank has begun using blockchain technology after signing a contract with the United Kingdom-based cryptocurrency Ripple (Akbank Lab, 2017). In addition, Istanbul Settlement and Custody Bank Inc. have implemented the translation of jewels such as gold into virtual currency (Takasbank, 2018). Borsa Istanbul has also initiated a project that will facilitate the exchange of information and documents via blockchain technology (Borsa Istanbul, 2018). Numerous enterprises in the logistics and transportation industries have launched their blockchain-based transportation and tracking projects with their worldwide partners (Tektaş and Kırbaç, 2020). TÜBİSAD conducted the first supply chain

blockchain project in Türkiye in cooperation with IBM (TÜBİSAD, 2022). The Ministry of Commerce announced that it has begun using blockchain-based technology for commercial transactions in 2020 (Customs TV, 2020).

5. Developments of Blockchain in Academia

Academic institutions and research centers have been closely monitoring the blockchain technology in Türkiye. The quantity of scientific theses on blockchain in Türkiye has increased beginning in 2019. 84 of the 95 dissertations on blockchain were master's theses, while 11 were doctorate dissertations (YÖK Thesis Center, 2022). Between 2004 and 2022, a total of 318 papers about blockchain were generated in the TÜBİTAK Dergipark system, 230 of which were research articles. More than seventy of these papers were written about business and finance, followed by law and social sciences. The interdisciplinarity of papers is an additional remarkable aspect of published works (Dergipark, 2022). The connection of blockchain technology with software, law, finance, business and management and other related areas is critical in the multidisciplinary orientation of studies on this subject.

Furthermore, there has been a considerable increase in the institutionalization of blockchain research units in Türkiye. The Blockchain Research Laboratory (BZLab) was established in 2017 under the Mathematical and Computational Sciences Unit of BİLGEM UEKAE to conduct R&D on the infrastructure, installation, security and privacy analysis, business models, crowdfunding approaches and various technical details of blockchain technologies in order to address the needs of public and private organizations (UEKAE, 2022). BİLGEM UEKAE continues to host scientific programs and events at the primary and secondary levels with stakeholders such as Turkcell, the Central Bank of the Republic of Türkiye, Borsa Istanbul and Takas Istanbul, which play significant roles in Türkiye's National Technology Initiative (Blokzincir Bilgem, 2022). The Blockchain Research Group at Muğla Sıtkı Koçman University (MSKU-Blockchain Research Group) was founded in 2017 (MSKÜ, 2017). The Boğazici University project Integration of Low Energy Class Devices into Blockchain-Based Internet of Things Infrastructure was launched in 2017 and is running (BÜ, 2017). Marmara Blockchain Community commenced operations in 2018 (Marmara University, 2018). Bahçeşehir University and the Northeastern University of the United States collaborated to establish the Blockchain Center (BAU BlockchainIST Center) in 2019 (BAU, 2019). The Blockchain Applied and Research Center of Istanbul Aydin University was opened on February 22, 2021 (IAÜ, 2021). The "Blockchain Technologies and Innovation Center" at Istanbul University was opened in December 2022 as part of the Ministry of Industry and Technology's Social Development Support Program (SOGEP). In addition to the student clubs in numerous universities, a platform called UniChain was founded by young, active, enthusiastic and qualified university students interested in blockchain technology in Türkiye (UniChain, 2022).

Academics and researchers working on blockchain technology are pioneers in the university knowledge ecosystem and are interested in blockchain technology in Türkiye. Therefore, a scenario in which administrative prioritizing increases in higher education institutions will accelerate Türkiye's specialization and deepening of this technology. It is evident that the premier institutions in the world working on this technology give substantial financial assistance from the perspective of the resource problem. For instance, the MIT Media Lab (MIT Media Lab, 2022) at the Massachusetts Institute of Technology in the United States is funded by Google, IBM, Intel, Deloitte, Ford, Cisco, Samsung and General Electric (İlkbahar, 2019). It is crucial that the efforts launched by universities in Türkiye on this

subject have the backing of major external sponsors and investors. The atmosphere of mistrust surrounding cryptocurrency also impedes research on blockchain technology in Türkiye. The regulation of cryptocurrencies and efforts to make the law more stable will also have a big impact on blockchain research, an emerging technology (Doğrul and Korkut, 2020). As a matter of fact, digital reality and cognitive technologies such as augmented virtual reality (AR-VR), artificial intelligence (AI) and the internet of things (IoT) are predicted to be the direction areas of blockchain technology in the coming years (Deloitte Insights, 2018). Türkiye has already taken these subjects into the list of strategically prioritized topics.

6. Conclusion

Trends and recent developments in the world's scientific literature indicate that blockchain technology's main applications are highly broad and that this technology has become an important competitive arena among developed nations. According to the concept analysis of blockchain-centric publications, "Challenges", "Management", "Framework", "Internet" and "Technology" emerged as the most popular concepts. It has been concluded that the concepts of "Personalization", "Paradigm", "Mac Protocol", "Consensus" and "Data-Security" are going to increase their significance as underlined in the results of the Yalcin and Daim's 2021 study. Additionally, it has been found that the terms "Management", "Challenges", "Framework", "Big Data" and "Technology" are matured concepts in academic publications. Although Türkiye has attained a certain level in terms of the number of publications, partnerships and practices, its economic level lags behind other nations. Nonetheless, there is a favorable correlation between the growth in publications addressing Türkiye and the expansion of practice and R&D efforts.

As a result of this research and the comparison of the concepts mentioned in blockchain publications, the technology's leading keynotes and problems have been explained. It comes to mind that security is emphasized less in Türkiye-based publications than in global literature and in this instance, blockchain technology continues to be viewed with concern over cryptocurrencies. As a result of the research, it was concluded that Türkiye placed a greater emphasis on technology in terms of logistics, banking and commercial applications, whereas international publications were more concerned with the systemic and software components of technology.

In addition to the courses included in the curricula of higher education institutions, the establishment of thematic research centers was established during the development phase of blockchain technology in Türkiye. The activities centered on blockchain technology fit comfortably with the programs launched in collaboration with university representatives and newly established sector representatives. Due to the creative and decentralized character of blockchain, it is partially evident that studies and research on this topic are still viewed with skepticism. However, centers were formed in universities and projects were undertaken, with the intention of introducing creative approaches to the traditional education and training system, with an emphasis on new technological trends and global trends. This study, which focuses on the global and Turkish blockchain literature trends, has also been enabled to map the blockchain technology's implementers. Institutions and organizations that focus on blockchain in Türkiye are the leading stakeholders of Türkiye's domestic and national technology Initiatives. This confirmed the assumption of this chapter that blockchain technology is strategically prioritized in Türkiye.

References

Akbank Lab. (2017). Blockchain Teknolojisi Türkiye'de İlk Kez Akbank'ta. https://www.akbanklab.com/tr/guncel/basinda-biz/blockchain-teknolojisi-Türkiyede-ilk-kez-akbankta (Accessed: 10.04.2022).

BAU. (2019). Blockchain Konusunda ilk Uzmanlık Eğitimi BAU'da Veriliyor. https://bau.edu.tr/haber/15014-blockchain-konusunda-ilk-uzmanlik-egitimi-bauda-veriliyor (Accessed: 20.04.2022)

BCTR. (2022). Türkiye Bilişim Vakfı. https://bctr.org/ (Accessed: 11.04.2022)

BKM. (2018). Herkes İçin Blockchain. https://bkm.com.tr/wp-content/uploads/2018/12/herkes_icin_blockchain_belgem_io_BKM_2018.pdf (Accessed: 15.04.2022).

Blokzincir Bilgem. TÜBİTAK Blokzincir Araştırma Laboratuvarı, https://blokzincir.bilgem.tubitak.gov.tr/ (Accessed: 15.04.2022)

Borsa İstanbul. (2018). Türkiye'nin İlk Finansal Blockchain Projesi Borsa İstanbul Bilişim Teknolojileri Ekibi Tarafından Hayata Geçirildi. https://www.borsaistanbul.com/tr/duyuru/1096/Türkiyenin-ilk-finansal-blockchain-projesi-borsa-istanbul-bilisim-teknolojileri-ekibi-tarafindan-hayata-gecirildi (Accessed: 10.04.2022).

BÜ. (2017). Blokzincir Tabanlı Nesnelerin İnterneti Altyapısına Düşük Enerji Sınıfı Cihazların Entegrasyonu. https://arastirma.boun.edu.tr/tr/proje/blokzincir-tabanli-nesnelerin-interneti-altyapisina-dusuk-enerji-sinifi-cihazlarin (Accessed: 20.04.2022)

Casino, F., Dasaklis, T. K., Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification and open issues. *Telematics and Informatics, 36,* 55-81.

Cornella, A., Zamengo, L., Delepierre, A., Clementz, G. (2020). Blockchain in Defence: A Breakthrough?, FINABEL (European Army Interoperability Center). https://finabel.org/wp-content/uploads/2020/09/FFT-Blockchain.pdf.

Costums TV. (2020). Ticaret Bakanlığı Blockchain Çalışmalarına Başladı, 10.01.2020. https://www.gumruktv.com.tr/ticaret-bakanligi-blockchain-calismalarina-basladi (Accessed: 15.04.2022).

Daim, T. U., & Yalcin, H. (2022). Digital Transformations: New Tools and Methods for Mining Technological Intelligence. Edward Elgar Publishing.

Daim, T., Lai, K. K., Yalcin, H., Alsoubie, F., & Kumar, V. (2020). Forecasting technological positioning through technology knowledge redundancy: Patent citation analysis of IoT, cybersecurity and Blockchain. Technological Forecasting and Social Change, 161, 120329.

Daniele, R., Hicks, D. & Martin, B. R. (2015). What is an Emerging Technology?. SWPS 2015-06, Available at SSRN: https://ssrn.com/abstract=2743186 or http://dx.doi.org/10.2139/ssrn.2743186

Deloitte Insights. (2018). Tech Trends 2019: Beyond Frontier. https://www2.deloitte.com/content/dam/Deloitte/br/Documents/technology/DI_TechTrends2019.pdf (Accessed: 12.04.2022).

Dergipark. (2022). TÜBİTAK ULAKBİM. https://dergipark.org.tr/tr/search?q=%22blockchain%22+%22blokzincir%22&section=articles (Accessed: 20.04.2022).

Doğrul, M. & Korkut, C. (2020). The Future of Cryptocurrency After the Pandemic, Reflections on the Pandemic in the Future of the World içinde, Türkiye Bilimler Akademisi Yayınları, ISBN: 978-605-2249-53-6, DOI: 10.53478/TUBA.2020.101. pp. 642-654.

Doğrul, M., & Erğurum, A. (2021). Blok Zincirinin (Blockchain) Literatür Büyümesi Işığında Yeni Siber Güvenlik Arayışları. *Güvenlik Bilimleri Dergisi, 10,* 175-194.

Gümrük TV. (2020). Ticaret Bakanlığı Blockchain Çalışmalarına Başladı, 10.01.2020. https://www.gumruktv.com.tr/ticaret-bakanligi-blockchain-calismalarina-basladi (Accessed: 15 Nisan 2022).

İAÜ. (2021). "İstanbul Aydın Üniversitesi Blokzincir Uygulama ve Araştırma Merkezi", https://www.aydin.edu.tr/tr-tr/arastirma/arastirmamerkezleri/blokzincir-uygulama-arastirma-merkezi/Pages/default.aspx (Accessed: 20.04.2022)

İlkbahar, Recep. (2019). Türkiye'deki Üniversiteler ve Blokzincir. https://recepilkbahar.medium.com/t%C3%BCrkiyedeki-%C3%BCniversiteler-ve-blokzincir-7f96b8ddd7ba (Accessed: 11.04.2022).

Lele, A. (2018). Blockchain, Disruptive Technologies for the Militaries and Security, 197–202.

Marmara Üniversitesi. (2018). "Marmara Blokzinciri Topluluğu" https://www.meetup.com/tr-TR/Marmara-Blokzinciri-Toplulu%C4%9Fu-Marmara-Blockchain-Community/?_cookie-check=V66q5hEtBHExlALR (Accessed: 20.04.2022)

Miraz, M. H. & Ali, M. (2018). Applications of Blockchain Technology beyond Cryptocurrency. *Annals of Emerging Technologies in Computing (AETiC), 2*(1), 1-6.

MIT Media Lab. (2022). https://www.media.mit.edu/ (Accessed: 12.04.2022).

Mohsen, A., & Gunasekaran, A. (2019). Blockchain-Enabled Technology: The Emerging Technology Set to Reshape and Decentralize Many Industries, *Int. J. Applied Decision Sciences, (12*)4, 424-444.

MSKÜ. (2017). Muğla Sıtkı Koçman Üniversitesi Blok Zinciri Araştırma Grubu". https://www.youtube.com/watch?v=umqfL1GQPag (Accessed: 20.04.2022).

Takaoğlu, M., Özer, Ç. & Parlak, E. (2019). Blokzinciri Teknolojisi ve Türkiye'deki Muhtemel Uygulanma Alanları. *Uluslararası Doğu Anadolu Fen Mühendislik ve Tasarım Dergisi, 1*(2), 260-295.

Takasbank. (2018). "Takasbank'tan Blokzincir Tabanlı Yeni Nesil Transfer Sistemi". https://www.takasbank.com.tr/tr/duyurular/duyuru-detay/takasbank-tan-blokzincir-tabanli-yeni-nesil-transfer-sistemi (Accessed: 12.04.2022)

Tektaş, B. & Kırbaç, G. (2020). Lojistik Sektöründe Blokzinciri Teknolojisinin Kullanılmasına Yönelik Bir Vaka Analizi İncelemesi ve Lojistik Şirketi Uygulaması. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 25*(3), 343-356.

Topcu, Altay, B. & Sumerli Sarıgül, S. (2020). Dünyada ve Türkiye'de Blok Zinciri Teknolojisi: Finans Sektörü, Dış Ticaret ve Vergisel Düzenlemeler Üzerine Genel

Bir Değerlendirme. Avrupa Bilim ve Teknoloji Dergisi, Ejosat Özel Sayı 2020 (ARACONF), 27-39. pp. 36-37.

TÜBİSAD. "Türkiye'nin ilk tedarik zinciri blokchain projesi IBM ile hayata geçiyor". Türkiye Bilişim Sanayicileri Derneği, https://www.tubisad.org.tr/tr/guncel/detay/Türkiyenin-ilk-tedarik-zinciri-blokchain-projesi-IBM-ile-hayata-geciyor/33/1240/0 (Accessed: 18.04.2022)

Turkishtime. (2018). Türk Şirketler 'Blokzincir'i Keşfetmeye Başladı. Turkishtime Dergi, http://turkishtimedergi.com/dijital-ekonomi/turk-sirketler-blokzinciri-kesfetmeye-basladi/ (Accessed: 12.04.2022).

U.S. National Defense Authorization Act. (2019). Conference Report, For the Fiscal Year 2020. https://docs.house.gov/billsthisweek/20191209/CRPT-116hrpt333.pdf.

UEKAE. (2022). TÜBİTAK BİLGEM Ulusal Elektronik ve Kriptoloji Araştırma Enstitüsü. https://uekae.bilgem.tubitak.gov.tr/

UniChain. (2022). https://unichaintr.com/# (Accessed: 14.04.2022).

Yalcin, H., & Daim, T. (2021). A scientometric review of technology capability research. *Journal of Engineering and Technology Management, 62*, 101658. https://doi.org/10.1016/j.jengtecman.2021.101658

Yalcin, H., & Daim, T. (2021). Mining research and invention activity for innovation trends: case of blockchain technology. *Scientometrics, 126*(5), 3775-3806.

YÖK Thesis Center. (2022). https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp (Accessed: 14.06.2022).

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