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Blockchain adoption perspective in future food supply chain: A systematic literature review

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ABSTRACT

When companies want to operate smoothly, grow the business, satisfy consumers, and generate sales, it means operational management is working well. One of the dominant components in operational management is supply chain management, which is currently focused on various technological adoptions offered in the digitalization era (blockchain, IoT, and RFID) on supply chain management, and various better impacts on supply chain performance. This study has limited research on the food sector, along with growing quality and healthy food sector awareness. This study uses a systematic literature review (meta-analysis) with a blockchain adoption perspective on future food supply chain topics. This study aims to determine research themes, publication rankings, research methodology, and Country of research. Also, to determine this technological adoption, and to find out the lack of sector on research themes for future research. The source of data in this study came from scientific journal articles from meta-data on Google Scholar, the results were found in the 277 articles which were processed on selection to be 51 articles with various research topics such as best practical method, engagement process, and quality assurance.

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INTRODUCTION

Every aspect of a business is affected by its operational performance. When a company wants to operate smoothly, grow its business, satisfy consumers, and generate sales, this means that operational management is working well. Operational management includes several activities of the company including planning, organizing, and supervising the course of production and manufacturing of the company. Good operations management allows companies to run effectively and efficiently with existing organizational resources able to meet the desires of consumers. In other words, operations management can fulfill product creation in terms of production processes and product value creation. The increasing consumer demand for products allows companies to continue to grow and want to provide embedding of product value to consumers, with all current adoption companies are trying to hook their potential customers with the features and advantages of their product services.

An analysis released by market observers and blockchain developments from the Netherlands (Blockdata. tech) found that 50 such companies are developing blockchain from various sectors in their companies (Knegtel, 2020). Blockdata also found that the highest use of blockchain in these companies (a list of 50 companies released by Forbes) is used for the development of their supply chain systems, including traceability systems and systems that detect countries of origin (Kshetri, 2021). The trial application of Blockchain technology innovation can be a potential, and a breakthrough, not only used in the financial and banking sectors, but can also be developed in other sectors, especially in the supply chain sector with the function of blockchain as an increase in product traceability, supporting authenticity, and legitimacy (Wang et al., 2019).

Refers to International Data Corporation (IDC), the entire world spends funds to adopt and implement *Blockchain* at a touching cost of *$4.1* billion US dollars in 2020, an increase of 50% from 2019. IDC predicts that the market for adoption of Blockchain will touch $18.9 billion US dollars by 2024 (IDC, 2021; Kshetri, 2021). In major industries in the world in 2020, this technology is adopted in various sectors in the world. supply chain management, including improving abilities tracking and traceability system, originality guarantee system, financial and payment systems, distribution and logistics systems (Castillo, 2019; Knegtel, 2020).

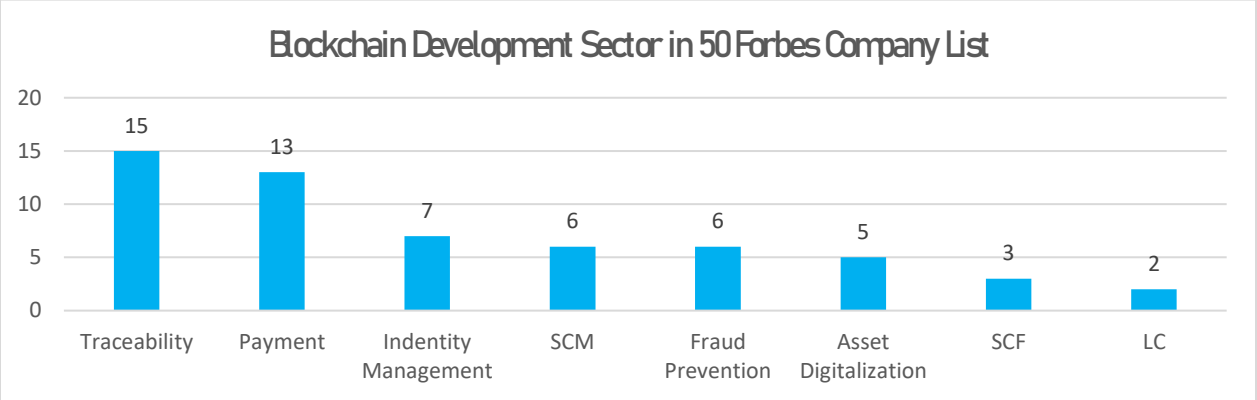

Figure 1. Blockchain development sector in 50 companies
Source: Forbes, 2019 in Blockdata. tech, 2020

Technology experiments on supply chain also briefly shook the supply chain sector world Especially in the sector Food supply chain in 2016 carried by the company Walmart in collaboration with IBM announced two major projects with experimental applications of the technology Blockchain to browse fresh mangoes and fresh pork products they sell at supermarkets Walmart until it can be traced until it is known Country of Origin raw material manufacturer. The two companies consider that the importance of traceability, especially in fresh food products, can bring major changes to the system Tracing Their fresh produce, this technology can be one solution to shorten their traceability time which previously took 7 (seven) days with a manual method by viewing the details of the shipping invoice, by adding features Barcodes on mango and fresh meat products, only with scan barcode They can browse products that are in supermarkets Walmart Until arriving at the location and origin of their product distributors in just 2.2 seconds (HyperLedger, 2018).

There are many opinions and speculations about the impact of technological breakthroughs in Blockchain on the development of the supply chain, but understanding the potential of this technology is still very limited. Along with the development and spread of the use of this technology is still in its growth stage, systematic literature review is considered to be able to help research in the future, systematic literature review is the most powerful method to be used as a list of summaries of selected journals

(according to certain standards), current research areas, and research areas on a specified topic, hence the presence of systematic literature review This is expected to facilitate research in the future, and can provide understanding for the adopters Is it necessary to adopt this technology or just as an observer for breakthrough innovations? (Tranfield, D., Denyer, D., and Smart, 2003; Deep Wang et al., 2019). Systematic literature review It is also expected to be a new take on technology Blockchain and Food supply chain fact of its application not only as a trend, whether according to existing scientific articles, blockchain Food supply chain Potentially as a positive or negative technological breakthrough.

From the information above, researchers are interested in researching using systematic literature review research methods that focus on blockchain and food supply chain topics, considering that the number of scientific article publications with the theme of literature review with these topics was found to be small, based on journal search results on the journal search software Publish or Perish There are only 6 (six) articles with a period of 2019-2022 (Figure 2),

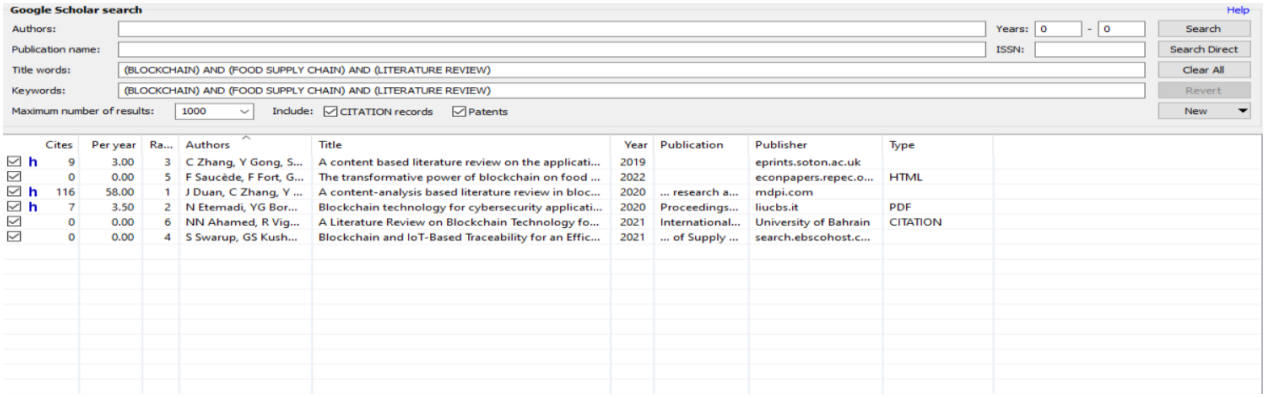

Figure 2. Search results of literature review scientific journal
Source: Data researcher, 2022

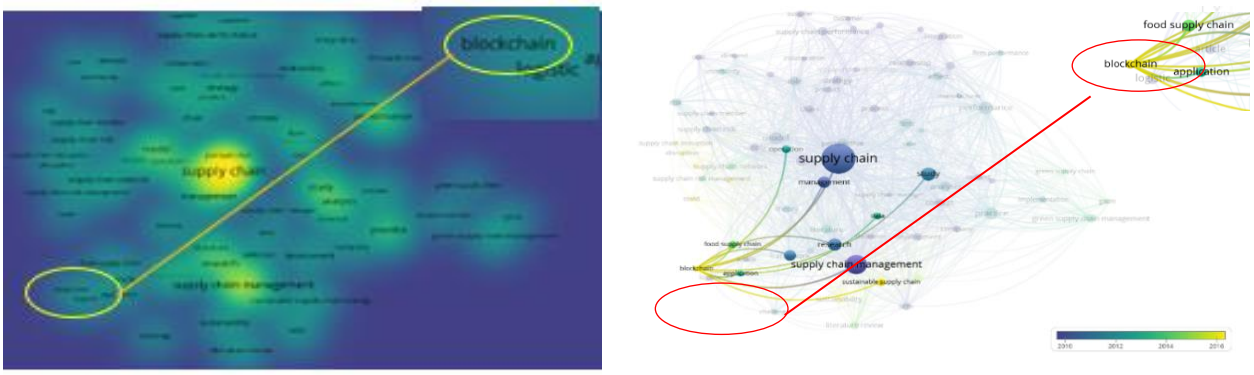

Figure 3. Bibliographic Mapping (Blockchain-Supply Chain)
Source: Data researcher, 2022

Apart from the journal search results on the journal search software application Publish or Perish with the topic of blockchain and food supply chain, researchers also explore information by analyzing research maps (bibliographic mapping) with Vos Viewer software, with analytical data sources in the form of meta-data downloaded from journal search results through software Publish or Perish with supply chain keywords. It is obtained that blockchain is one of the research topics on the topic the yellow sector in Figure 3 on the right (Research Publish Year Mapping), this shows that research on this topic can be said to be

relatively published in the latest research year when viewed in figure 3 on the left (Research Publish Density), the dim yellow color indicates density (published articles) with the topic of blockchain are less or less researched compared to other topics studied alongside supply chain research topics.

LITERATURE REVIEW

Operations management is a series of activities to create value in the form of goods or services by converting inputs into outputs (Heizer & Render, 2017). Supply Chain management or supply chain management is the coordination of all activities, starting from raw materials to consumer satisfaction (Heizer & Render, 2017).

In this study, supply chain management or supply chain is a topic of discussion before entering into a specific topic, namely the second keyword "food supply chain" that researchers will use in the scientific journal search software Publish or Perish, based on the understanding of supply chain or supply chain from several experts (Heizer & Render (2017), Robert & Chase (2014), Virona (2020) and Azara (2020) Researchers concluded that the supply chain is a series of processes of planning, implementing, controlling, distributing, and selling raw materials that are processed into goods or services by adding value, until it reaches the final consumer, while supply chain management is the entire arrangement of the series of processes of planning, implementing, controlling, distributing, and selling raw materials that are processed into goods or services by adding value until it reaches the final consumer.

Food supply chain is used by researchers as the second keyword used by researchers on scientific article search engines Publish or Perish, FSC is the activity or process of switching products (food) from producers (farmers) through the process of production, distribution, retail, to the end consumer "farm to fork" (Dani, 2015; Iakovou et al., 2015; Ouden et al., 1996). FSC is a series of supply chain activities specific to products with food types, FSC has differences with supply chains in general because many factors can affect the success of FSC because food is one type of product that has a major risk in the process of its activities here are some success factors that need to be considered at FSC including product contamination, temporary or permanent power loss, IT system paralysis, recall of uncontaminated products (due to unidentified), logistics network paralysis, economic uncertainty challenges, food safety regulations, absence of water reserves, increased labor costs, unavailable materials, loss of space, war, pandemic, absence of suppliers, natural disasters, fuel oil increase, and terrorist deviant acts (Dani, 2015).

Blockchain is the third keyword used by researchers in journal searches, blockchain language contains two syllables, namely block and chain, a block which means collection, stack, and chain which means a chain, or link.

Table 1. Blockchain According to Experts

No	Source	Description
1.	Blockchain-based supply chain 4.0 and (Virona, 2020)	Blockchain can be likened to a ledger technology that records every switch or transaction in a block of data, where each block of data is interconnected between one block of data with another block of data (peer-to-peer) that has occurred, the process of the transition uses a cryptographic coding system (hash).
2.	Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions (Bambara & Allen, 2018)	Blockchain is a database that includes a digital chain in the form of block data on transactions or movement of distribution of products or services, which is contained in one block in which there is a series of codes from transactions or movement Block, each move adds a new block, before the

	creation of a new block the system validates the previous blocks.
3. Blockchain Technology and Its Relationships to Sustainable Supply Chain Management (Crosby, M., P. Pattanayak, S. Verma, 2016) deep (Saberi et al., 2019)	Blockchain is a distributed database record or public/private ledger that records all digital activities that can be monitored, viewed and shared with the scope of people who are given access (authorization clients).
4. How Blockchain Technologies Impact Your Business Model (Morkunas et al., 2019)	Blockchain is a decentralized database of every transaction or asset movement, known as a distributed ledger, which is maintained and updated by the computer network that inspects a transaction before a new block of asset data is issued and added to the ledger.

Based on the understanding of blockchain according to experts, researchers can conclude that blockchain is a collection of transaction block data or the movement of assets stored on a server called a ledger, where the collection of blocks is interconnected between the latest block to the earliest block, the block It exists on every computer system of every party in the ledger network, is immutable, and cannot be manipulated. This can be the reason for increasing the security of the transaction distribution network, and can also increase trust between one party and another party on the ledger network. But in practice the technicalities of using blockchain can be adjusted to the needs of the adopter system, one example that we often hear is the use of blockchain in the Bitcoin financial system (digital cryptocurrency), a system of buying and owning digital assets that uses NFTs (non-fungible tokens) linked to digital assets.

METHOD

In this study, there is a research object to find out the perspective of blockchain application in the future of the food supply chain with systematic literature review studies, by obtaining a database in the form of bibliographic metadata of scientific journals on the topic of blockchain and food supply chain Which will be presented with results in the form of, a list of journals that have been classified based on publication quality with the Scimago Journal Rankings website tool, categorizing the research sector of scientific articles, the country of origin of scientific journal research, and the type of scientific journal research. As for this study, the unit of analysis was carried out on scientific articles published on Google Scholar with the keywords "Journal, (Blockchain) and (Food Supply Chain) [title], (Blockchain) and (Supply Chain) starting in 2018".

Research methods in research It uses a systematic literature review study approach, this methodological procedure is developed to identify references with relevance to specific topics in a predetermined bibliographic database of scientific journals (Campbel et al., 2010 in Ferenhof et al., 2014). Systematic literature review (meta-analysis) has advantages over Traditional Review, among the advantages are strengthening the scientific methodology approach to summarize research results, using research protocols (stages, and classification of selected journals), searching for research results and articles carried out systematically, there are clear criteria for which articles will be used as research material, minimizing bias, can be replicated, synthesizing results in the form of meta-analysis (statistical processing), and narrative (meta-synthesis) (Perry & Hammond, 2002).

In this study the type of data used is quantitative data, according to (Sudaryono, 2019) Quantitative methods are research that aims to describe social phenomena or symptoms quantitatively or analyze how social phenomena or symptoms that occur in society relate to each other.

In this study, researchers dug into data sources secondary Form Meta Scientific journal data obtained from the results of searching through software publish or perish. Data secondary is data obtained through a third party (Hair et al., 2020). Collection techniques in this study carried out documentation methods and reviewed library data, documentation methods according to (Sudaryono, 2019) are data in the form of writing, images, or works of art.

Population (Hair et al., 2020) is the entire data obtained on the object of study. In this study, the population data obtained was in the form of 227 scientific articles obtained by the method of searching scientific articles through the software Publish or Perish (Google Scholar), keywords "(Blockchain) and (Food Supply Chain) [title], (Blockchain) and (Food Supply Chain) from 2018", or "(Blockchain) and (Food Value Chain) [title], (Blockchain) and (Food Value Chain) from 2018", or "(Blockchain) and (Food Logistic) [title], (Blockchain) and (Food Logistic) from 2018", or "(Blockchain) and (Food Distribution) [title], (Blockchain) and (Food Distribution) from 2018".

The sample according to (Hair et al., 2020) is a set of small relative taken using the technique of sampling probability non-probability. This research uses non-probability, purposive sampling, which shows that the sample has certain classifications and criteria to be further processed and analyzed by researchers. The sample in this study was taken from the results of the classification of scientific journals with a method of selecting publication rankings, relevance to research topics, and having open access. Researchers use non-probability sampling and purposive sampling techniques to select scientific articles that have Q1-Q4 publication ranking criteria and journals that have close relevance to the topic of discussion that researchers can download, then the sample obtained after selection is 51 scientific research articles.

Research flow and data analysis techniques

Before entering into data analysis techniques, researchers try to describe how the research flow in this study begins to get the results and conclusions of the study. The following is the flow of research by adopting the stages of research cited and developed from scientific articles (Indarti et al., 2020):

1. Determination of literature review topics
   At this stage, researchers choose the main topic of research by determining two keywords, namely "Blockchain" and "Food Supply Chain".
2. Search and data collection
   At this stage, researchers try to find and collect scientific research articles using Publish or Perish (Google Scholar) software. Researchers searched the search field with the format "(Blockchain) and (Food Supply Chain) [title], (Blockchain) and (Food Supply Chain) from 2018", or "(Blockchain) and (Food Value Chain) [title], (Blockchain) and (Food Value Chain) from 2018", or "(Blockchain) and (Food Logistic) [title], (Blockchain) and (Food Logistic) from 2018", or "(Blockchain) and (Food Distribution) [title], (Blockchain) and (Food Distribution) from 2018". The description of the following search format means "search for journals with the title and title of blockchain and food supply chain from 2018 to 2022. In this search, researchers managed to collect scientific journal metadata with a total of 227 journal articles.
3. Selection and download of scientific research articles
   The next process after obtaining scientific research articles, researchers select scientific research journals based on the quality of publications (Q1, Q2, Q3, and Q4) through the institutional page of the publication quality ranking Scimago Journal &; Country Rank, then researchers get the results of journal selection by grouping the quality of journal publications, and choose journals that have relevance to the research topic, and download journals that It has been selected in journals that have open access to obtain a total of 51 scientific research articles.
4. Digitization of scientific research articles (indexing)

After getting the selected and downloaded journals, the researcher digitizes the scientific journal in which there are abstracts, keywords, research methods, research sector, research year, research country, publication quality, and application case studies (if any), and the researcher saves the data with Microsoft Excel software format.

5. Data analysis process
   At this stage, the researcher reads the abstract of each scientific research article, but if the researcher assesses that the abstract still does not represent the entire research, the researcher reads all parts of the scientific research article, with the results of the researcher presenting data in the form of descriptive narrative analysis (Ferenhof et al., 2014), in addition, the researcher presents the contents of a summary of scientific research articles, research mapping charts (sector/theme, country, year, and research methodology).

RESULTS AND DISCUSSION

In this study, 51 scientific research articles were obtained that have passed the selection process from a total of 227 journals with the search topics "Blockchain" and "Food Supply Chain". The 51 articles if grouped based on the ranking (ranking) of the scimagojr site.

Table 2. Ranking of Selected Journal Articles (Scimagojr)

No	Rank (Scimagojr)	Number of Articles
1	Q1	11
2	Q2	15
3	Q3	11
4	Q4	5
5	*Not Indexed*	9

Source: Data processed, 2022

In the table above we can see several journal rankings from 51 articles that have been selected by researchers, including the ranking of journal publications Q1 with the number of 11 articles, Q2 with the number of 15 articles, Q3 with the number of 11 articles, Q4 with the number of 5 articles, and the last one has no ranking but in relevance the researcher considers the article worthy of review, the journal comes from an international seminar with a total of 9 articles. The journal is obtained and analyzed for one month, the analysis carried out includes the separation of journals that have journal ratings and relevance to the research topic and have open access for download. The following descriptions of journal publications that have been selected include the following:

1. Q1, is a ranking of journal publications with top 1-25 rankings in the field of blockchain and FSC discussion, with journal sources including Information Technology for Development, Computers in Industry IEEE Access, Technological Forecasting &; Social Change, Production Planning & Control, International Journal of Information Management, Journal of Cleaner Production, Journal of Cleaner Production, IEEE internet of things journal, International Journal of Information Management, and International Journal of Production Research.
2. Q2, is a ranking of journal publications ranked in the top 26-50 in the field of blockchain and FSC discussion, with journal sources including the International Conference on Smart Blockchain, International Journal of Environmental Research and Public Health, Sustainability, Agriculture, Information, International Food and Agribusiness Management Review, Mobile Information Systems,

International Journal Communication System, Transactions on Trans Emerging Telecommunications Technologies, Sensors, and European Conference on Parallel Processing.

3. Q3, is a ranking of journal publications ranked in the top 51-75 in the field of blockchain and FSC discussion, with journal sources including Discrete Dynamics in Nature and Society, International Journal of Information Systems and Supply Chain Management, International Journal of Information Technology, Journal of Engineering and Applied Sciences, International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), Turkish Journal of Computer and Mathematics Education, Ifac-Papers Online, International Journal of Food Engineering, International Journal of Advanced Computer Science and Applications, and International Journal of Logistics Systems and Management
4. Q4, is a ranking of journal publications ranked in the top 76-100 in the field of blockchain and FSC discussion, with journal sources including The International Conference on Advances in Emerging Trends and Technologies, Innovative Product Design and Intelligent Manufacturing Systems, Lecture Notes in Mechanical Engineering, SN Computer Science, Supply Chain Management: An International Journal, and Calitatea.
5. Not indexed, is a ranking of journal publications that do not rank in the top 100 in the field of blockchain and FSC discussion, but have strong relevance to the field of research, with publication sources including IEEE International Conference on Blockchain, IEEE/ACM 2nd International Workshop on Emerging Trends in Software Engineering for Blockchain (WETSEB), International Seminar on Research of Information Technology and Intelligent Systems, International Conference on Smart Blockchain, Proceedings 2019, International Journal of Blockchains and Cryptocurrencies, 2018 IoT Vertical and Topical Summit on Agriculture - Tuscany (IOT Tuscany), International Conference on Computational Science and Its Applications, and Management Science.

After selecting research journal articles, researchers take the characteristics of the research theme based on the journal (Indarti et al., 2020), five research themes were obtained, including: engagement process, quality control assurance, critical success factors, production and distribution process, FSC operation support. Based on the characteristics of the research theme above, the following scientific study journal articles were obtained.

Table 3. Research Themes on Blockchain and FSC

No	Research Theme	Number of Articles	Source
1	Critical Success factors	2	
1a	Supply Chain Bottlenecks	1	(Pawar et al., 2021)
1b	Performance Output	1	(Joo & Han, 2021)
2	Engagement process	24	
2a	Best Practice Methods	11	(Shahid et al., 2020); (Shakhbulatov et al., 2019); (Baralla, Pinna, et al., 2019); (Hayati, 2018); (H Huang, X Zhou, 2019); (Caro et al., 2018); (Amen et al., 2019); (Patel et al., 2021); (Bettín-Díaz et al., 2018); (Kaur et al., 2021); (Santos et al., 2021)
2b	Integration of blockchain technology and FSC	1	(Z. Y. Liu &; Guo, 2021)
2c	Implementation and adoption	12	(David et al., 2022); (Marchese & Tomarchio, 2022); (Fu et al., 2020); (Tipmontian et al., 2020);

			(Yadav et al., 2020); (Rogerson & Parry, 2020); (P. Liu et al., 2020); (Balamurugan et al., 2022); (Dey et al., 2021); (Köhler &; Pizzol, 2020); (Mondal et al., 2019); (Hong, 2021)
3	FSC Operation Support	10	
3a	Overview of scientific research	10	(Tan et al., 2018); (Kumar, 2020); (Zhao et al., 2019) (Duan et al., 2020); (Peña et al., 2020); (Ali et al., 2021); (Kramer et al., 2021); (SA Bhat, NF Huang, IB Sofi, 2021); (Tsoukas et al., 2022); (Kayikci et al., 2022)
4	Production and distribution process	2	
4a	Process Integrity	1	(Rajániová et al., 2020)
4b	Value addition	1	(Treiblmaier & Garaus, 2022)
5	Quality Assurance	13	
5a	Evaluation	1	(Mao et al., 2018)
5b	Transparency and traceability	12	(Tayal et al., 2021); (Miraz et al., 2020); (Bumblauskas et al., 2020); (Scuderi et al., 2019); (Casino et al., 2020); (Longo et al., 2020); (Baralla, Ibba, et al., 2019); (Chan et al., 2019); (M Mohan, 2021); (Zhang et al., 2022)

Source: Data processed, 2022

Based on the table above, three discussions of the highest research themes were obtained, namely engagement process, quality assurance, and FSC operation support.

First Engagement Process, application of technology Blockchain has an absolute advantage in several factors in the supply chain including asymmetry information, cost efficiency, traceability, time effectiveness, immutability, authentication, and Proof of Work (David et al., 2022; Fu et al., 2020). Next (Yadav et al., 2020), the application of technology Blockchain has transparency capability facilities, Integrity, and data that cannot be manipulated, in addition to an increase in Food Safety, Lean operation on operations Food supply chain (FSC) (Balamurugan et al., 2022; P. Liu et al., 2020)**.** Some of the best application methods researchers also found from several journal articles, including the use of interplanetary file storage system (IPFS) To increase efficiency, better maintain data, and as a reliable method or solution, IPFS is a system of calling an object or code that is needed by providing a Query (code of the unit of the invocation system Database) callers who are detailed and focused on a specific object (Shahid et al., 2020), the use of architecture Hyperledger sawtooth It is also considered to reduce energy consumption and increase the number of Record Data capable of up to 1000 Record per second (Baralla, Pinna, et al., 2019), other architectures are also like food trail proposed by researchers from the Bandung Institute of Technology Indonesia is considered to be able to provide application facilities including accurate information, verified transaction, distributed, and immutability (Hayati &; Nugraha, 2018). Application methods Blockchain with additions such as Third Party Certification (TPC) Broadcasting

Equipped with Token It is also considered to increase transparency and maintain capabilities sustainability Consumer behavior (Santos et al., 2021). Using an Electronic Product Code (EPC) combined with Radio frequency identification (RFID) is also considered to improve efficiency, transparency capabilities, and Safety in every FSC process (H Huang, X Zhou, 2019). Added technology deployment features Blockchain The FSC is also considered to be able to improve the evaluation ability of each process at FSC in America, by adding features Monitoring Every shift in supply chain distribution to waste, and allows the stakeholders to evaluate transportation activities that are not needed in the future (Shakhbulatov et al., 2019). In addition to the advantages of applying the technology Blockchain In FSC, there are also several challenges and several things that must be considered in the application of the technology, including the availability of software that is adaptable With an enterprise supply chain system, purchase costs Hardware Supporting the Application of Technology Blockchain, and determination of traceability levels tailored to the demands of the company or supply chain ecosystem (Tipmontian et al., 2020).

Second, Quality Assurance, in this research theme, there are two topics of discussion including evaluation, review of transparency capability improvement, and traceability. Like the addition of features credit evaluation in the practice of FSC transition is considered more effective and efficient, minimizing the presence of Asymmetric information Among stakeholders (Mao et al., 2018). Application of technology Blockchain FSC is also considered to be able to improve capabilities tracking, Transparency, and traceability (Casino et al., 2019; Chan et al., 2019; M Mohan, 2021; Scuderi et al., 2019; Tayal et al., 2021; Zhang et al., 2022).

Third, FSC operation support, focuses on the review of scientific and technological article reviews Blockchain on FSC. It was found that there was a topic of discussion of the benefits of application Blockchain among them are security guarantees, Reliability, transparency, traceability, Information Sharingsupporter Decision-making, Food Sustainability and Food Safety (Ali et al., 2021; Bhat et al., 2021; Kramer et al., 2021; Peña et al., 2020; Tsoukas et al., 2022), as well as an increase data security, Collaboration between stakeholders (Kayikci et al., 2022). In addition to the benefits of applying the technology Blockchain, several challenges must be considered in the application of the technology, including storage capacity and size, security leaks, high cost, and policy issues, water use management, and sustainability Manufacturing (Zhao et al., 2019).

Based on the results of grouping according to the research theme, researchers present several pictures related to the research theme based on the research year (figure 4), research theme based on publication rank (figure 5), research theme based on research methodology (table 4), research methodology based on research year (figure 6), research methodology based on publication rank (figure 7), publication rank based on research year (figure 8), country research (figure 9), and figure the number of citations based on the year of study (figure 10).

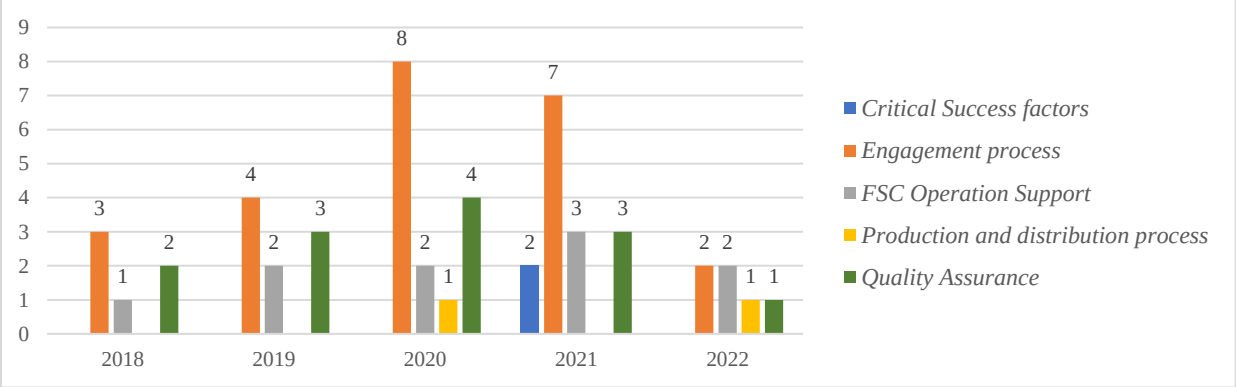

Figure 4. Research theme based on research year

In figure 4, we can see that articles with the theme of *engagement process* research have the largest number each year, with sub-themes of best application methods, and application and adoption that still dominate the discussion of research topics every year.

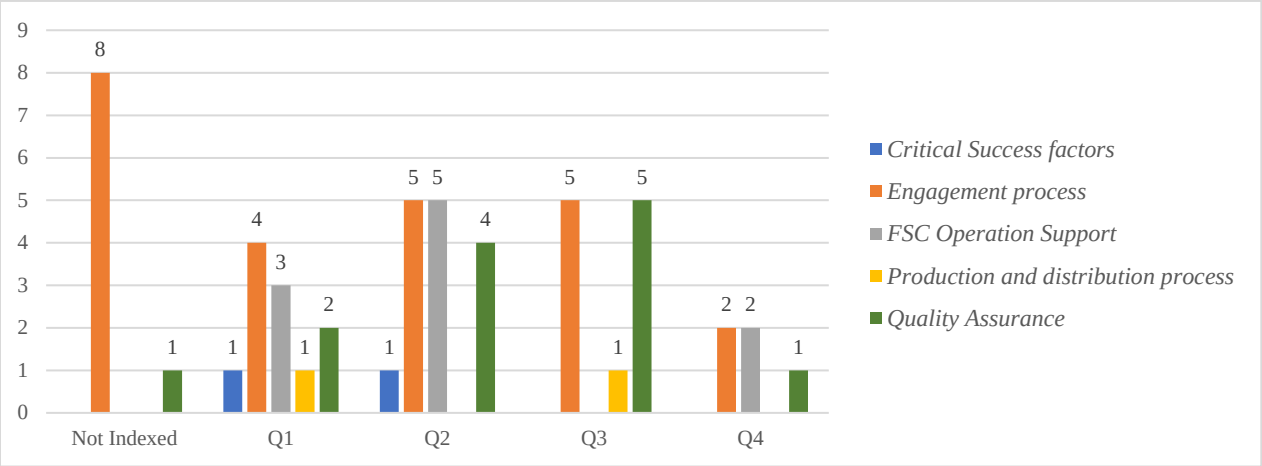

Figure 5. Research Themes Based on Publication Rankings

Figure 5 shows us that articles with Q1 journal publication rankings are still dominated by the engagement process with sub-themes of best application methods, as well as application and adoption. In addition to the engagement process research theme, the Q1 journal publication ranking is also dominated by FSC operation support with the sub-theme Scientific research review, based on this Researchers in various countries are still researching and weighing the benefits, and challenges of implementing blockchain technology In FSC based on data obtained by previous researchers, the discussion of topics with sub-themes of scientific research reviews is still dominated by reviews of application benefits including transparency, traceability, efficiency, and information sharing.

Table 4. Research Theme Based on Research Methodology

No	Research Methodology	Critical Success factors	Engagement process	FSC Operation Support	Production and distribution process	Quality Assurance	Number of Articles
				Conceptual			
1	Conceptual Case Studies	1	22	1	-	10	34
2	Conceptual Literature Review	-	-	9	-	-	9
3	Empirical Interviews	-	-	-	-	1	1
				Empirical			
4	Empirical Survey	1	2	-	1	1	5
5	Empirical Grounded Theory	-	-	-	1	1	2
	Total	2	24	10	2	13	51

Source: Data processed, 2022

Based on the table 5, we can see that the selected journal articles are dominated by articles with a case study conceptual methodology with a total of 34 articles, while the empirical methodology is dominated by an empirical survey with a total of 5 articles.

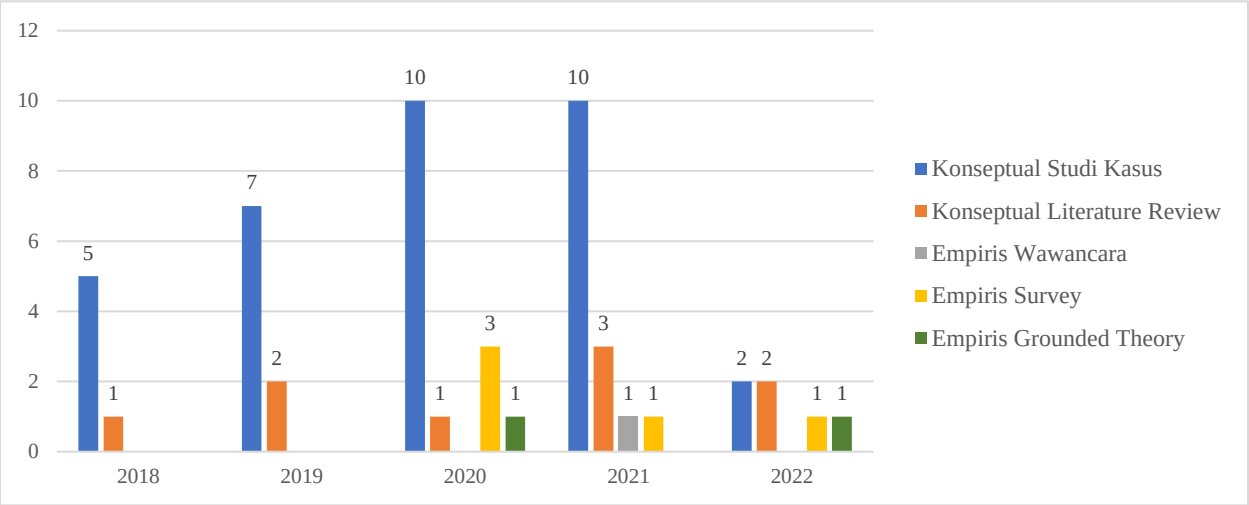

Figure 6. Research Methodology Based on Research Year

The case study conceptual methodology is obtained as the highest type of methodology from 2018-2021, followed by a conceptual literature review.

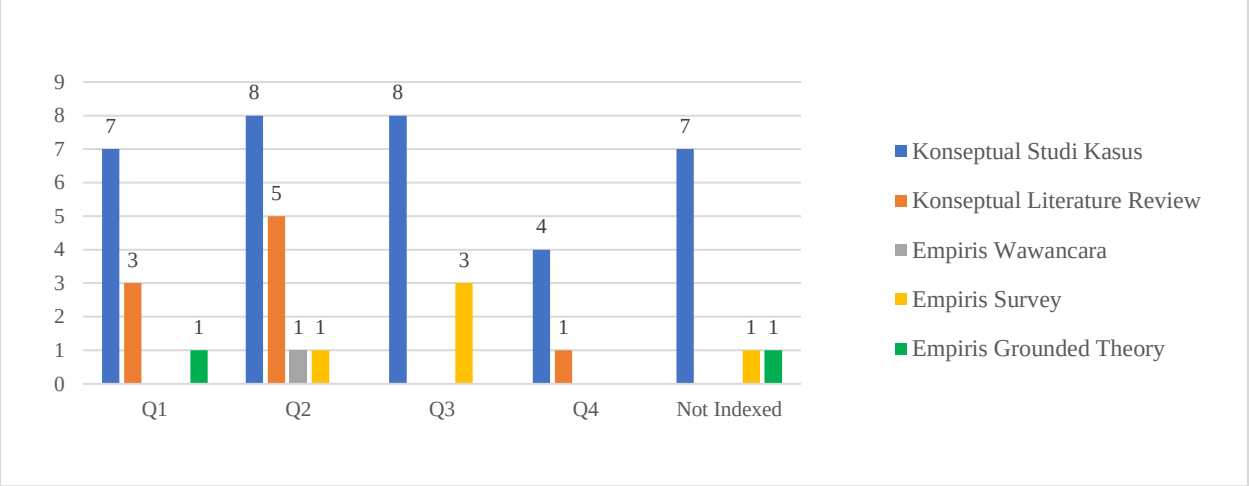

Figure 7. Research Methodology Based on Publication Rankings

From figure 7, it is obtained that *Q2* dominates the publication ranking of each research methodology.

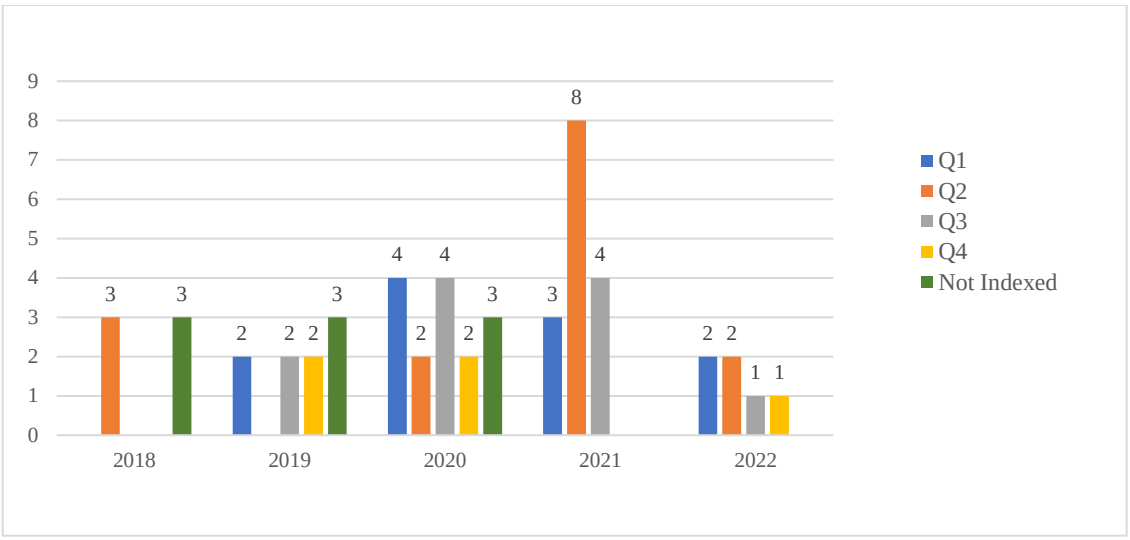

Figure 8. Publication Ranking by Year of Research

Based on Figure 8, the publication rank of *Q1* journals is consistently published from 2019-2022.

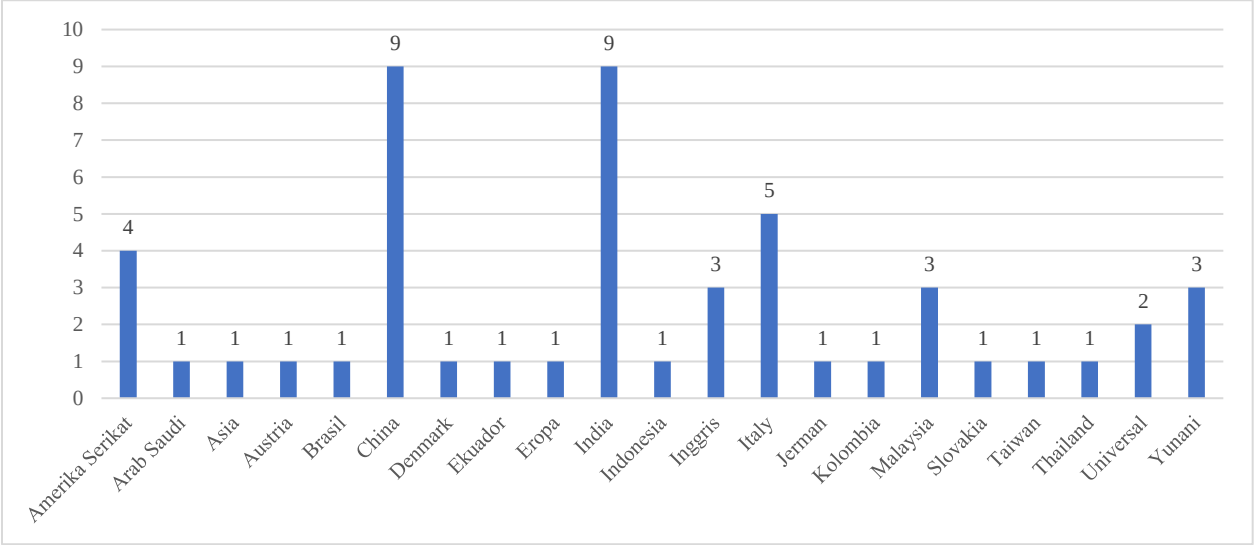

Figure 9. Number of Articles by Research Country

Based on the picture above, China and India topped the highest research countries with 9 (nine) articles each, and Indonesia itself with only one article.

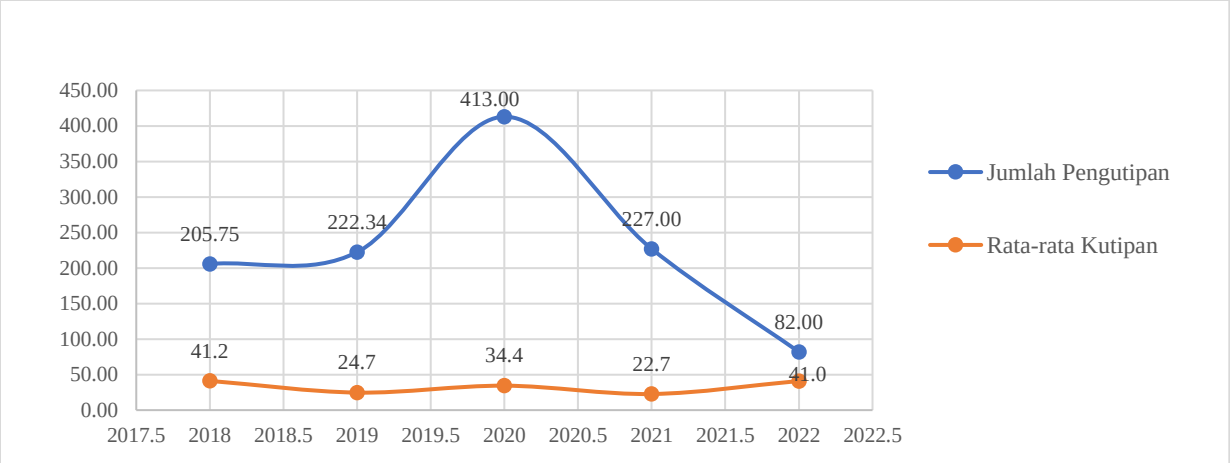

Figure 10. Number and Average of Citations by Year

Based on Figure 10, we can see that the highest number of citations was in 2020 with 413 citations, specifically the number contributed by journals (Bumblauskas et al., 2020) as many as 110 citations per year, but based on the highest average citations obtained in 2018 with an average citation of 41.2, and in 2022 with an average of 41.0 citations.

Table 5. Supply Chain input-process-output flow

Input	Process	Output
Engagement process	Production and Distribution Process	Quality Control Assurance
Critical Success Factor Pre-Implementation	FSC Operation Support	Critical Success Factor Consequences
Engagement Process Benefits: cost efficiency, traceability, time effectiveness, Immutability, Authentication, and Proof of Work (David et al., 2022; Joo & Han, 2021; Santos et al., 2021). Best Practice Methods and Adding Features: Interplanetary File Storage System (IPFS) (Shahid et al., 2020). Electronic Product Code (EPC) (H Huang, X Zhou, 2019) Third-Party Certification (TPC) (Santos et al., 2021). GET query (Kaur et al., 2021).	Production and Distribution Process Process Integrity - Smart Contracts (Rajániová et al., 2020) Value Addition - Label Blockchain on food products that have status Familiar Notes (Treiblmaier & Garaus, 2022).	Quality Control Assurance Evaluation - Credit Evaluation Features (Mao et al., 2018) Blockchain Adoption Impact - Improve capabilities tracking, Transparency, and traceability (Casino et al., 2019; Chan et al., 2019; M Mohan, 2021; Scuderi et al., 2019; Tayal et al., 2021; Zhang et al., 2022)

Input	Process	Output
IoT (RFID) (Mondal et al., 2019) Blockchain Architectures FoodsQRBlock (Dey et al., 2021). FoodTrail (Hayati, 2018). Hyperledger Sawtooth (Baralla, Pinna, et al., 2019). Hyperledger Fabric (Kaur et al., 2021)		
Critical Success Factors Secure FSC with blockchain Revising Regulation Training the Stakeholders (Pawar et al., 2021)	FSC Operation Support Adoption literature review Benefits Security guarantee, Reliability, transparency, traceability, Information Sharingsupporter Decision-making, Food Sustainability and Food Safety (Ali et al., 2021; Bhat et al., 2021; Kramer et al., 2021; Peña et al., 2020; Tsoukas et al., 2022). Security and collaboration between stakeholders (Kayikci et al., 2022) Challenges Storage capacity and size considerations, security leaks, high cost and policy issues, water use management, and sustainability Manufacturing (Zhao et al., 2019)	Critical Success Factor Output Performance There is a positive influence on the application of the technology Blockchain (transparency, traceability, and security) against the level of consumer trust and satisfaction (Joo & Han, 2021).

In the table above, researchers try to represent the results of this research in the input-process-output flow, so it is obtained that in the first flow of **input,** there are two components, namely the engagement process, and critical success factors. The engagement process consists of the benefits of implementing blockchain on

FSC, the best deployment methods and the addition of deployment features, and the deployment architecture proposed by several studies. Critical success factors consist of securing the supply chain with the application of blockchain, revising regulations, and training the stakeholders. **Second,** in the process section, there are two components, namely the production and distribution process, and FSC operation support. The production and distribution process consists of process integrity through smart contracts and value addition. FSC operation support consists of the benefits of applying to the distribution process with the application of blockchain to the FSC and the challenges of implementing blockchain to the FSC process. **Third**, the output section has two components, namely quality control assurance, and critical success factors (Consequences). Quality control assurance consists of evaluation and blockchain adoption impact. The critical success factor (consequences) is the performance output of the application of blockchain technology, namely the level of trust and consumer satisfaction.

After being presented with the flow of inputs, processes, and outputs. Researchers also present data from the perspective of the application of blockchain in the food supply chain, Researchers take this perspective based on empirical combinations of the perspective between the perspective of blockchain and food supply chain on variable operations, then obtained among others as follows:

1. Security perspective. Application of technology Blockchain in the Food supply chain is Considered to be able to improve security, both on the information system side, namely Blockchain itself, and on the safety side of its products (Joo &; Han, 2021; Kayikci et al., 2022; Pawar et al., 2021).
2. Traceability perspective. Benefits of applying technology Blockchain There's also traceability (David et al., 2022; Joo & Han, 2021; Santos et al., 2021), this is one of the important things in the implementation of the Food supply chain where one of the variables indicators is Product recall (traceability) that allows the stakeholders Able to distinguish the origin of these food products, especially when there is a problem with the product.

CONCLUSION

Based on the results of the analysis and discussion of systematic literature review studies with the topic of perspectives on the application of blockchain in the future of the food supply chain, the theme of research discussion based on journal articles that have been selected by researchers is several research themes, including Critical success factors, Engagement process, FSC operation support, Production and distribution process, and Quality assurance. The three research themes with the highest number of article discussions include 24 articles, Quality assurance with 13 articles, and FSC operation support with 10 articles. The publication ranking of the journals that have been selected by researchers obtained as many as 51 articles with the composition of Q1 with a total of 11 articles, Q2 with a total of 15 articles l, Q3 with a total of 11 articles, Q4 with a total of 5 articles, and the last Not Indexed but in relevance Researchers consider the article worthy of review, the journal comes from an international seminar with a total of 9 articles. The research methodology of selected journals is dominated by the conceptual methodology of case studies with a total of 34 articles, and the conceptual methodology of scientific research reviews with a total of 9 articles. The country of origin of research from selected journals is dominated by China and India, with 9 articles each, followed by Italy with 5 articles, while for the United States, 4 articles were obtained, for Indonesia itself only 1 article was obtained. Methods of application of technology Blockchain in Food supply chain In the future, according to selected journals, several methods of application will be obtained, including the use of an interplanetary file storage system (IPFS) (Shahid et al., 2020), third party certification (TCP) (Santos et al., 2021), electronic product code (EPC) combined with radio frequency identification (RFID) (H Huang, X Zhou, 2019). Some of the deployment architectures offered by selected journals in the future include Hyperledger Fabric (Kaur et al., 2021), Hyuperledger Sawtooth (Baralla, Pinna, et al., 2019), Kranti (Patel et al., 2021), FoodTrail (Hayati &; Nugraha, 2018), Ethereum (M Mohan, 2021)and FoodsQRBlock (Dey et al., 2021). Research sectors that still need to be researched in the future

based on research themes that have a relatively low number include the Critical Success Factor with the topic of research on supply chain barriers (food), and Output performance, as well as on the research theme Production and Distribution Process with topics of discussion of process integrity, and value addition.

Based on the results of research that has been conducted by researchers with systematic literature review studies on the topic of perspectives on the application of blockchain in food supply chains, researchers seek to provide suggestions as research considerations in the future, including the following:

1. Research themes with the topic of blockchain application in FSC that still need to be improved include Production and distribution process, and Critical success factors. Researchers in the future can also add other categories in their research such as blockchain transition in food supply chain with empirical curves (similarity of connecting indicators), addition of correlation tests and relationship tests with causal loop diagram models, adding specifications of food supply chain variables with the perspective of Hazard Analysis and Critical Control Points (HACCP) and Halal food supply chain, and respondents' testing of blockchain technology perspectives on supply chains in general. Future systematic literature review research also needs to pay attention to keywords that are not too abstract (specific) including food supply chain, halal food supply chain, green supply chain, and HACCP food supply chain. Based on the results of journal identification in this study, the researcher recommends increasing research with the Empirical survey method by targeting operational practitioners in Indonesia towards the application of blockchain technology in the supply chain that is adaptable to the latest conditions in the field.
2. Companies and future research can further review how the best methods of applying blockchain technology in the food supply chain, especially in Indonesia, are easily adapted by considering costs, human resource capabilities, system safety levels, food safety, and environmental friendliness. Review blockchain architectures such as FoodTrail published by the Bandung Institute of Technology research institute if applied to existing industries in the country. The government can also encourage research and facilitate regulations related to supply chain system integration in Indonesia. Increasing research on the topic of the application of blockchain technology in the food supply chain or supply chain can also provide knowledge for parties including companies, and the public in general about the benefits of applying the technology.
3. Future research needs to review the research sector related to the supply chain bottlenecks of blockchain technology in the food supply chain that are adapted to existing conditions in Indonesia, as well as review integrated production and distribution models by applying blockchain technology in the supply chain in general and specifically.

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