Emerging trends and performance measurement of cryptocurrency research during 2013–2022: a systematic review based on computational mapping

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Abstract
Purpose – The emergence of cryptocurrencies has tremendously changed the way of financial transactions around the world which has led to form distinct discussions in the field regarding its reliability. This paper aims to evaluate the published literatures on cryptocurrency identifying its growth, citation, prolific authors, journals, countries, active funding agencies, collaboration pattern and emerging research hotspots in the area.

Design/methodology/approach – Scientometrics and Altmetrics parameters have been incorporated in the study. Literatures covered from the Scopus database searching within “Article Title, Abstract, Keywords” with keywords “cryptocurrency” OR “digital currency” OR “bitcoin” OR “Ethereum” by limiting the time range of 2013–2022, English language and journal articles only. Total 6,107 documents have been identified. The further analysis and visualisation is performed using MSExcel, VOSviewer, Biblioshiny and Tableau. Another tool, Dimension.ai is used to identify the Altmetric Attention Score.

Findings – The findings reveal that the growth of research and citation rate hiked from the year 2017 till now. Elie Bouri is the top contributor, IEEE Access is the most prolific journal, China being the prolific country. Topics like Blockchain, Bitcoin, Ethereum, smart contracts, financial markets are emerging researched hotspots. The reliability of crypto market is still not clear because of its high volatility. The findings of the study will be more useful in the academia, subject specialists, research institutions, funding agencies, publishing agencies in decision-making.

Originality/value – To the best of the authors’ knowledge, there is no such study found considering both Scientometrics and Altmetrics approaches on cryptocurrency research with the selected time bound.

Keywords Cryptocurrency, Virtual currency, Scientometrics, Altmetrics, VOSviewer, Biblioshiny, Tableau

Paper type Research paper

Introduction
Along with the evolution of human civilisation, the monetary system has also undergone many transformations starting from the barter system to the digital currency. The evolution of money can be observed from the emerging crisis in the oldest barter system that led to development of paper money (Dodwani, 2021). The study of Anbugeetha and Nandhini (2021)
presented the stages of money starting from commodity money – metallic or metal coins – paper money – credit money – electronic or plastic money – cryptocurrencies. In the recent times, cryptocurrencies have gained much importance among different fields like business and finance, economics, engineering, computer science, researchers, investors and policymakers (Ramona et al., 2019). With the growth of new innovations and technologies in the economy market, the emergence of cryptocurrencies has tremendously changed the way of financial transaction. The financial crisis that occurred in the year 2008 has led to the development of the first cryptocurrency Bitcoin by Satoshi Nakamoto that allows end-to-end electronic transaction by groundbreaking the market capitalisation and scientific interest (Corbet et al., 2018; Jalal et al., 2021; Mezquita et al., 2023). It provides a secure online transaction through peer-to-peer connection with cryptographic algorithm in a decentralised mechanism, which denies the interference of any middleman or government body due which it is globally accessible from any location. Previously, there other digital currencies have also been introduced like E-gold in 1996 and Liberty in 2006 but not received much popularity like bitcoin and Ethereum (García-Corral et al., 2022). The volatility of the Bitcoin is very high still have given higher returns to the investors (Vasudeva, 2023). The peer-to-peer network system is supervised by a system called blockchain technology, which is a significant component of the cryptocurrency. The Blockchain is a distributed database that acts like a digital ledger for keeping the record of all the cryptocurrency transactions throughout the network consumers (Alsmadi et al., 2022). The transaction is carried out by the miners who mines the electronic currencies for creating a new unit from the existing ones (Eyal and Sirer, 2013). There also other cryptocurrencies attracting the attention of people in the market like Ethereum, Litecoin and Ripple (XRP) (Charles and Darné, 2019; Nikolova et al., 2020; Fang et al., 2022). Moreover, as every object has its pros and cons, there are lot of discussions going on cryptocurrency both in academic and non-academic setting regarding its reliability and usefulness in future. The actual meaning of cryptocurrency is still not clear to many and lacks awareness among the general people. Previous studies have discussed on its advantages and disadvantages, The good side of it is that it provides a secure and faster payment system cutting off the third-party interference (Giudici et al., 2019). Bjerg (2016) claimed that cryptocurrencies have challenged the present conventional form of currency. Gowda and Chakravorty (2021) find the cryptocurrency transaction better than conventional bank transaction but less experienced as the banks. Some studies have also claimed another demerit that cryptocurrency also may lead to price volatility and cybercrimes (Chudinovskikh and Sevryugin, 2019; Gupta and Chaudhary, 2022). Many developed and developing countries like the USA, Canada, Singapore, Switzerland, Russia, Iran, etc., have found cryptocurrency a friendly electronic finance system (Jani, 2018). Shukla et al. (2022) states that in India, initially the government’s unwillingness to adopt cryptocurrency and big taxes, stands as a barrier for investments on cryptocurrency. The adoption of cryptocurrency may help to cut off corruption in developing economies. Blockchain is one of the burning assets in the fourth revolution which will foster the global GDP and Asia will be highly benefitted from it (Bhimani et al., 2022). The research on cryptocurrency can be observed consistently increasing only from 2014 (Molling et al., 2020). Scientific researches are the ways to find the real truth behind a problem, new innovation and ideas which benefits the society. Moreover, evaluating the published research papers enables to know the scientific scenario in a subject area including its growth over years, prolific, researchers, sources, organisations and countries as well as the research trend. The systematic analysis of research is known as Scientometrics, a branch of bibliometrics that deals with the study of science.

A number of Scientometrics and bibliometric analysis is conducted on cryptocurrency research. Calderon-Monge and Ribeiro-Soriano (2023) investigated the research trending
topics in the literature of digitalisation in context to the areas of management, marketing, finance and accounting from the Web of Science database. The analysis of co-occurrence in the finance and accounting were found “blockchain” and “fintech” to be highly occurred with connection to financial services and banking. It reflects the increasing impact of digitisation into the financial and banking sector. Alsmadi et al. (2022) has found 1,225 literatures on cryptocurrency in the Scopus database, discovered that the journal Finance Research Letters to be highly productive, UK to be the most influential, Tianjin University, China to be the most productive. Research hotspots areas like “cryptocurrency”, “blockchain” and “Fintech” are highly occurred in the keyword analysis. Guo and Donev (2020) states that the research on cryptocurrency is growing exponentially but lacks research collaboration between different countries and authors. Yüzenoğlu et al. (2022) investigated the 30 selected studies on cryptocurrencies during COVID-19 period. It is found that the awareness of cryptocurrencies in Malaysia is higher than other countries during pandemic period and the attention of researchers is increased towards studying the people’s behaviour like intention, attention and risk related to cryptocurrency. Aysan et al. (2021) has analysed the literatures on bitcoin between 2011 and 2020 from the Scopus database. The findings revealed that the growth rate of literatures is 100%, researches are mostly belonged to computer science field, China is the largest fund provider, the keyword analysis reveals that the blockchain technology and cryptocurrency are highly associated with bitcoin in market capitalisation and research interest. Molling et al. (2020) found the highly focused research topics on exchange rate, fluctuation of price and volatility of cryptocurrency. Alqudah et al. (2023) have systematically reviewed on sustainability of bitcoin, claims that energy usage and carbon footprint may be the next research trend on bitcoin’s sustainability. After reviewing some previously published literatures, the gap found is that there is no such study found conducted on both Scientometrics and Altmetrics with the such time bound. Altmetric is the latest metrics which is a better version of citation considered as an early indicator of research impact on its audience through social media. Altmetric Attention Score (AAS) is counted based on the attention received by the research papers in the form of likes, share, tweets, bookmarks, downloads, citation, etc., on various social network sites (Chellappandi and Vijayakumar, 2018). The Altmetric score is a source of getting one’s work reach to maximum readers and discussed and communicated by others which directly leads to citation as well. The concept Altmetric is emerged in the year 2010 by Jason Priem. The AAS indicates the impact not only in academic setting but also non-academic setting as presently social media is run by everybody in the world. While the number of citations in the papers of cryptocurrency will show the interest of other researchers and the AAS will reveal the influence of cryptocurrency on common man also. Therefore, the present study aims to use both Scientometrics and Altmetric parameters on cryptocurrency research published between 2013 and 2022 through the lens of Scopus database. The Scopus is a leading multidisciplinary citation and abstracting database launched in the year 2004 by Elsevier (Scopus preview, 2023).

Research questions

**RQ1.** What is the growth of research on cryptocurrency over the past decade?

**RQ2.** Which are the highly prolific sources on cryptocurrency research like, author, journal, country and affiliation?

**RQ3.** What areas of publication are highly influencing and their impact upon social media?
RQ4. Which are the influential funding bodies supporting the research on cryptocurrency?

RQ5. What is the collaborative network among different countries?

RQ6. What are the trending areas associated with cryptocurrency research?

Data and methodology
The answers to the questions of the present study on cryptocurrency research are obtained through two analytical processes that is Scientometrics and Altmetric analysis. The term “Scientometrics” is coined by Vassily V. Nalimov in 1960s evolved from the bibliometrics which deals with the study of science (Hood and Wilson, 2001). It is a robust tool for assessing the pattern of scientific literature like its growth, prominent scientific actors, collaborative structure between national and international research, conceptual structure of research through keyword analysis, etc. It is primarily based on two approaches, i.e. performance analysis for assessing the productivity of researcher, institutions or countries and other approach is science mapping which includes the scientific structure such as bibliographic coupling, citation, co-word and co-authorship analysis (Noyons et al., 1999; Borgohain et al., 2022a; Basumatary et al., 2022). The emergence of Altmetric has transformed the landscape of scientific and academic paranoia by measuring the research impact through its dissemination on social media. The study has used Altmetric tools to analysis the social attention of general masses received by the research publication on cryptocurrency.

The collection and analysis of data is performed in three stages as shown in the Figure 1. The literatures on cryptocurrency have been collected from Scopus database published between 2013 and 2022. The study has considered Scopus database because it has updated and larger coverage of publications (Saikia et al., 2023). The study of García-Corral et al. (2022) found that Scopus have more articles on cryptocurrency than Web of Science database. Firstly, the data was extracted from the Scopus using some appropriate keywords to the study in the search bar by running “Article Title, Abstract, Keywords” with keywords “cryptocurrency” OR “digital currency” OR “bitcoin” OR “Ethereum”) conducted on 21 July 2023. The search operator “OR” was used for connecting all the primary words to include all the research publication related to the keywords (Borgohain et al., 2022b). The search resulted in total of 18,269 documents. But to comply with the scope and aim of the study, the total data further filtered with some limitations with the time range of year “2013–2022”, language as “English” and document type as “journal article” then it resulted in 6,107 items. The study has not counted the publications published in the year 2023 in order to avoid misinterpretation because of the running year as many more publications are yet to come. The selected data along with all its bibliographic information has been exported into .csv file for further analysis in MS Excel and other tools. The second stage deals with application of Scientometrics parameters to the research publications for analysing its growth and science mapping. The citation analysis, network visualisation of co-authorship among countries and organisation and keyword analysis is performed using three visualisation software, i.e. VosViewer, Bibiloshiny and Tableau. The third phase implies to measure the AAS of the highly cited research publication to identify the social attention and Mendeley readership. The AAS and Mendeley readership are extracted from Dimension.ai (https://dimensions.altmetric.com/) database of the highly cited publications with the help of the DOIs, respectively. Based on the results, the AAS and Mendeley readership scores of each publication have been recorded manually in an excel sheet for a comprehensive analysis.
Data analysis and interpretation

Rise of publication and citation over the period

Analysing the growth of publication facilitates predicting the future of a subject area in the scientific field and the citation indicates its value. Figure 2 displays the growth of research publications and citation received on cryptocurrency research between 2013 and 2022 from Scopus database. The figure is created using Tableau Public 2023.1. The analysis of the figure reveals that research on cryptocurrency in the beginning was very few with 10 papers in 2013 but increased to 1,997 papers in 2022 with an annual growth rate of 80.13%. It reflects the radical growing importance on cryptocurrency in the scientific purview specially from the year 2017 till present. The citation of the publications per year is also shown in the figure. The citation count indicates the value of a work, which appears to be beneficial to many other researchers, higher the citation more would be the demand of the subject area. Figure 1 also displays the citation of the publications in 10 years. It is observed that the range of citation has vastly increased from year 2017 to 2020 after that the citation count seems decreasing at pace. Although, it takes time up to years to receive citation after publication of the paper. However, it is clear that globally the cryptocurrency has gained immense importance from the year 2017 till present time.

Top 10 highly influential papers based on citation count and Altmetric Attention Score

Table 1 displays the highly influential papers based on highest citations along with AAS and Mendeley readership received during the time period. The AAS and Mendeley

Source: Author’s own work
readership is assessed to identify the instant impact of the highly cited publications to demonstrate people’s attention and interest from all the categories. Because AAS does not take longer period to show research’s impact (Basumatary et al., 2023). From the analysis of the top 10 papers, it is found that the researchers are mostly influenced by the papers related to “blockchain” and “bitcoin”. The paper “Blockchain challenges and opportunities: A survey” has received the highest citation i.e. 1,737 with very least AAS (6) and a good Mendeley readership score (2125). It means that this paper was specifically benefitted to other researchers in their works, and also read by a good number of readers but has received very less attention in social media, less discussed by the common people. In short more valued in academia less in non-academia. Moreover, the paper “Bitcoin: Economics, technology, and governance” is appeared to receive maximum AAS i.e. 384 published in Journal of Economic Perspectives with 818 citation count and 1956 Mendeley readership. It signifies that the paper is widely discussed and shared among different social networking sites, also discussed and read in academia through Mendeley though received an average number of citations. The paper “Where is current research on Blockchain technology? - A systematic review” have received highest Mendeley readership, i.e. 3,542 with 1,204 citation count and 321 AAS. This paper is mostly valued in the academia by the readers of different categories in the mendeley, although the citation count was at moderate level but the second most highly communicated paper in social media.

**Top author**

Table 2 displays the top 10 productive authors on cryptocurrency research. It is found that Elie Bouri from Lebanese American University appears to be the most active researcher with 66 publications on cryptocurrency. Secondly, Khaled Salah has contributed 54 papers from Khalifa University of Science and Technology, UAE, followed by Raja Jayaraman with 43 papers from the same affiliation. Authors from China are more active than any other countries in the world.

Journals are the prime source for producing the research papers, so it is essential to identify the journal source which is producing maximum publications in an area of interest. Table 3 displays the list of top 10 prolific journals based on the number of publications on cryptocurrency, its ISSN, Impact Factor (2022) and publisher. The top 10 journals are classified manually in the excel sheet by running the filter in the column of number of documents. The journal IEEE Access with 3.4 IF tops the position by publishing 329 papers.
<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Title</th>
<th>Year</th>
<th>Journal</th>
<th>Citation</th>
<th>AAS</th>
<th>Mendeley readership</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blockchain challenges and opportunities: A survey</td>
<td>2018</td>
<td><em>International Journal of Web and Grid Services</em></td>
<td>1,737</td>
<td>6</td>
<td>2,125</td>
</tr>
<tr>
<td>2</td>
<td>IoT security: Review, blockchain solutions, and open challenges</td>
<td>2018</td>
<td><em>Future Generation Computer Systems</em></td>
<td>1,545</td>
<td>13</td>
<td>2,996</td>
</tr>
<tr>
<td>3</td>
<td>Where is current research on Blockchain technology? - A systematic review</td>
<td>2016</td>
<td><em>PLoS ONE</em></td>
<td>1,204</td>
<td>321</td>
<td>3,542</td>
</tr>
<tr>
<td>4</td>
<td>Bitcoin and beyond: A technical survey on decentralised digital currencies</td>
<td>2016</td>
<td><em>IEEE Communications Surveys and Tutorials</em></td>
<td>1,080</td>
<td>23</td>
<td>1,480</td>
</tr>
<tr>
<td>5</td>
<td>Bitcoin: Economics, technology, and governance</td>
<td>2015</td>
<td><em>Journal of Economic Perspectives</em></td>
<td>818</td>
<td>384</td>
<td>1,956</td>
</tr>
<tr>
<td>6</td>
<td>Bitcoin, gold and the dollar - A GARCH volatility analysis</td>
<td>2016</td>
<td><em>Finance Research Letters</em></td>
<td>781</td>
<td>3</td>
<td>969</td>
</tr>
<tr>
<td>7</td>
<td>A survey on the security of blockchain systems</td>
<td>2020</td>
<td><em>Future Generation Computer Systems</em></td>
<td>720</td>
<td>11</td>
<td>2,080</td>
</tr>
<tr>
<td>8</td>
<td>Blockchain</td>
<td>2017</td>
<td><em>Business and Information Systems Engineering</em></td>
<td>718</td>
<td>28</td>
<td>1,997</td>
</tr>
<tr>
<td>9</td>
<td>The inefficiency of Bitcoin</td>
<td>2016</td>
<td><em>Economics Letters</em></td>
<td>701</td>
<td>13</td>
<td>664</td>
</tr>
<tr>
<td>10</td>
<td>Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin</td>
<td>2015</td>
<td><em>Economics Letters</em></td>
<td>679</td>
<td>96</td>
<td>875</td>
</tr>
</tbody>
</table>

*Source: Authors' own work*
related to application of blockchain in different market trade. Moreover, the journal with the second highest IF (10.4) with maximum citation (13,398) Finance Research Letters has produced 255 papers on cryptocurrency, bitcoin volatility and COVID-19 and Ethereum followed by Physica A: Statistical Mechanics and its Applications with 88 papers. However, the journal with highest IF (10.6) IEEE internet of Things journal have very least number of publications, i.e. 50 related to blockchain application in IOTs. Elsevier appears to be the most active publisher on cryptocurrency research because out of 10 prolific journals, five of them belong to Elsevier like Finance Research Letters, Physica A: Statistical Mechanics and its Applications, Research in International Business and Finance, Economic Letters and Future Generation Computer System. The rest of the prolific journals are also peer-reviewed based belong to different publishers published maximum papers in the area. It is found that journal articles are proven to have more scientific value than the other forms of publications (Basumatary et al., 2022).
**Country’s production**

Although, cryptocurrency now have become a global phenomenon, so the present study aims to analyse the country which have been highly active into the scientific field on cryptocurrency. It will reflect the culture of work and research activities in the new financial system from country to country. **Table 4** depicts top 10 highly productive country based on the number of publications published. The analysis found China to be highly strong in the area of cryptocurrency considering the number of publications (1,133) and citation (30,601) followed by the USA with 926 papers and then UK with 576 NP. However, India being a developing country is no less but appears to be the fourth highest in the list with 557 NP and 8,022. The rest of the prolific countries are presented in the **Figure 3** using map chart in MS Excel, which shows the countries productivity in the map through different shades of yellow colour. The lighter shade indicates the less NP and the darker shade indicates maximum NP. It can be observed that the China’s map is in dark yellow colour which it has maximum number of publications on cryptocurrency. The shade of USA’s map is little lighter than the former which indicates to have second highest producer of papers (926).

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Country</th>
<th>No. of publications (NP)</th>
<th>Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>1,133</td>
<td>30,601</td>
</tr>
<tr>
<td>2</td>
<td>USA</td>
<td>926</td>
<td>28,000</td>
</tr>
<tr>
<td>3</td>
<td>UK</td>
<td>571</td>
<td>22,513</td>
</tr>
<tr>
<td>4</td>
<td>India</td>
<td>557</td>
<td>8,022</td>
</tr>
<tr>
<td>5</td>
<td>Australia</td>
<td>330</td>
<td>11,630</td>
</tr>
<tr>
<td>6</td>
<td>South Korea</td>
<td>300</td>
<td>7,537</td>
</tr>
<tr>
<td>7</td>
<td>Italy</td>
<td>286</td>
<td>7,715</td>
</tr>
<tr>
<td>8</td>
<td>France</td>
<td>262</td>
<td>11,366</td>
</tr>
<tr>
<td>9</td>
<td>Canada</td>
<td>233</td>
<td>7,439</td>
</tr>
<tr>
<td>10</td>
<td>Germany</td>
<td>224</td>
<td>7,771</td>
</tr>
</tbody>
</table>

**Source:** Authors’ own work

**Table 4.**
Top ten productive country

![Countrywise productivity](source: Author’s own work)
Co-authorship of countries
Collaboration is an important component in research for networking of ideas and work culture between two or more authors at regional, national and international level to obtain common research finding. Figure 4 presents the co-authorship of countries to understand its collaboration nature on cryptocurrency research. The figure is created in VOSviewer, considering co-authorship of country analysis. By functioning full counting with maximum number of countries per document is 25 and minimum number of documents of a country is 40. It is found that 48 countries have been meet the threshold among the co-authorship link would be calculated. As shown in the figure, each circle (cluster) represents a country and the size of the node will replicate the quantity of the contribution of authors. The countries of collaboration have formed six clusters. Bigger size of cluster will have larger publication size and connecting lines from one cluster to another depicts the linking between the countries. The network visualisation of co-authorship of countries shows that the node of China is the largest among all in size, which indicates its maximum productivity followed by USA. The figure consists 48 items, 6 clusters, 704 links and 3,984 total link strength. Cluster 1 in red consist 12 items (Bangladesh, Egypt, India, Malaysia, Pakistan, Qatar, Russia, Saudi Arabia, South Korea, Tunisia, Turkey, UAE), Cluster 2 in green consist 10 items (Austria, Belgium, Canada, Denmark, Finland, Germany, Iran, Italy, Netherlands, Switzerland), Cluster 3 in blue consists 9 items (Brazil, Indonesia, Israel, Poland, Portugal, Spain, Ukraine, UK, USA), Cluster 4 in yellow consists 9 items (China, Czech republic, Hong Kong, Japan, Norway, Romania, Singapore, Taiwan, Thailand), Cluster 5 in purple consists 4 items (Australia, Ireland, New Zealand, Vietnam) and Cluster 6 in shallow blue consists 4 items (France, Greece, Lebanon, Lebanon)

Figure 4. Co-authorship of countries
Source: Author’s own work
The collaboration structure depicts that China being the most active country collaborated with Southeast Asia and East Asian countries like Hong Kong, Japan, Singapore, Taiwan, Thailand and also with Norway and Romania. It shows that the collaboration nature is well among the countries on cryptocurrency.

Active funding agencies
Funding agencies partakes a great role in the scientific landscape that covers the monetary fund to carry out research in different relevant subject areas. It plays an important role in promoting scientific research by government or non-government bodies under various national and international realm. Therefore, it is necessary to identify and acknowledge the active global funding agencies in burning areas of research. Table 5 shows the list of top 20 funding agencies across the world that has highly funded the researches on cryptocurrency based on the frequency of publications. It is found that out of 20 highly active funding agencies most of them are belong to China like National Natural Science Foundation of China, National Key Research and Development Programmes (NKPs), NSFC, National Cryptography Development Fund and Fundamental Research Funds for the Universities of Henan Province. However, the Chinese Government has banned the function of cryptocurrency trade in China since 2017 even though it was one of the leading investors of bitcoin before the ban (Chen and Liu, 2022). But the researches are much going on regarding the non-crypto blockchain in various sectors of China for MNCs through the support of the government. The study results that National Natural Science Foundation of China, NSFC ranks first to fund 209 papers on cryptocurrency. The funding agencies of East Asian countries are seeming highly active in promoting research related to cryptocurrency than the other countries. Moreover, the Horizon 2020, European Union, have provided the second highest fund to 65 papers followed by Japan Society for the Promotion of Science (45 papers) then National Science Foundation, USA, with 44 papers and so on. The analysis is performed manually in the MS Excel sheet from the data set.

Research hotspots
Identification of the trending research areas is necessary to get an insight into the origin of a subject area. The study has performed a keyword analysis from the retrieved literatures to find out the research trend on cryptocurrency. Figure 5 presents the co-occurrence of keywords, which is generated using VOSviewer considering full counting with minimum number of occurrences of a keyword is 50 where 95 keywords meet the threshold and form a network visualisation. The figure consists of four clusters in different colours, 95 items and 2,980 links, the size of the cluster is proportionate to the number of publications and the lines connecting the clusters represents the linking between the clusters or terms. From the analysis, it is found that the bigger cluster of “blockchain” means that it is one of the trending areas associated with cryptocurrency. With blockchain, the other interlinked areas are the smart contracts, digital storage, privacy, Ethereum, information management, authentication, etc. Secondly, the next bigger cluster is “bitcoin” and its interlinked areas are cryptocurrency, electronic money, investments, internet, financial market, volatility, etc. Moreover, the other clusters like “block-chain”, which is same as “blockchain” its interlinked research areas are distributed ledger, miners, consensus protocols, proof of work, etc. It can be summarised that the blockchain technology is gaining immense importance because of its features like network security, digital ledger and decentralisation and on trend in the scientific scenario. However, bitcoin is found to be the most demanded cryptocurrency followed by the another one named Ethereum.
<table>
<thead>
<tr>
<th>Rank</th>
<th>Funding agency</th>
<th>Frequency</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>National Natural Science Foundation of China, NSFC</td>
<td>209</td>
<td>China</td>
</tr>
<tr>
<td>2</td>
<td>Horizon 2020 Framework Programme,</td>
<td>65</td>
<td>European Union</td>
</tr>
<tr>
<td>3</td>
<td>Japan Society for the Promotion of Science</td>
<td>45</td>
<td>Japan</td>
</tr>
<tr>
<td>4</td>
<td>National Science Foundation, NSF,</td>
<td>44</td>
<td>USA</td>
</tr>
<tr>
<td>5</td>
<td>National Key Research and Development Programmes (NKPs)</td>
<td>34</td>
<td>China</td>
</tr>
<tr>
<td>6</td>
<td>National Research Foundation of Korea, NRF</td>
<td>21</td>
<td>Korea</td>
</tr>
<tr>
<td>7</td>
<td>Ministry of Education, MOE</td>
<td>20</td>
<td>Korea</td>
</tr>
<tr>
<td>8</td>
<td>Khalifa University of Science, Technology and Research, KU,</td>
<td>19</td>
<td>United Emirates of Arab (UAE)</td>
</tr>
<tr>
<td>9</td>
<td>Ministry of Higher Education, Malaysia, (MoHE)</td>
<td>18</td>
<td>Malaysia</td>
</tr>
<tr>
<td>10</td>
<td>Ministry of Science and Technology, Taiwan, MOST</td>
<td>17</td>
<td>Taiwan</td>
</tr>
<tr>
<td>11</td>
<td>Ministry of Science, ICT and Future Planning, MSIP</td>
<td>17</td>
<td>South Korea</td>
</tr>
<tr>
<td>12</td>
<td>Engineering and Physical Sciences Research Council, EPSRC</td>
<td>17</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>13</td>
<td>Institute for Information and Communications Technology Planning and Evaluation</td>
<td>16</td>
<td>South Korea</td>
</tr>
<tr>
<td>14</td>
<td>Coordenação de Aperfeiçoamento de Pesoal de Nivel Superior, CAPES</td>
<td>16</td>
<td>Brazil</td>
</tr>
<tr>
<td>15</td>
<td>Fundação para a Ciência e a Tecnologia, FCT</td>
<td>13</td>
<td>Portugal</td>
</tr>
<tr>
<td>16</td>
<td>Russian Foundation for Basic Research</td>
<td>12</td>
<td>Russia</td>
</tr>
<tr>
<td>17</td>
<td>Deanship of Scientific Research</td>
<td>12</td>
<td>Israel</td>
</tr>
<tr>
<td>18</td>
<td>National Cryptography Development Fund</td>
<td>11</td>
<td>China</td>
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<tr>
<td>19</td>
<td>Fundamental Research Funds for the Universities of Henan Province</td>
<td>8</td>
<td>China</td>
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<td>20</td>
<td>Center for Digital Supply Chain and Operations Management</td>
<td>8</td>
<td>United Emirates of Arab (UAE)</td>
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</table>

**Source:** Authors' own work
To understand the geographical difference in the interest of research, a three-field plot figure is compiled considering the countries, keywords and authors shown in Figure 6. The figure is created using Biblioshiny (Bibliometrix R package) software under overview section selecting the three-field plot with 20 countries, keywords and authors. The thickness of the rectangles and connecting lines indicates the frequency of the publications contributed by the countries and authors. The three-field plot is known as Sankey diagram, which is used to present the quantitative information of relationship among variables (Riehmann *et al.*, 2005). The figure shows that different countries and authors have worked on various areas of the subject. China
is putting a lot of efforts on blockchain technology in various sectors because its security rather than the cryptocurrency regulation. However, the countries like India, UAE and USA have also scientifically engaged in the areas of blockchain, Bitcoin, Ethereum, smart contracts, etc.

**Conclusion and discussion**

The study has systematically analysed the published literatures on cryptocurrency between 2013 and 2022 from the Scopus database to understand the emerging global interest on cryptocurrency and its other scientific structure. The questions raised in the study have been attained through the application of Scientometrics and Altmetrics parameters to the collected data. The results have revealed many unknown facts about cryptocurrency from a scientific purview starting from research growth to its significance at the global level. The research on cryptocurrency seems accelerated its growth and citation rate specifically from the year 2017 and it is gradually continuing. The topic Blockchain have become the focal point to many researchers and readers of national and international setting based on the citation, AAS and Mendeley readership. The author Elie Bouri from Lebanese American University appears to be the most active researcher with 66 publications on cryptocurrency. The prime source *IEEE Access* is found to be the prolific journal that has published 329 research papers during the time period. China is the largest producer of researches in the area of cryptocurrency considering the number of publications (1,133) and citation (30,601). Even though crypto market is banned in China but Hangzhou Internet court has implemented the blockchain technology specifically for other purpose like to safeguard the copyright of digital literatures. The collaboration structure signifies that there is a good level of teamwork between both developed and developing countries. China being the most active country collaborated mostly with Southeast Asian and East Asian countries like Hong Kong, Japan, Singapore, Taiwan, Thailand, also with Norway and Romania as well as with the developed countries like USA and UK. In case of financial assistance, The National Natural Science Foundation of China, NSFC ranks top among the top 20 active funding agencies which have provided funding support to 209 research works. Moreover, during the 10-year period, sub-topics like “blockchain”, “bitcoin” and “Ethereum” are on trending areas of cryptocurrency. Moreover, Blockchain is the main technology that is frequently appearing in the research papers of cryptocurrency (Yli-Huumo et al., 2016). Because security is the biggest concern when it is about virtual money and the blockchain technology is the one keeping records of the transactions securely. The extension of the blockchain technology has enhanced the public’s consideration of cryptocurrency. Bitcoin is still reigning the crypto world and Ethereum is following alongside. In a generic note, Asian countries are found to have shown a wide participation in research into the subject. In a concluding note, cryptocurrency is one of the global burning issues, in one hand different countries imposing its regulation where on the other hand, some other countries are not ready to do so but in the scientific world there still extensive researches are going on concerning its reliability and usability. At global outlook, the Asian countries are putting more concern into the subject.

In account of its implications, the present study has scientifically evaluated the literatures on cryptocurrency and its outcome will add significant value to the global financial systems, emerging economy and academia. As the researches on cryptocurrency is extensively increasing it will let the public policymakers, crypto users, subject academicians, etc., to gain valuable insight on its importance. However, the social media attention is still at a moderate level, it shows the lack of general mass’s proper knowledge of its sustainability in future. The volatility and risk bother the common people to trust the virtual currency like the other banking systems because of the privacy and security, Ojih et al. (2022) called it as crypto-hesitancy. The study of De Almeida and Gonçalves (2023) claims that the crypto-market is mostly invested by irrational investors,
and the uncertainty leads them scattered beliefs when the trade rise as a result it is subjected to speculative bubbles. The use of blockchain has been expanded to various other sectors than cryptocurrency only such as enterprises, managing records, administrative work, automated contract management, identity verification and supply chain tracking (Katuu, 2022). The emerging areas acquainted with the cryptocurrency like Blockchain, Bitcoin, Ethereum, smart contracts, financial markets, etc., will provide the readers a valuable insight on its functionality. Social media platforms are the best place to create awareness on any issue whether by discussing, sharing, liking and promoting a content. It is a suggestion to give more online attention by the common people to create a mutual understanding on the current scenario of cryptocurrency. As the blockchain plays the role of security in the transaction process, so the IT industries should stress more on this to bring up with improved security systems to escape from the hackers and cyber crimes. The reliability of crypto market is still not clear because of its high volatility and still lots of debate going on it. There are very rare studies found on its long-term investment strength, but it might be beneficial as a speculative asset.

Apart from the study’s contribution, it has also some limitations. Firstly, the data in the current study is solely depended on the well-known academic database, i.e. Scopus. Secondly, the type of document is considered “research articles” only and finally, the time span selected is “2013–2022”. Within these limitations the results have been identified. The findings of the study will be more useful in the academia, subject specialists, research institutions, funding agencies, publishing agencies in decision-making. For an extensive and generalised result future researches can be carried out covering other databases like Web of Science, Dimensions and Google Scholar with a wide range of data. This may turn out with some different findings and facts related to this area. Other researchers can also conduct some case studies on the attitude and perspective of people of different geographical background regarding cryptocurrency, sustainability of Bitcoin, risk assets, advancement of blockchain in promoting cryptocurrency.

References


Further reading


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