

# Blockchain Technology in Malaysian Context: Bibliometric Analysis and Systematic Review

Mahmood A. Bazel<sup>a,\*</sup>, Mazida Ahmad<sup>a</sup>, Fathey Mohammed<sup>a</sup>

<sup>a</sup> School of Computing, Universiti Utara Malaysia, Sintok, Kedah, Malaysia

\*Corresponding author: mahbazel@gmail.com

**Abstract**—Blockchain technology has attracted widespread attention due to its compelling features, such as decentralization, transparency, and smart contracts, which can address significant issues in various industries in developing countries such as Malaysia. However, although several studies have arisen from diverse academic backgrounds addressing blockchain in Malaysia, no studies provide a comprehensive review and classification of the research in this field. The main goal of this research is to conduct a bibliometric analysis and systematic review of all blockchain papers published in Malaysia to understand the evolution of knowledge and present state and identify prospective future research fields. Web of Science and Scopus databases searched for existing literature on blockchain in Malaysia, and 76 papers were reviewed and categorized based on study purpose/focus, domain/sectors, the methodology employed, theories applied, and level of analysis. The findings show that blockchain is under-explored in Malaysia, and most current studies focus on Blockchain adoption in specific industries such as finance and supply chain management. However, in other areas, such as healthcare and education, Blockchain conceptual progress is still in its infancy. These findings are being utilized to suggest future research paths in this discipline, such as the need for methodological improvements and a theoretical basis to study blockchain in different sectors.

**Keywords**— Blockchain; cryptocurrency; bibliometric analysis; systematic review; Malaysia.

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## I. INTRODUCTION

Blockchain technology (BCT) has interested researchers and practitioners since Bitcoin was introduced in 2008 [1]. BCT is rapidly expanding its uses outside of the financial industry. BCT is a decentralized ledger technology that secures, verifies, and transparently maintains all transactions done on the top of a peer-to-peer network [2]. Before a transaction can be saved in the ledger, the data will be encrypted and confirmed by other participating parties, after which a new block of data will be added to the chain and viewable to all public users. A block cannot be erased or changed after it has been established. The BCT idea seeks to build a system that is impartial, decentralized, borderless, and network resilient [3]. The real benefit of BCT over traditional techniques is that it allows two parties to conduct safe transactions via the Internet without the intervention of a third party. Removing the third party can lower transaction costs and strengthen transaction efficiency and security [4].

The significance of BCT has been compared to that of the Internet in the early 1990s due to the enormous variety of advantages it may provide to every sector [2]. BCT is widely

regarded as a game changer, potentially leading to digitization in practically every area involving value exchanges due to its revolutionary capacity [5]. It has experimented with supply chain [6], sharing economy [7], logistics [8], medical records [9], and intellectual property management [10] on a global scale. Some developed nations are already using the advantages of BCT, and it has the potential to significantly influence developing nations' socioeconomic environments, notably in the areas of governance, education, health, and business [11].

In Malaysia, BCT has not progressed very far due to the lack of structures and directions and the lack of current knowledge of BCT [11]. According to the Malaysian Industry-Government Group for High Technology (MIGHT), BCT is expected to be adopted in different domains in Malaysia in 2025. Local banks CIMB and Maybank are already aggressively promoting the technology's growth. MIGHT is sure that using BCT would increase several Malaysian sectors' productivity and openness [12]. Malaysia's national Applied Research and Development Centre (MIMOS) is dedicated to advancing BCT for the nation's digital transformation. Blockchain will be Malaysia's digital transformation path's transformational and ubiquitous change engine through the

five ecosystem building blocks of Collaboration, Amplifier, Talent, Legal and Governance, and Enablers. BCT has been successfully deployed on some projects in Malaysia, including palm oil traceability, contactless payment tracking, and vaccination traceability [13]. While acknowledging its benefits and advantages, numerous problems must be overcome to fully utilize BCT. The National Blockchain Roadmap 2021-2025 is designed to prepare Malaysia for Blockchain 2.0 or beyond Bitcoin and to address corporate concerns ranging from fraud management to supply-chain monitoring to identity verification to increase efficiency and lower costs [11]. Blockchain will be accepted and used because it provides seven compelling features for addressing major business concerns across sectors. These seven features are security, time and cost efficiency, fraud reduction, record keeping, decentralized, transparency, and smart contracts [11]. Fig. 1 depicts how BCT will foster growth and change in market hotspots.



Fig. 1 The potential impact of Blockchain (source:[11])

As the Malaysian government calls for an increase in the number of research papers in the BCT domain [14], it is worthwhile to undertake research studies that explore a thorough overview of the present body of knowledge in this sector. However, there has not yet been a bibliometric study or comprehensive evaluation of the state-of-the-art in Malaysia's BCT described in the literature. Therefore, to continue progressing in this field, a thorough systematic review and bibliometric analysis study of the most current Malaysian scientific articles in the BCT domain is required to unearth valuable data for the BCT research community. This gap motivates us to do this work to evaluate and provide a systematic and realistic sketch of the BCT research in Malaysia. Reviewing the current literature enables us to understand the breadth and depth of existing studies while identifying potential gaps that need to be filled.

The main aim of this study is to provide a bibliometric analysis and systematic review of all BCT publications in Malaysia to comprehend the development of knowledge and current state and determine potential future research areas. The study uses a hybrid strategy, combining systematic review with bibliometric analysis. This mixed method provides information on the research development and presents state and insights into potential future research initiatives. With the main aim of this study, the following objectives guided the conduct of this review:

- To identify the current status of scientific publications on BCT in Malaysia.
- To investigate the existing intellectual structure of scientific publications on BCT in Malaysia (research themes, domains/sectors, methodologies, theories, and level of analysis)
- To find the current research gaps and identify the future research direction.

This work adds to the corpus of knowledge on BCT in more than one manner. First, we use a hybrid method, detecting significant research trends by bibliometric analysis and conducting a comprehensive literature review. Such an approach contributes to covering the breadth and depth of the field. Second, the research synthesizes knowledge structure by carefully examining the conceptual and intellectual frameworks of the subject area. Third, the study selects and gives a descriptive evaluation of the most significant publications; it acts as a reference for researchers working on this subject and suggests future research paths for BCT in Malaysia.

The rest of this paper is structured as follows: section II describes the material and methods used in this study. Section III presents the quantitative results from the bibliometric study, qualitative analysis results from a systematic review, and a discussion of the findings, highlighting the current gaps with suggestions for future research. Lastly, section IV concludes the paper.

## II. MATERIALS AND METHODS

This research aims to identify the progress of BCT technology research in Malaysia by reviewing published papers and providing researchers and practitioners with perspective and future guidance on BCT adoption. Our review process uses a mixed-review strategy consistent with the study goal and objectives: a systematic review [15] and bibliometric analysis [16]. The systematic review followed the "Preferred Reporting Items for Systematic Review and Meta-Analyses" (PRISMA) guidelines. PRISMA is a comprehensive approach for generating data and contributing to identifying research structures and routes, as well as a potential future study [15]. In addition, a systematic review can give a comprehensive overview of the research landscape [17], unlike a narrative literature review, where conclusions are focused mainly on descriptive findings of a specific field of expertise and may be prone to selection bias.

Furthermore, bibliometrics is a popular method for generating a whole picture in a literature review [18], [19]. Bibliometrics starts with creating questions to be answered, such as when, where, who, and what. When refers to years or the targeted period; where refers to countries or other geographic regions; who refers to authors; and what refers to keywords [20]. The review process in this study employs a three-stage planning, conducting, and reporting, as shown below.

### A. Planning Stage

This stage begins with establishing the study's scope and research questions. The main aim of this study is to provide a systematic and realistic sketch of BCT research in Malaysia. So, the study's scope is collecting BCT papers related to the Malaysian context to make a detailed analysis and extract

valuable information. The research questions suggested for this study are:

- What is the current state/trend of scientific publications on BCT-related to Malaysia?
- What is the existing intellectual structure of scientific publications on BCT in Malaysia?
- What are the gaps and directions for future research?

### B. Conducting Stage

This stage involved choosing databases, developing a search strategy, and implementing inclusion and exclusion criteria for document selection. Then, depending on the study's objectives, the initial step was to collect data on BCT research in Malaysia. The structured search terms for dominant studies were conducted in the primary collection of the Scopus and Web of Science (WoS) datasets since they are the most extensive citation and abstract databases of peer-reviewed papers worldwide, summarizing the highly qualified research output worldwide in all subjects [21]. The search was conducted on Aug. 30, 2022, with no time constraints.

The study uses the following search string: `(("blockchain*" OR "Cryptocurrenc*" OR "bitcoin" OR "smart contract*") AND "Malaysia*")` for the search in author keywords, abstract, and title. We limited the search to English-only publications, and the type of documents were Journal articles, conference papers, and book chapters. As a result, 126 publications were collected from Scopus (n=76) and WoS (n=50) databases. In addition, duplicate documents were identified and excluded (n=50). As a result, 76 papers were included in our bibliometric analysis and systematic review. The flow diagram in Fig. 2 displays the employed research strategy of this study.

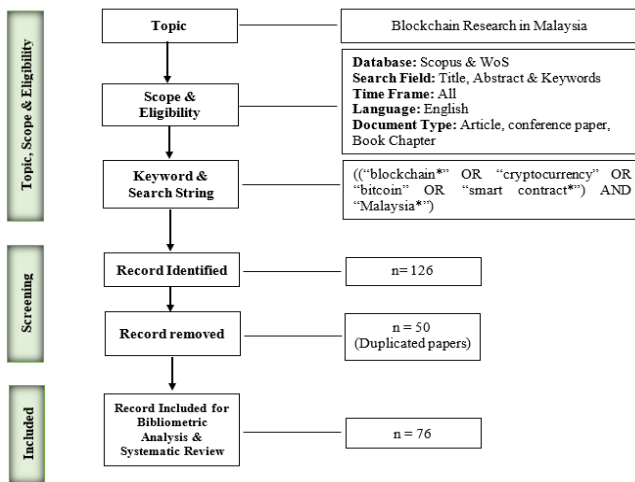


Fig. 2 The research strategy flow diagram

### C. Data Processing and Analysis Stage

A systematic review and bibliometric analysis were undertaken to investigate and understand existing research on BCT in Malaysia. The mixed review approach is used in this study to comprehend the studied issue fully. This mixed technique aids in understanding the evolution and present state of research and provides insights into future study prospects. Gough [22] claims that the mixed reviews approach allows for several levels and views in addition to

combining concept generation with empirical evaluation. The systematic review aims to present a comprehensive picture of existing research to identify knowledge gaps and estimate future research orientations.

The bibliometric technique offers a quantitative scientific mapping tool, which complements the systematic review [16]. It focuses on the structural and dynamic characteristics of scientific research. Visual maps can more accurately depict the study environment and facilitate focus on crucial research topics. Several visual text mining tools are available, including VOSviewer, CiteSpace, Gephi, and BibExcel. The capabilities and qualities of each instrument and analytical approach must be considered while choosing the appropriate tools. Given its focus on visualizations of maps, appropriateness for visualizing more extensive networks, and text mining abilities, the VOS viewer was used in this study to carry out these findings.

## III. RESULTS AND DISCUSSION

The outcome of our search was 76 publications (59 journal articles, 14 conference papers, and three book chapters) contributed by 160 authors from 107 organizations and published in 57 venues. These publications contained 425 keywords and were cited 678 times. Table I shows the general search results from the Scopus dataset, and Fig. 3 presents the type of documents analyzed in this study.

TABLE I  
SUMMARY OF GENERAL RESULTS

Description	Results
Documents	76
Publication venues	57
Authors	160
Authors' Affiliations	107
No of citations	678
Author's Keywords	425

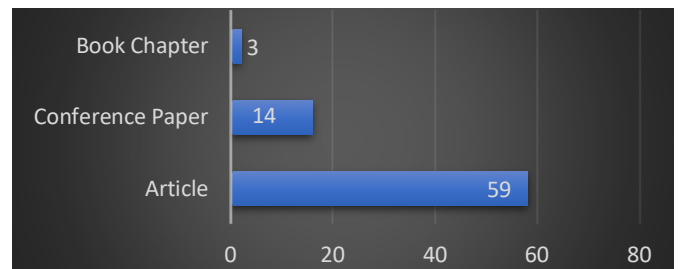


Fig. 3 The type of documents included in this review

The following sub-sections present the results and discussion of the publications related to BCT in Malaysia included in this study. Firstly, it presents the results of bibliometric analysis. Secondly, it presents the results of a systematic review. Lastly, discuss the findings and present suggestions for future research based on the current gaps found.

### D. Bibliometric Analysis Results

This sub-section presents the results of bibliometric analysis of the publications of BCT in Malaysia in the following aspects: annual scientific production and citations; publication venues; top authors, affiliations, and supporting

funding organizations; influential papers; and keywords co-occurrence analysis.

1) *Annual scientific production and citations*

This section employed the yearly number of publications focused on BCT in Malaysia until August 2022. Without regard to the search duration, the first publication was in 2017 and focused on Bitcoin users in Malaysia by exploring their experience and trust challenges of using bitcoin. Fig. 4 and Fig. 5 can provide some insights into the annual production of the articles and citations.



Fig. 4 The annual number of total publications

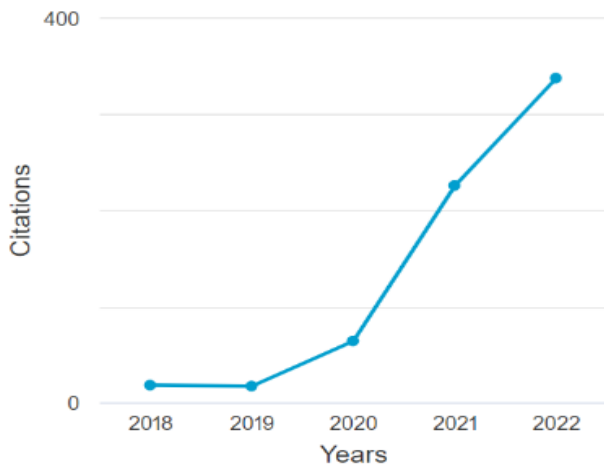


Fig. 5 The annual number of total citations

Fig. 4 depicts an increasing publication trend, with significant growth from 2018 to 2022. The split for each year from 2018 to 2022 was 5, 12, 19, 23, and 19 out of 76

publications. This increase is predicted to rise gradually by the end of 2022. This growing publication trend demonstrates the significance of BCT and its role in Malaysian digital transformation, particularly during the last three years. Furthermore, this trend shows that academics and practitioners regard BCT as critical to the future technological uprising and a means of solving data-related problems in the different sectors, becoming a hot research topic.

In addition, we expected to observe an increase in the number of citations as the number of publications in the BCT domain increased. The data depicted in figure 5 support this idea. The first citations appeared in 2017 when there were just two. Following that, there were 18 citations in 2018 and 17 citations in 2019. Nonetheless, the number of citations to Scopus-indexed BCT publications has increased dramatically since 2020, with 64, 226, and 338 citations in 2020, 2021, and 2022 (until Aug. 30, 2022).

2) *Publication venues*

There are 57 publishing outlets relevant to BCT research in Malaysia. According to the publication distribution of papers, BCT research has been published in a wide range of top-tier journals that focus on the technology's implications for business, management, manufacturing processes, sustainability, and logistics. The fact that publications emerge in such a wide range of journals demonstrates BCT's multidisciplinary character and the adaptability of its applications across various industries. This mapping review reveals that “The Journal of Advanced Research in Dynamical and Control Systems” possessed the highest number of publications (n=4), representing 5.26% of total publications. In addition, we analyzed those shortlisted outlets based on additional parameters such as the total amount of citations, average citations per publication, and average norm citations to determine the influence of each venue on the BCT research community. The results show that the “International Journal of Information Management” has ranked first in total citations. As seen in Table II, which displays the most popular venues, the journal with the most papers published is not always the journal with the most influence in research. This might be because the papers in these sources were published more recently and have yet to climb the total citations ladder.

TABLE II  
TOP POPULAR VENUES

Source title	No of Documents	% Of total documents	Total Citations	Avg. Citations	Avg. Norm. Citations
“Journal Of Advanced Research in Dynamical and Control Systems”	4	5.26	12	3	0.5
“International Journal of Advanced Computer Science and Applications”	2	2.63	21	11	2.2
“International Journal of Logistics Research and Applications”	2	2.63	18	9	5.8
“International Journal of Supply Chain Management”	2	2.63	15	8	0.7
“Journal Of Islamic Marketing”	2	2.63	16	8	0.4
“Technology in Society”	2	2.63	22	11	2.2
“Conference On Human Factors in Computing Systems – Proceedings”	1	1.32	71	71	1
“International Journal of Information Management”	1	1.32	167	167	8.9
“International Journal of Production Research”	1	1.32	89	89	4.7
“Plos One”	1	1.32	26	26	5.3
“Supply Chain Management”	1	1.32	34	34	1.8
“Technological Forecasting and Social Change”	1	1.32	30	30	6.1

### 3) Top authors, affiliations, and supportive funding organizations Contributing to the Publications

A total of 160 authors from 107 affiliations have published papers related to BCT research in Malaysia. Table III enumerates the top 10 most productive authors identified based on the total number of publications. Miraz, M.H from Sunway University is the most contributed author (n=7), followed by Hassan, M.G from Universiti Utara Malaysia (n=4). The top ten most productive researchers produced 34 articles, accounting for 44.74% of all publications.

TABLE III  
MOST PRODUCTIVE AUTHORS

Author	No published papers	% of papers
Miraz, M.H.	7	9.21%
Hassan, M.G.	4	5.26%
Kalid, K.S.	3	3.95%
Mubarik, M.	3	3.95%
Omar, M.	3	3.95%
Ooi, K.B.	3	3.95%
Tan, G.W.H.	3	3.95%
Wong, L.W.	3	3.95%
Yeong, Y.C.	3	3.95%
Ahmad, M.N.	2	2.63%

Regarding top institutions, the research efforts of BCT in Malaysia have been contributed by various institutions (n=107 affiliations). Table IV lists the most productive institutions/affiliations contributors to BCT research, ranked according to the number of publications. The University with the most articles was published in Universiti Utara Malaysia (n=16), followed by Universiti Teknologi Malaysia (n=12). Universiti Sains Malaysia ranked third and has contributed ten publications.

TABLE IV  
MOST PRODUCTIVE AFFILIATIONS

Affiliations	No. of Published papers	% Of documents
Universiti Utara Malaysia	16	21.05%
Universiti Teknologi Malaysia	12	15.79%
Universiti Sains Malaysia	10	13.16%
Universiti Kebangsaan Malaysia	8	10.53%
Universiti Kuala Lumpur	7	9.21%

Table V represents the funding organizations that have supported carrying out research in BCT technology in Malaysia, which ranked according to the number of publications. Among the 76 publications reviewed in this study, the Ministry of Higher Education, Malaysia, has supported the most significant number of papers (n=15). Then, five articles received funding from Universiti Teknologi Malaysia, while Universiti Utara Malaysia supported four papers.

### 4) Influential papers

Analyzing significant publications would help researchers and practitioners understand which papers have garnered the most significant attention in the BCT community. In addition, it would help determine what kind of research investigations and approaches would result in high-quality study work, impressing the BCT community. Citation analysis is an excellent method for determining the influence of work [23].

From 76 documents analyzed, 46 papers have at least one citation, and 30 papers have no citations. Table VI displays the title, author's name, year of publication, and the total number of citations for the top ten most cited papers, sorted by the total number of citations. Highly cited publications can impact their relevant research subdomains, influencing the scope of future research efforts. The "Time to seize the digital evolution: Adoption of BCT in operations and supply chain management among Malaysian SMEs" ranked the first influential paper with 176 total citations. It was followed by "Unearthing the determinants of BCT adoption in supply chain management", with 89 citations. The authors investigated the factors influencing BCT adoption for supply chain management in these two top articles.

TABLE V  
FUNDING AGENCIES FOR PUBLICATIONS OF BCT IN MALAYSIA

Funding Agencies	No of publications
Ministry of Higher Education, Malaysia	15
Universiti Teknologi Malaysia	5
Universiti Utara Malaysia	4
Kementerian Pendidikan Malaysia	2
National Natural Science Foundation of China	2
Universiti Kebangsaan Malaysia	2
Universiti Teknikal Malaysia Melaka	2
Universiti Tun Hussein Onn Malaysia	2
Hong Kong University of Science and Technology	1
Lembaga Pengelola Dana Pendidikan	1
Ministry of Education - Singapore	1
Research Management Centre, International Islamic University Malaysia	1
Swinburne University of Technology	1
Universiti Malaysia Sabah	1
Universiti Teknologi MARA	1
Yayasan UTP	1

TABLE VI  
MOST PRODUCTIVE AFFILIATIONS

Paper Title	Year	Total Citations
"Time to seize the digital evolution: Adoption of blockchain in operations and supply chain management among Malaysian SMEs"	2020	176
"Unearthing the determinants of Blockchain adoption in supply chain management"	2020	89
"Design for trust: An exploration of the challenges and opportunities of bitcoin users"	2017	71
"The blockchain-based Halal traceability systems: a hype or reality?"	2020	34
"A sustainable Blockchain framework for the halal food supply chain: Lessons from Malaysia"	2021	30
"The adoption of cryptocurrency as a disruptive force: Deep learning-based dual stage structural equation modelling and artificial neural network analysis"	2021	26
"The blockchain-enabled technology and carbon performance: Insights from early adopters"	2021	22
"Applying Blockchain for Halal food traceability"	2022	18
"Malaysian Muslim investors' behavior towards the blockchain-based Bitcoin cryptocurrency market"	2020	16
"A framework for traceable and transparent supply chain management for agri-food sector in Malaysia using blockchain technology"	2019	13

### 5) Keywords Co-occurrence Analysis

This section examines the main keywords addressed by the 76 articles in this review. According to Su and Lee [24], the co-occurrence analysis of keywords enables us to discover research themes and analyze the progress of research frontiers within a specific knowledge area. When importing Scopus data to VOS viewer for keyword analysis, we set the minimum number of keyword occurrences to 3, identifying 24 keywords out of 425. Keywords have similar meanings, those with matching meanings, but different spellings are combined. For example, “blockchain”, “block-chain”, and “blockchain technology” are combined into “blockchain”. The keyword co-occurrence network is depicted in Fig. 6. Each node represents a keyword, and its size is proportional to the number of publications that contain that term.

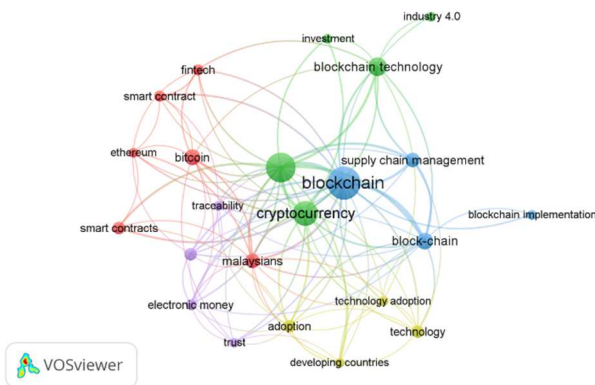


Fig. 6 Keywords co-occurrence network

Furthermore, the width of a line connecting two phrases reflects how frequently they appear together. Table VII shows the words that have at least three occurrences.

TABLE VII  
MOST PRODUCTIVE AFFILIATIONS

Keywords	Total Link Strength	Occurrence
Blockchain	140	54
Malaysia	108	35
Cryptocurrency	43	20
Adoption	34	11
Smart Contracts	20	9
Bitcoin	17	8
Supply Chain Management	22	7
Transparency	18	5
Electronic Money	15	4
Fintech	12	4
Ethereum	10	3
Industry 4.0	2	3
Investment	5	3

Blockchain, cryptocurrency, adoption, smart contracts, Bitcoin, and supply chain management are towards the top of the list of the most often appearing keywords, with occurrence weights (total link strength) of 54 (140), 20 (43), 11 (34), 9 (20), 8 (17), and 7 (22). Following blockchain, the most engaged keywords are cryptocurrency, demonstrating that researchers intend to conduct blockchain for cryptocurrencies. In addition, adoption is one of the main topics combined with BCT research. BCT is a new technology, demonstrating that a substantial amount of

research has been conducted and continues to be conducted in this area. The analysis also revealed that scholars are interested in combining BCT with supply chain management. Finally, this analysis demonstrates that BCT has a good security architecture, and professionals believe that BCT can enhance traceability.

### E. Qualitative Results (Systematic Review)

For researchers, the bibliometric analysis gives a high-level categorization of BCT research in Malaysia. Nonetheless, a comprehensive evaluation should be conducted to identify particular subjects and gaps in Malaysian BCT research. Given that the research on the BCT in Malaysia context includes different focuses, domains/sectors, methods, theoretical integration, and groups, many related terms have also appeared in the keywords of articles. The systematic review approach begins with the quantitative problem hypothesis and proceeds to process the research object, which comprises both explicit and potential or implicit information content [25]. As a result, this study uses the systematic review approach to classify all papers and give a comprehensive framework for BCT research in Malaysia. Every primary article extracted was read in full, and all the details were captured. The papers were classified from five perspectives: research theme (areas of purpose/focus), targeted domain/sector, the methodology adopted, theories used, and level of analysis. The classification framework for BCT-related Malaysia research papers is presented in Fig. 7. The details of this classification for this systematic review are described in the following sections.

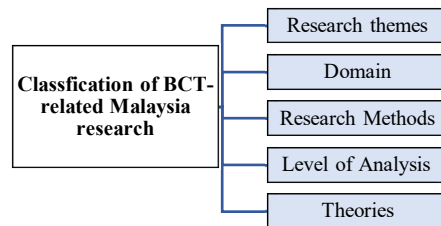


Fig. 7 A classification framework for BCT-related Malaysia research

#### 1) Research Themes

Based on the purpose/focus of the documents included in this review, we classified and grouped the articles into three research themes: behaviour and perception theme, BCT conceptualization and economy theme, and BCT-based applications theme. The behaviour and perception theme addresses studies relevant to the socio-technical aspects of BCT, such as adoption, drivers, barriers, awareness, trust, legislation, and ethics. The conceptualization and economy theme contains papers that intend to offer a better understanding and current knowledge of BCT and future aspirations that border on the business implications of BCT, such as role, potential, impact, satisfaction, and performance. Finally, the BCT-based application's theme comprises articles connected with the BCT models, frameworks, architectures, tools, and solutions proposed to be applied in a different area. So, to understand where we stand on BCT in Malaysia, it is critical to grasp the goal of the studied research on the previously mentioned themes.

The results show that behavior and perception themes represented 56.58% (n=43) of publications, followed by conceptualization and economy 25.00% (n=19), and solutions and application 18.42% (n=14). Fig. 8 demonstrates the distribution of papers among the research themes.

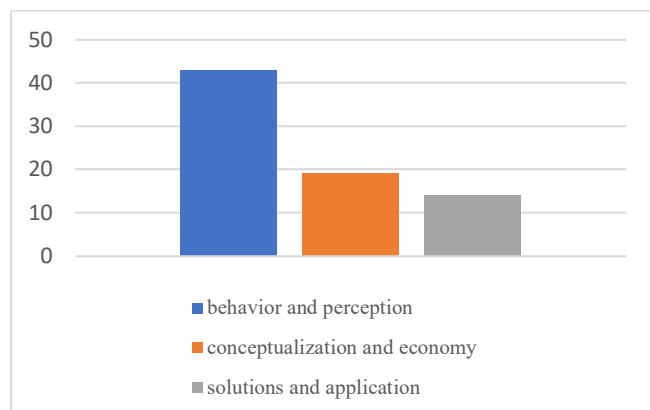


Fig. 8 Literature classification by research themes

Concerning the papers classified under the behavior and perception theme, the main topics investigated are adoption intentions, awareness, drivers and barriers, trust, and legislation issues. Given that BCT is a new technology, it was not surprising that the BCT adoption behavioral intentions had the most attention from scholars. Most adoption studies focused on investigating the factors influencing the adoption intentions of cryptocurrencies and bitcoin [26]–[37]. A study [38] attempted to examine the role of shari'ah compliance on cryptocurrency acceptance. Additionally, the factors affecting BCT adoption were studied in banking and financial institutions [39], [40]. Two studies focused on adopting BCT in Zakah management [41], [42].

The other studies related to the adoption of BCT were on the hotel industry [43], Education [44], warehouse operations [45], SME [46], logistics [8], retail market [47], operations and supply chain management [48], [49]. Furthermore, the barriers to BCT adoption in the halal sector were investigated, and a conceptual framework for these constraints was proposed [50]. In manufacturing, studies [51], [52] investigated organizational factors and drivers of BCT adoption for carbon trading and energy efficiency. The study [53] examined the systemic and psychological barriers to the use of BCT for manufacturing operations management.

The extent of BCT technology awareness within the BCT community was examined in [54]. In [55], the authors evaluated the intelligence community's acceptance of data sharing based on BCT. Also, some studies within this theme focused on the role of trust. Some studies analyzed the trust impact of using BCT & bitcoin for peer money transfer [56], the experience and trust challenges with bitcoin users [57], and the mediating role of trust on the factors that influence BCT in e-Logistic [58]. Some studies focused on describing strategies to assist BCT with the appropriate legislation to boost adopters' trust. Study [59] focused on BCT and the "Personal Data Protection Act 2010" (PDPA) in Malaysia. It has identified many critical components of the PDPA that may clash with Malaysia's BCT deployment. In [60], the authors analyzed the legal challenges associated with implementing BCT smart tenancy in Malaysia. It investigated

the present state of smart contracts in Malaysia and the practicality of the Malaysian framework in dealing with the most recent development.

In terms of conceptualization and economic theme, the research topics in existing research include BCT's potential, role, and industrial and economic impact in different domains. Typical studies are as follows: The study [61] examined how BCT might change and bring answers to Malaysia's present healthcare industry issues. Some studies addressed the possibility of using BCT technology to tackle problems in Malaysia's construction industry [62]–[64]. The study [65] highlighted the discussions on using BCT for waqf management. The study [66] investigated the correlations between BCT visibility, supply chain integration, and supply chain performance in Malaysia's semiconductor sector in the digital transformation era. In [67], the authors tested the direct impact of BCT technologies on supply chain sustainability in Electrical and Electronics Firms. A study [68] examined the influence of BCT on green supply chain practices to encourage pro-environmental settings in manufacturing enterprises' supply chains. The function of the BCT-based supply chain in supply chain integration has been identified [69]. The significance of BCT in circular economy activities and its influence on organizational performance has been explored [70], [71]. A study [72] examined the influence of BCT-Bitcoin in Malaysian marketplaces. A study [73] investigated if BCT technology has the potential to resolve trust concerns in the Islamic interbank monetary system.

The application's final theme comprises articles connected with the models, frameworks, architectures, tools, and solutions based on BCT that have been proposed to be applied to specific areas of society. Specifically, the authors in [74] developed a food management tool for traceability in the seafood supply chain. In [75], the authors presented a BCT-based framework for the agri-food sector for a traceable and transparent agri-food supply chain management system. In [76], the authors showcased how BCT technology conserves marital data and enhances data-sharing efficiency for Malaysian Muslim marriage records. In [77], authors designed an e-voting system using BCT by developing an online-based. In [78], authors developed a 'Musharakah' model based on Smart Contracts in which investors credit their investments for 'Musharakah' purposes with virtual lenders for specific Shari'ah-compliant entities and share profits based on an agreed dividend under the 'Musharakah' guidelines. A study [79] focused on developing a framework for applying BCT in higher education, raising the effectiveness of distributed systems, and improving their security and dependability. In [80], authors offered a solution based on BCT to the issue with the existing crowdfunding scene worldwide. In [81], authors designed a retail BCT requirement model to optimize industrial supply chain operations by improving consumer benefits. In [82], authors developed a vaccination system that uses BCT as the data storage medium to connect healthcare providers' vaccination records. In [83], authors proposed a BCT model to address the issue of a new traffic offence punishment point regulation. In [84], authors proposed a BCT-IoT system to provide a superior solution for monitoring river quality and allowing users to interact, retrieve, and analyze actual and historical data.

## 2) Domains/sectors

BCT has been intensively researched in Malaysia across several domains/sectors. The papers gathered were examined according to these domains/sectors to offer an overview of the present state of BCT research in Malaysia. Fig. 9 displays the domains and fields of study for BCT in Malaysia. The finance domain ranks at the top, with 33 studies. These studies include five areas: cryptocurrency, financial transactions, bitcoin, Islamic finance, and Zakah payment management. Supply chain management (n=12) is ranked the second most frequently investigated domain in the literature reviewed. These studies explored the adoption, potential, or impact of BCT-based supply chain management solutions related to visibility, tracking, and tracing in semiconductors, electrical and electronic sectors, manufacturing, food, and agriculture. The third domain was logistics (n=4). Other domains included in the analyzed studies were retail market, construction, and manufacturing with (n=3) each; healthcare industry and SMEs with (n=2) each. Finally, the remaining studies were distributed in different domains: education, warehouse industry, higher education, intelligence community, hospitality and tourism, traffic offenses, waqf management, Muslim marriage records, land registry management, e-

voting, and river monitoring, with one paper each. Table VIII presents the distribution of analyzed studies based on their domains and themes.

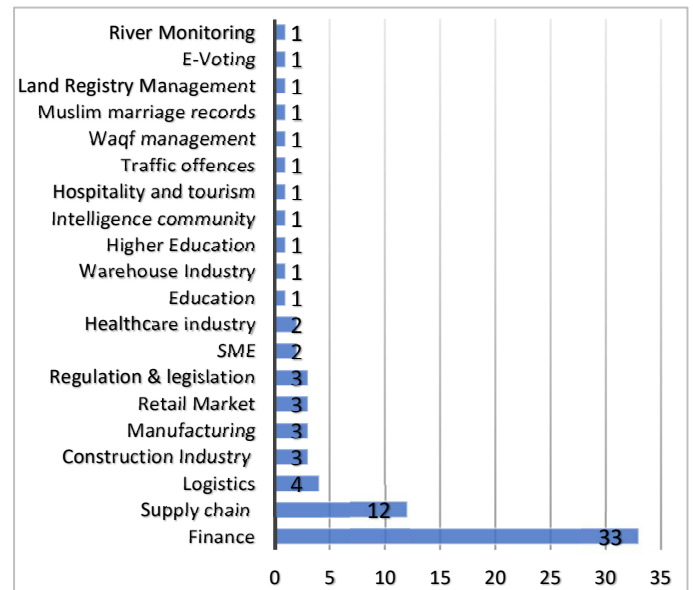


Fig. 9 The domain/sectors included in the analyzed studies

TABLE VIII  
DISTRIBUTION OF STUDIES ACCORDING TO THE DOMAINS STUDIED AND THEMES

Domain \ Theme	Behavior & perception Theme	Conceptual & Economy Theme	Application Theme	Total
Finance	Cryptocurrency	[26]–[28], [30]–[35], [37], [38], [54], [85]–[88]	[91]	19
	Financial transactions	[39], [40]	[80], [92]	4
	Bitcoin	[29], [36], [56], [57], [93]	[72]	6
	Islamic finance		[73]	2
	Zakah payment management	[41], [42]		2
Supply Chain Management	All industries	[49]		1
	Agriculture		[94]	1
	Electrical and Electronics		[67]	1
	Food		[70]	1
	Halal Food		[95]	2
	Agri-Food			1
	Seafood			1
	Manufacturing		[69] [97]	2
	Semiconductor		[66]	1
	SMEs	[48]		1
Logistics	e-logistics	[8], [58]		2
	Halal Food	[50], [98]		2
Construction Industry		[62]–[64]		3
Manufacturing	[51]–[53]			3
Retail Market	[47]	[99]	[81]	3
Regulation & legislation	[59], [60], [100]			3
SMEs	[46]	[71]		2
Healthcare industry		[61], [82]		2
Education	[44]			1
Warehouse Industry	[45]			1
Higher Education			[101]	1
Intelligence community	[55]			1
Hospitality and tourism	[43]			1
Traffic offences			[83]	1
Waqf management		[65]		1
Muslim marriage records			[76]	1
Land Registry Management			[102]	1
E-Voting			[77]	1
River Monitoring			[84]	1
<b>Total</b>	<b>43</b>	<b>19</b>	<b>14</b>	<b>76</b>



### 3) Research Methodology

The classification by methodology was based on the research method used in the analyzed paper. The documents are classified into a survey, interview, case study, mixed methods, simulation and experiment, theoretical review, and conceptual orientation categories, as shown in Table IX. The survey recorded the highest count, 55.26% of the methods used in the analyzed studies. The survey was used to measure social phenomena, the intensity of social relationships, and shifts in the amount. Several scholars applied survey research to investigate BCT adoption (e.g., [26], [44], [48], [51], [53]) or the impact of BCT on performance (e.g., [64], [66], [70]). It was followed by simulations and experiments, with 14.47% of studies employing techniques to simulate real-world functioning or test a novel idea using computer software. Because BCT is a relatively new research topic, we found that 13.16% of studies theoretically discussed BCT without any empirical investigation.

The interview method was used in 6.58% of studies undertaken to investigate the BCT suitability or to analyze hurdles and adoption needs or potentials of the technology (e.g., [8], [50]). Conceptual studies were 5.26% which illustrated the early stage of research on BCT by developing an initial conceptual framework and recommended decision-makers and academics to test these frameworks and further develop BCT-based systems (e.g., [39], [45], [91], [101]). Case studies are further applied in 2.63% of studies to generate insights into successful BCT projects (e.g., [95], [96]). Lastly, 2.63% of studies adopted a mixed method using qualitative and quantitative methodologies and techniques. By considering the research methodologies in this review, this study sheds light on where future BCT research may focus in terms of methods.

TABLE IX  
DISTRIBUTION OF STUDIES ACCORDING TO RESEARCH METHODS UTILIZED

Method	Studies used	Total	Percentage
Survey	[26]–[38], [40], [42]–[44], [46]–[49], [51]–[56], [58], [66], [67], [70]–[72], [85], [87]–[89], [93], [94], [97]–[99]	42	55.26%
Simulation & experiment	[74]–[78], [80], [82]–[84], [92], [102]	11	14.47%
Theoretical review	[59]–[62], [65], [73], [81], [90], [100]	10	13.16%
Interview	[8], [50], [57], [63], [64]	5	6.58%
Conceptual	[39], [45], [91], [101]	4	5.26%
Mixed Method	[41] [69]	2	2.63%
Case study	[95] [96]	2	2.63%

### 4) Level of analysis

The classification of the analysis level would consider the targeted population if they were users and society (individual level) or firms and industries (organizational level). Some studies did not employ a specific level of analysis; therefore, they were classed as "General." Fig. 10 depicts the level at which the studies evaluated were carried out. 30.26% of the publications (n=23) were in a general category, so these articles do not belong to an individual or organization since they primarily intended to give a generic body of information relevant at all levels relating to BCT. Aside from general-interest publications, many BCT studies (n=29) concentrated

on the individual level and (n=24) on organizational-level research.

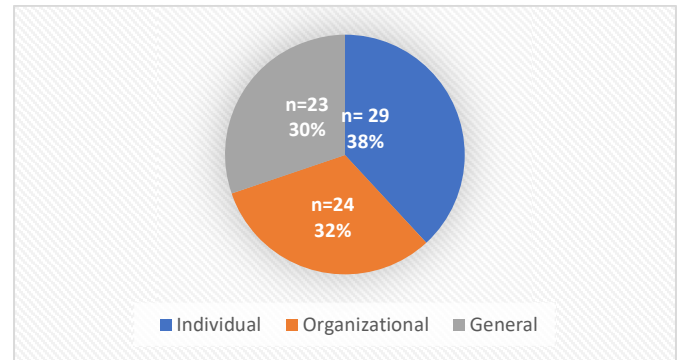


Fig. 10 Literature classification by level of analysis

### 5) Theories used

The 76 publications were analyzed via the lens of the theories adopted. Based on the findings, most research on BCT in Malaysia was not theoretically directed and classified under the "no theory" group (n=42, 55.26%). However, since some articles reviewed utilized simulation and experiments, conceptual orientation, and theoretical reviews, they were not based on any research theory framework/model. Out of the 76 papers reviewed, less than half of the publications (n=34, 54.76%) used one or more theories as their theoretical foundation. Table X lists 15 theories used by one or more publications.

TABLE X  
DISTRIBUTION OF STUDIES ACCORDING TO THEORIES/MODELS USED

Theory/Model	Studies	No of papers
No Theory	[8], [29], [30], [33], [35], [37], [50], [54], [57], [59]–[65], [69], [70], [72]–[78], [80]–[84], [87], [89]–[93], [95], [97], [100]–[102]	42
Unified Theory of Acceptance and Use of Technology (UTAUT)	[26]–[28], [32], [34], [38], [42], [45]–[47], [49], [56], [58], [88], [99]	15
Technology acceptance model (TAM)	[40], [41], [43] [44]* [36]* [55]*	6
Technology–organization–environment framework (TOE framework)	[48] [52] [51]* [36]*	4
Diffusion of innovations (DOI)	[85] [98]* [44]* [51]*	4
Theory of planned behavior (TPB)	[31] [36]*	2
Institutional Theory (INS)	[98]* [96]*	2
Practice-Based View (PBV)	[71]	1
General System Theory	[67]	1
Innovation Resistance Theory (IRT)	[53]	1
Social Network Theory	[94]	1
Risk management in technology (RMiT)	[39]	1
Network Theory	[66]*	1
Resource-Based Theory (RBT)	[66]*	1
Agency Theory	[96]*	1
Technology Readiness Index (TRI)	[55]*	1

\* Study combines two or more theories

As shown in Table X, the UTAUT topped the list of theories used, appearing in 15 of the 76 evaluated publications, accounting for 19.74% of the theories employed by one or more researchers, making it the most prominent of the theories included in this study. It is followed by TAM with (n=6) and TOE (n=4). The rest of the theories appeared only once in the examined studies. In addition, we can observe that some studies (n=6) that theoretical frameworks or models underpinned turn to combine two or more theories. For instance, in [36], the authors combined the TPB, TAM, and DOI frameworks in investigating the determinants of BCT-based bitcoin investment decisions among Malaysian Muslim communities. In another instance, to investigate organizational factors related to BCT adoption in the manufacturing industry, authors in [51] combined the TOE and DOI frameworks. The INS and DOI combined to Investigate the intention to participate in a BCT-based Halal traceability system [98]. TAM and TRI models combined to study the acceptance of BCT in the intelligence community [55].

#### *F. Discussion*

This study used bibliometric analysis and SLR to review 76 primary studies of BCT in the Malaysian context. This section discusses the results, the gaps in current research, and the opportunities for future research for BCT within Malaysia. From the descriptive analysis, it is clear that academic study on BCT in Malaysia began to expand in 2017 and rapidly increased after that. Possible explanations for this expansion include the unheard-of rise in bitcoin value in 2017. Since then, particularly between 2018 and 2021, the yearly release of BCT has grown. The findings presented that 56.58% of the analyzed studies focused on the behavior and perception of BCT. These findings show that most previous research has focused on the BCT acceptance stage before actual technology use. The findings showed that further research is needed to fully understand the effects of BCT and its practical applications, which creates an excellent opportunity. The studies recognize the beneficial changes BCT has brought about in several fields. These studies, therefore, promote the creation of other BCT-based apps to support operations in these fields. They think that creating new applications might boost the advantages associated with BCT.

The findings show that most studies focused on the finance domain (n=33), followed by supply chain management among several sectors (n=12). BCT in other industries such as manufacturing, healthcare, construction, education, and tourism have been investigated in a few research scopes, even though the enormous potential BCT can offer to these domains. These findings leave the potential for more research initiatives in many industries, as BCT has unique characteristics that must be carefully considered for each industry. Concerning the research instruments used, most studies utilized a survey (55.26%). Several scholars applied survey research that focused on exploring BCT adoption. Other methods, such as simulation and theoretical review, have been adopted in 14.47% and 13.16% of studies. However, the interviews, case study methods, and mixed methods are less employed in the studies analyzed. By considering the research methodologies in this review, this study sheds light on the methodology that future BCT

research may rely on to increase the rigor of their investigations. As for the theories/models used in the collected articles, the results show that (44.74%) of the articles employed theory, and most research on BCT in Malaysia were not theoretically directed (55.26%). In addition, based on the collected material, we found that most of the studies focused on the individual or organizational level. The national level has not been studied and needs more attention in future research.

From the above findings, this study explores the gaps in current research and the opportunities for future research for BCT within Malaysia. It recognizes that BCT technology is in the early stages, and the topic of BCT in Malaysia is still under-explored. It needs to be further studied, examined, and better understood. Although research on BCT adoption has risen, it is essential to mention that most studies have concentrated on financial services. This review revealed a dearth of detailed empirical studies on BCT adoption and current hurdles to implementation in various industries, including healthcare and higher education. It is vital to highlight the need for additional empirical studies to assess stakeholders' maturity levels and readiness to implement BCT applications in numerous industries; this might be a future research direction.

The causal correlations between technical, organizational, and regulatory constraints remain ambiguous, necessitating more empirical investigation. Determining what influences BCT adoption can help them handle their difficulties more effectively. Similarly, significant research possibilities exist in establishing the organizational structures that might support and expedite BCT adoption in many sectors. More research is needed on the properties of BCT technology that may impact its acceptance and use. Further research should focus on the technological features of BCT and their relationships to human/social elements of technology adoption and integration. The implications of BCT applications, with their bad and good aspects, in specific cultural situations would aid in developing these applications socially and economically. BCT demonstrates tremendous promise to increase security and transparency in information exchange across several organizations [103]. Bridging gaps between different disciplines and industries can give an exciting insight into several benefits of BCT that further merit investigation.

Furthermore, there is a need for more publications that examine the necessity of creating a legal framework to handle BCT integration; also, it is necessary to assess the effectiveness of current laws and regulations and risk management practices. Future research might concentrate on the systemic risk caused by digital BCT-based services and explore techniques for mitigating them. Additionally, the researchers must investigate the future influence of legislation on digital BCT-based services and technology implementation. BCT adoption and use can also benefit sustainability measures in specific areas, which should be addressed.

In terms of methods, few researchers have investigated BCT using simulation or optimization research methodologies. In this situation, valuable possibilities exist, as targeted adoption of BCT requires economic analysis and optimistic predictions. Smart contract functionality and

advanced data analytics methods may aid further effective interaction and increased resource sharing across many groups, but they should be supported by extensive research. Furthermore, there is a scarcity of interviews or mixed-method research that examines BCT in Malaysia from a methodological standpoint. It is advised that future studies employ mixed-methods research, qualitative techniques, or phenomenological perspectives by including interviews or focus groups in addition to questionnaire surveys. This technique should be utilized to acquire a more realistic understanding of the BCT phenomenon and to gather industry experts' ideas on how to adopt BCT properly. The researcher's focus may also be on BCT use cases and applications. The technology's adoption potential might be increased even further by integrating technological study on BCT in a particular field with value-added use case analysis.

Regarding theories/models, most existing studies do not use theories. The importance of technological, social, and psychological factors in determining the adoption of BCT applications has received scant attention. This research gap has to be filled by looking at adoption theories and models across various industries. Therefore, we propose that future studies use well-established research frameworks and models for BCT research to become more prominent in cutting-edge information systems research. Understanding what influences the adoption and implementation of BCT would be clarified by including many theories/models, particularly when the factors are connected to BCT-specific properties. Examining these theoretically based indicators can help managers adopt BCT and assess its effects. Specific theory-based viewpoints on BCT and how the technology affects or generates new ideas in various fields provide study opportunities. To understand why businesses and individuals choose to accept BCT, researchers should adopt theoretical viewpoints. To better understand BCT's fundamentals and aid in facilitating technology adoption, further work may be done to examine the grand theories' application to BCT.

Furthermore, most of the studies analyzed in this review focused on the individual or organizational level when investigating the BCT in Malaysia, while no attention has been paid to the national level. The main goal of the adoption research is to identify the determinates that promote or obstruct BCT adoption. BCT research focusing on the national level will increase support for BCT-friendly legislation and public understanding of the technology. Furthermore, the insightful findings of national-level research may support national laws supporting the ease of BCT acceptance and use. Consequently, we recommend BCT studies that focus on the national level.

Lastly, several more interesting areas may be studied, such as how other Industry 4.0 technologies interact with BCT as they seldom function separately. Lastly, a possible research direction is a comparison of the prospects, risks, costs, and advantages of integrating BCT with other technologies in different industries in Malaysia.

#### IV. CONCLUSION

BCT is a rapidly growing research topic with enormous potential effects. Although the precise timing of transformative BCT applications cannot be known, BCT gives scholars an extensive and exciting research

environment, as proven in this study. Any new technological research and application has an overall impact on society only after multiple development cycles. Thus, the influence of BCT on the economy and society is projected to emerge gradually as the growth of ledger technology necessitates the gradual development of governmental regulation and organizational rules. Therefore, researchers must remain updated on research trends to get insight into future research directions. To the best of our knowledge, this study is among the first to combine bibliometric analysis and systematic review methods into the analytical and descriptive study of BCT research fields in Malaysia. The use of this mixed method increases the validity of our study.

This study presented a systematic and comprehensive picture of how BCT research in Malaysia progresses, captured cutting-edge advances in this domain, and identified the new trends in this topic. This review may help academicians and researchers understand BCT research in different sectors and subsectors in Malaysia. By offering a specific viewpoint on the growth of BCT research, this study adds to the body of BCT knowledge in Malaysia. This study can also be helpful for policymakers, government organizations, and practitioners in several sectors by providing them with emerging BCT-based applications. Additionally, it would encourage future collaborations between business and academics on projects and works like performance evaluation of BCT-based developed applications and systems.

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