

Bibliometric analysis of scientific production on international trade and cryptocurrency



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ABSTRACT

There has been a remarkable increase in the number of publications on international trade and cryptocurrency in recent years. This paper aims to analyze the literature on international trade and cryptocurrency in the Web of Science database. This study uses the bibliometric method and mapping analysis. The cluster analysis is conducted based on the keyword analysis. These publications are reviewed from different aspects such as type of publication, language, and book title. This study found that 767 articles which are related to cryptocurrency and international trade. Among the countries in which these studies are conducted, China ranks the first, followed by the USA and UK, respectively. Various organizations in different countries support studies on this topic. In conclusion, cryptocurrency technologies draw the attention of academia, and the use of cryptocurrency in international trade will determine the future trade structure. The innovative features of cryptocurrency can develop new business models, which may be the reason for the academic interest in this matter. It will be useful for businesses and governments to follow this potential carefully to benefit from the advantages of innovative business models.

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1. Introduction

Cryptocurrencies have attracted the attention of several sectors in recent years such as finance (Burggraf and Rudolf, 2020; Qureshi et al., 2020; Apergis et al., 2020), computer sciences (Prybila et al., 2020; Alonso-Monsalve et al., 2020; Borges and Neves, 2020), and international trade (Chu et al., 2020; Makarov and Schoar, 2020). Recently, several studies on cryptocurrency have been published in many disciplines. The highly fluctuating cryptocurrency market had its peak in 2017 (Higbee, 2018). Such cases lead to the growth of end-to-end markets and the emergence of new cryptocurrencies in blockchain technologies as an important element of financial markets (Rehman and Apergis, 2019). The future of cryptocurrencies is expected to reshape the digital assets and financial industries. Cryptocurrency is based on blockchain technology, it bears its features and offers confidentiality to its

users. With its low transaction cost potential and ability to make a transaction without finding an intermediary, it's attracted huge attention in the last decade (Baek et al., 2019). The cryptocurrency is traded 24 hours (Groby et al., 2020), and the blockchain which is the technology used by cryptocurrencies offer opportunities for international organizations. Cryptocurrency technologies are the tools to facilitate economic development and provide customized management services. It has the capability of proving the digital asset or content of a document at a certain time. It is a payment mechanism and accounting system that has human-to-machine interaction and also machine-to-machine transaction capacity. Moreover, it is a worldwide ledger that can register, approve and transfer all assets of the community (Swan, 2015). Although cryptocurrencies have several positive aspects, certain challenges are also observed such as integration with the real world while applying and using cryptocurrencies. These challenges along with the positive aspects will be the future productive and efficient areas of research for us (Bhat and Vijayal, 2017).

In this study, a bibliometric analysis was conducted on the studies focusing on international trade and cryptocurrency. The purpose of the analysis was to determine the academic knowledge

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production features of the publications focusing on international trade and cryptocurrency. In this way, the characteristics of the interaction between cryptocurrency and international trade will be revealed.

2. Related literature

Bibliometric analyses have been used in several scientific disciplines. For example; Kamran et al. (2020) analyzed blockchain and the Internet of Things with a bibliometric study method. Miot et al. (2020) applied a bibliometric approach to their publications on Dermatology in 2009-2019. El Mohadab et al. (2020) used a bibliometric method to map the current state of COVID-19. They analyzed various aspects such as the number of publications, number of citations, and the country of publication. Verma et al. (2021) used a bibliometric method for their publication on forty years of applied mathematical modeling. The purpose of their study was to determine the leading authors, topics, universities, and countries in that field. They used VOSViewer software for visualization. Tsai et al. (2020) reviewed the literature in order to perform the bibliometric analysis of municipal solid waste management in a circular economy. Pizzi et al. (2020) focused on the publications of academics in the field of business and management on sustainable development. They used VOSViewer software for visualization in their study where they focused on 266 publications from 2012 to 2019. Gao et al. (2020) studied open innovation. Wang et al. (2021) used the data from 1980 to 2019 in their study where they focused on decision-making on indefinite groups. In that period, they analyzed 4887 articles they found on the Web of Science (WoS). Like in several publications, they also analyzed different aspects such as countries, organizations, and authors. Usman and Ho (2020) analyzed more than 4000 articles in their study where they focused on the application of soil and water reclamation. Alvarez-Peregrina et al. (2020) analyzed 346 articles published from 1960 to 2019 in their study on multi-focus contact lenses. Merediz-Solà and Bariviera (2019) performed a bibliometric analysis of Bitcoin literature. They used a dataset of 1162 articles indexed on WoS. Their study described the keywords, authors, and journals about Bitcoin which is a leading cryptocurrency. As another example, the data from 1989 to 2019 was collected using the keyword "Analysis using ANSYS." This analysis also covered the search on titles and abstracts in addition to subjects and keywords and key phrases in articles. As a result of the search, they included 359 articles they found in their bibliometric analysis (Muhammad et al., 2020). Some studies did not search all articles but instead, they selected a hundred articles having the highest number of references and included them in the analysis (Paladugu et al., 2002).

Another study conducted in this way was a bibliometric analysis performed for the Industrial

Marketing Management Journal, in which they found that although the studies on "trade" were at the center of the research topics of the relevant journal, it was one of the least researched topics. Further analyses demonstrated that there was a limited number of studies on technological innovation. It appears that research studies mainly focus on international B2B trade. These studios ignored the role of such tools as the Internet of Things, artificial intelligence, blockchain, and production technologies. Certain research gaps can be identified through analysis of journals and recommendations can be devised for further research (Lacka et al., 2020).

3. Methodology

Bibliometric analysis enables researchers to performed macro and micro analyses of numerous studies, which may be helpful for them (Kokol and Vošner, 2019). The term statistical bibliography was proposed by Hulme (1923). This term seems to be ignored for two decades until it was used by C. F. Gosnell in an article on the obsolescence of literary works. Due to the recent increased attention to the assessment of scientific production, bibliometric studies have been performed and become a discipline. Following the establishment of the Institute for Scientific Information (ISI) in the USA in the 1960s, Eugene Garfield started the metrification of articles, journals, researchers, and organizations. It was later used by Raisig (1962) in a critical on citations. However, several authors never thought that the term statistical bibliography was sufficient. For that reason, the term bibliometrics is suggested for studies where mathematical and statistical methods are applied in books and other means of communication (Pritchard, 1969).

Bibliometric analysis is a common technique used to assess performance (Burghardt et al., 2020) With bibliometric analysis, it is possible to gather information about the structural features of the research field (Umut and Coştur, 2007). Today, scientific articles are compiled in large databases that allow assessing different aspects of articles such as authors, keywords, subject, citation, and organizational cooperation, and they are attached to indices. Considering that authors need to make a careful selection to cite the most relevant studies for their articles so that most of the cited articles can reflect their significance in the discipline. With this, organizations get valuable information about the individual and collective effects of the studies. The importance of bibliometric studies is beyond the organizational level. New researchers in a discipline can use it to understand the scope of the topic, emerging trends, and development in time. In this sense, it is different from the conventional literature research (Merediz-Solà and Bariviera, 2019). Like in many other study fields, bibliometric analysis is still evolving (Holden et al., 2005).

The publication features of the discipline are the first and effective indicator whether a bibliometric

analysis is applicable to a field. International peer-reviewed journals are a good option to see the publication features. If international journals are dominant or at least important means of communication in a discipline, bibliometrics analysis can be applied in most cases (Van Raan, 2005). The bibliometric analysis offers an effective way to handle thousands of articles and review the relevant literature from a macro perspective (Wang et al., 2020).

We searched those publications according to the following keywords: ("blockchain," "cryptocurrency," "bitcoin," "ethereum," "international business," "international trade," "logistics," "finance"). The results were analyzed according to publication years, WoS categories, source titles, research areas, countries/regions, document types, meeting titles, organizations, organizations-enhanced, book series titles, funding agencies, languages, and authors. WoS has become a golden standard for research discovery and analytics by diligently indexing the literature. WoS connects publications and researchers by way of citations in the comprehensive databases covering each discipline and controlled indexation. This database allows researchers to study certain areas such as Science Citation Index Expanded, Social Sciences Citation Index, and Conference Proceedings Citation Index-Science. To retrieve data from these areas, the following formula can be used (Chen et al., 2014): "TS = ("life cycle assessment*" OR "life cycle analys*" OR "life cycle sustainability assessment*" OR "life cycle sustainability analys*" OR ("eco balanc*" OR "ecobalanc*")). Timespan = 1998–2013.

Databases = (SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH). The retrieval time was 2014.03.31. TS was referred to as a topic search (i.e., search in the title, keywords, and abstract fields of a publication). The metadata of all articles included in the WOS (2020a) index accessed on 21.02.2020 was analyzed. These topics attract the attention of wide circles such as the financial economy, international trade, logistics, computers, and law. This part presents useful information to journals or authors interested in publishing articles on these topics about the development of the topics studied in such articles. Bibliometric rendering of the study was performed by using VOSviewer (version 1.6.14) package software. The website (http://lert.co.nz) was used to draw the world map.

4. Findings

4.1. Query

The data regarding the types of indices presented in Table 1 were searched in the WoS database. From the searched indices, SSCI, SCI-EXPANDED, and A&HCI have the oldest records. The data in these three indices have been stored there since 1975. The query used to collect data from WoS was as follows: ALL FIELDS: (("blockchain" OR "cryptocurrency" OR "bitcoin" OR "ethereum") AND ("international business" OR "international trade" OR "logistics" OR "finance")) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI Timespan=All years.

Table 1: Names of indices in the query (WOS, 2020b)

Short Index Name	Index Name	Starting Year
SSCI	Social Sciences Citation Index	1975
SCI-EXPANDED	Science Citation Index Expanded	1975
AandHCI	Arts and Humanities Citation Index	1975
CPCI-S	Conference Proceedings Citation Index- Science	1990
CPCI-SSH	Conference Proceedings Citation Index- Social Science and Humanities	1990
BKCI-S	Book Citation Index- Science	2005
BKCI-SSH	Book Citation Index- Social Sciences and Humanities	2005
ESCI	Emerging Sources Citation Index	2015

4.2. Tables

After all indices in Table 1 are searched on WoS; 25 publications from 2020, 358 from 2019, and 249 from 2018 were found (Table 2). Table 2 shows that the number of publications on the relevant query fields including primary cryptocurrency, blockchain, and international trade has increased in recent years. There was a remarkable increase in 2018 and beyond compared to the previous years.

Top three fields where the relevant articles were published were business finance, economics, and computer science information systems. Based on Table 3, it can be suggested that there is a high interest in cryptocurrency and technologies in the business finance sector. The publications in this sector were ahead of the other fields.

Table 4 shows that the top three journals where articles about international trade and

cryptocurrency are published were dominated by finance and business journals. After the top three, a high number of social sciences journals is also remarkable.

Table 2: Publication years

Publication Years	Records	% of 767
2020	25	3.259
2019	358	46.675
2018	249	32.464
2017	91	11.864
2016	24	3.129
2015	14	1.825
2014	5	0.652
2012	1	0.130

(0 Publication Years value(s) outside display options.)
(0 records (0.000%) do not contain data in the field being analyzed)

Table 5 shows the number of publications by research areas. Business Economics ranks the first with 469 publications. This is followed by Computer

Science with 180 publications. Engineering ranks third with 91 publications. It appears that the number of publications in the first ranking area is

different from and higher than that in the other areas.

Table 3: Web of science categories

Web of Science Categories	Records	% of 767
Business Finance	316	41.199
Economics	135	17.601
Computer Science Information Systems	86	11.213
Computer Science Theory Methods	69	8.996
Business	63	8.214
Engineering Electrical Electronic	63	8.214
Computer Science Interdisciplinary Applications	53	6.910
Telecommunications	48	6.258
Management	43	5.606
Operations Research Management Science	23	2.999
Physics Multidisciplinary	23	2.999
Engineering Industrial	19	2.477
Law	19	2.477
Computer Science Software Engineering	18	2.347
Social Sciences Mathematical Methods	14	1.825
Information Science Library Science	12	1.565
Multidisciplinary Sciences	12	1.565
Education Educational Research	11	1.434
Mathematics Interdisciplinary Applications	11	1.434
Transportation Science Technology	11	1.434
Computer Science Artificial Intelligence	9	1.173
Computer Science Hardware Architecture	9	1.173
Engineering Multidisciplinary	9	1.173
Transportation	9	1.173
Green Sustainable Science Technology	8	1.043

(52 Web of Science Categories Value(S) Outside Display Options.); (3 Records (0.391%) Do Not Contain Data in The Field Being Analyzed.)

Table 4: Source titles

Source Titles	Records	% of 767
Finance Research Letters	58	7.562
Research in International Business and Finance	25	3.259
Handbook of Blockchain Digital Finance and Inclusion Vol 2 Chinattech Mobile Security Distributed Ledger And Blockchain	24	3.129
Handbook of Blockchain Digital Finance and Inclusion Vol 1 Cryptocurrency Fintech Insurtech and Regulation	22	2.868
Physica A Statistical Mechanics and Its Applications	18	2.347
IEEE Access	14	1.825
Strategic Change Briefings in Entrepreneurial Finance	14	1.825
Journal of Corporate Accounting and Finance	13	1.695
Economics Letters	12	1.565
Vision 2020 Sustainable Economic Development and Application of Innovation Management	12	1.565
Journal of Risk and Financial Management	11	1.434
Journal of Risk Finance	10	1.304
CCS 17 Proceedings of The 2017 ACM SIGSAC Conference on Computer and Communications Security	9	1.173
Springerbriefs in Finance	9	1.173
Supply Chain Finance and Blockchain Technology the Case of Reverse Securitisation	9	1.173
Applied Economics Letters	8	1.043
Financial Innovation	7	0.913
Lecture Notes in Computer Science	7	0.913
North American Journal of Economics and Finance	6	0.782
Quarterly Review of Economics and Finance	6	0.782
2018 8th International Conference on Logistics Informatics and Service Sciences LISS	5	0.652
Applied Economics	5	0.652
Banking Beyond Banks and Money A Guide to Banking Services in the Twenty-First Century	5	0.652
Education Excellence And Innovation Management Through Vision 2020	5	0.652
International Review of Financial Analysis	5	0.652

(400 Source Titles value(s) outside display options.); (0 records (0.000%) do not contain data in the field being analyzed.)

In the breakdown of countries where the relevant publications on WoS were published (Table 6), China ranks the first with 140 studies. This was followed by the USA with 135 articles. England is in third place with 81 publications.

Fig. 1 shows the distribution of publications on WoS by country. There are almost no countries in the African Continent and the Middle East from which articles are published. The Republic of South Africa

is an exception in Africa. Brazil is an exception in South America.

Table 7 shows the distribution of publications by type of documents. The article ranks first with 534 publications. Presentation is in second place with 177 publications. The book chapter ranks third with 73. Table 8 presents the number of publications in conferences. 32nd Conference of The International Business Information Management Association ranks the first with 12 presentations. The conference

in the second place has 9 publications and the third one has 5 publications.

Table 5: Research areas

Research Areas	Records	% of 767
Business Economics	469	61.147
Computer Science	180	23.468
Engineering	91	11.864
Telecommunications	48	6.258
Physics	26	3.390
Operations Research Management Science	23	2.999
Government Law	20	2.608
Science Technology Other Topics	20	2.608
Mathematical Methods In Social Sciences	14	1.825
Mathematics	14	1.825
Transportation	13	1.695
Information Science Library Science	12	1.565
Education Educational Research	11	1.434
Environmental Sciences Ecology	9	1.173
International Relations	7	0.913
Social Sciences Other Topics	7	0.913
Automation Control Systems	6	0.782
Energy Fuels	6	0.782
Chemistry	5	0.652
Instruments Instrumentation	5	0.652
Criminology Penology	4	0.522
Public Administration	4	0.522
Sociology	4	0.522
Anthropology	3	0.391
Area Studies	3	0.391

(22 Research Areas value(s) outside display options.); (3 records (0.391%) do not contain data in the field being analyzed.)

Table 6: Countries/regions

Countries/Regions	Records	% of 767
China	140	18.253
USA	135	17.601
England	81	10.561
Germany	65	8.475
Australia	56	7.301
Russia	42	5.476
France	38	4.954
Switzerland	35	4.563
Singapore	31	4.042
South Korea	27	3.520
Italy	26	3.390
Canada	23	2.999
Spain	22	2.868
India	21	2.738
Netherlands	19	2.477
Brazil	16	2.086
Poland	16	2.086
Lebanon	14	1.825
Austria	13	1.695
Japan	13	1.695
Malaysia	13	1.695
Turkey	13	1.695
South Africa	12	1.565
Czech Republic	11	1.434
Ireland	11	1.434

(54 Countries/Regions Value(S) Outside Display Options); (7 Records (0.913%) Do Not Contain Data in The Field Being Analyzed)

Table 7: Document types

Document Types	Records	% of 767
Article	534	69.622
Proceedings Paper	177	23.077
Book Chapter	73	9.518
Early Access	39	5.085
Review	29	3.781
Editorial Material	21	2.738
Book	2	0.261
Book Review	2	0.261
Correction	2	0.261
News Item	1	0.130

(0 Document Types Value(S) Outside Display Options.); (0 Records (0.000%) Do Not Contain Data In The Field Being Analyzed.)

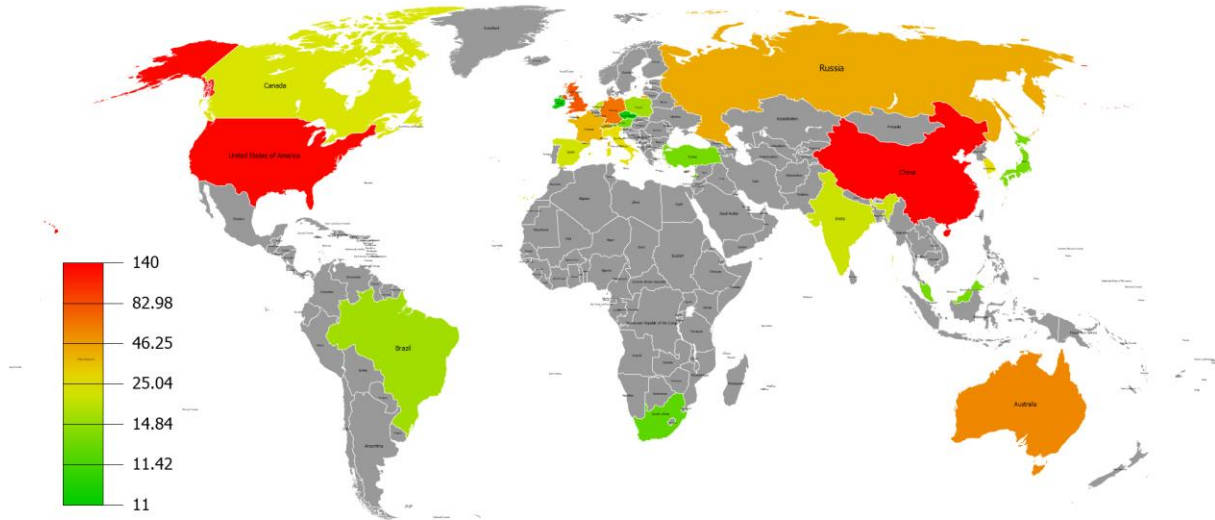


Fig. 1: Distribution of publications on WoS by countries

Table 8: Meeting titles

Meeting Titles	Records	% of 767
32 nd Conference of The International Business Information Management Association IBIMA	12	1.565
24 th Acm Sigsac Conference on Computer and Communications Security ACM CCS	9	1.173
33 rd International Business Information Management Association Conference	5	0.652
8 th International Conference on Logistics Informatics and Service Sciences LISS	5	0.652
31 st International Business Information Management Association Conference	4	0.522
11 th International Scientific Conference On New Challenges of Economic and Business Development Incentives for Sustainable Economic Growth	3	0.391
Crypto Valley Conference on Blockchain Technology CVCBT	3	0.391
International Conference on Economics Finance and Statistics ICEFS	3	0.391
11 th International Scientific Conference on Financial Management of Firms and Financial Institutions	2	0.261
13 th IEEE International Symposium on Autonomous Decentralized System ISADS	2	0.261
15 th International Scientific Conference on European Financial Systems 2018	2	0.261
1 st International Scientific Conference on Modern Management Trends and the Digital Economy From Regional Development to Global Economic Growth MTDE	2	0.261
21 st International Conference on Advanced Communication Technology ICACT	2	0.261
30 th International Business Information Management Association Conference	2	0.261
3 rd IEEE International Conference on Cloud Computing and Big Data Analysis ICCCBDA	2	0.261
4 th International Conference on Environmental Science and Material Application ESMA	2	0.261
5 th IEEE International Conference on Progress in Informatics and Computing Pic	2	0.261
5 th International Conference on Behavioral Economic and Socio-Cultural Computing BESC	2	0.261
IEEE International Congress on Cybermatics IEEE Conferences on Internet Of Things Green Computing and Communications Cyber Physical and Social Computing Smart Data Blockchain Computer and Information Technology	2	0.261
IFIP WG 5 7 International Conference on Advances in Production Management Systems APMS	2	0.261
International Conference on Blockchain Technology ICBCT	2	0.261
International Seminar on Computer Science and Engineering Technology SCSET	2	0.261
10 th International Conference on Computer Modeling and Simulation ICCMS	1	0.130
10 th International Symposium on Foundations and Practice of Security FPS	1	0.130
10 th Uwcisa Biennial Research Symposium on Information Integrity and Information Systems Assurance	1	0.130

(102 Meeting Titles Value(S) Outside Display Options.); (590 Records (76.923%) Do Not Contain Data in The Field Being Analyzed.)

Table 9 shows the organization where the authors of the publications are affiliated. Montpellier Business SCH ranks the first with 14 publications, followed by Cent University Finance Econ with 13 publications. The organization in the third plan has 2 publications.

Table 10 shows the list of Organizations-Enhanced publications. The University of London ranks the first with its support to 16 publications. Montpellier Business School ranks second with its support to 14 publications. The Central University of Finance Economics and University College London rank third with 13 publications. The support provided by the British organizations to publications

may be the reason why the UK is in third place in the country ranking.

4.3. Keyword analysis

The size of the circles shown in the image in Fig 2 demonstrates the frequency of the keywords. The thickness of the lines indicates which words were used together in similar studies (Kiraz and Demir, 2020). The cluster analysis was based on keyword analysis, according to which network map was created. The clusters created around the keywords were converted into Fig. 2 with three different colors.

Table 9: Organizations

Organizations	Records	% of 767
Montpellier Business SCH	14	1.825
Cent Univ Finance Econ	13	1.695
UCL	12	1.565
Singapore Univ Social Sci	11	1.434
Univ St Gallen	11	1.434
Holy Spirit Univ Kaslik	10	1.304
Singapore Management Univ	10	1.304
Left Coast	9	1.173
Univ Hong Kong	9	1.173
Crx Markets Ag	8	1.043
Pusan Natl Univ	8	1.043
Sultan Qaboos Univ	8	1.043
Peter Great St Petersburg Polytech Univ	7	0.913
Rmit Univ	7	0.913
Tianjin Univ	7	0.913
Univ Sydney	7	0.913
Univ Western Australia	7	0.913
Dublin City Univ	6	0.782
Nankai Univ	6	0.782
Peking Univ	6	0.782
Southwestern Univ Finance Econ	6	0.782
Swiss Fed Inst Technol	6	0.782
Univ Econ	6	0.782
Univ Huddersfield	6	0.782
Univ Pretoria	6	0.782

(950 Organizations Value(S) Outside Display Options.); (9 Records (1.173%) Do Not Contain Data In The Field Being Analyzed.)

Table 10: Organizations-enhanced

Organizations-Enhanced	Records	% of 767
University of London	16	2.086
Montpellier Business School	14	1.825
Central University of Finance Economics	13	1.695
University College London	13	1.695
Singapore University of Social Sciences Suss	11	1.434
University of St Gallen	11	1.434
Holy Spirit Univ Kaslik	10	1.304
Singapore Management University	10	1.304
Eth Zurich	9	1.173
Left Coast	9	1.173
University of Hong Kong	9	1.173
CRX Markets Ag	8	1.043
International Islamic University Malaysia	8	1.043
Pusan National University	8	1.043
Sultan Qaboos University	8	1.043
University of New South Wales Sydney	8	1.043
Peter The Great St Petersburg Polytechnic University	7	0.913
Royal Melbourne Institute of Technology Rmit	7	0.913
Tianjin University	7	0.913
University of California System	7	0.913
University of Sydney	7	0.913
University of Western Australia	7	0.913
Centre National De La Recherche Scientifique CNRS	6	0.782
Dublin City University	6	0.782
Nankai University	6	0.782

(964 Organizations-Enhanced value(s) outside display options.); (9 records (1.173%) do not contain data in the field being analyzed.)

An evaluation of the visual network map reveals that there are three main groups. The red group has 120 items; the green group has 112 while the blue group has 102 items. The dominant item in the green group is “cryptocurrency” which has a strong connection with the other items in both its own group and the ones in the other two groups. Logistic and trade in the blue group, however, could not form strong connections as much as cryptocurrency. “Business” in the red group formed a strong connection with technology, “blockchain technology,” “blockchain,” and “system” in the blue group apart from the items in its group. Fig. 3 demonstrates the connection created by the publications bearing the keywords used in the query.

According to the connections, cryptocurrency and the international trade ecosystem are related.

WoS Density Graph highlights the most frequently used words. As demonstrated in the graph, phrases such as “business,” trade,” and “logistic” are behind the phrases such as technology,” “blockchain technology,” “blockchain,” and “bitcoin.”

5. Conclusion

This paper analyses the production of academic knowledge related to international trade and cryptocurrency, recorded in the Wos database, and its power of change. The findings show that there has been a significant increase in the number of

however, could not form strong connections as much as “cryptocurrency.” “Business” in the red group formed a strong connection with “technology,” “blockchain technology,” “blockchain,” “system” in the blue group apart from the items in its group. These connections show that cryptocurrency and the international trade ecosystem are related.

Cryptocurrency and blockchain technologies attract the attention of the academic world. The change potential of these technologies may be the reason for such attention. It will be useful for organizations and countries that wish to use this potential to follow the trend of increase in the number of publications in this field carefully database. An analysis was performed on the production of academic knowledge about international trade and cryptocurrency based on blockchain technology for which very ambitious statements are made as regards its power of change.

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Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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