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Trends of Research on Product Quality Model in Sustainable Supply Chain of Automotive Component Industry: Bibliometric Analysis

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ABSTRACT

Product quality is a crucial factor that must be maintained throughout the automotive component supply chain. Previous research has generally examined quality management, sustainable supply chain management (SSCM), and digital technologies in the automotive industry, but these topics are still discussed separately. This study aims to map research trends, influential publications, keyword relationships, research gaps, and future research directions related to supply chain quality models in the automotive component industry. A Systematic Literature Review (SLR) combined with bibliometric analysis was conducted using PRISMA-based screening, VOSviewer and R-based bibliometric tools. The results show that publication activity has increased rapidly and is the highest in 2023. Key analysis shows a shift from conventional quality management to digital nutu management supported by Lean-Industry 4.0 integration, Blockchain-based traceability, and sustainable supply chains. The research gap lies in the absence of an integration model that links quality management, SSCM, and printed technology in the automotive supply chain. The main contribution of this research is to map the relationship between these dimensions and clarify the role of strategy in supporting product quality, supply chain sustainability, and digital technology. In addition, this research provides the basis for further research to develop and validate an integrated framework for quality management in sustainable automotive supply chains and supported by digital technology.

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1. Introduction

The automotive industry is a strategic sector that contributes significantly to the economy and industrial competitiveness of a nation. In Indonesia, the motorcycle industry plays an important role because motorcycles are the dominant mode of transportation. Based on data from BPS (Badan Pusat Statistik) the number of motorcycles reached 133.051.310 units in 2023, representing around 83.61% of the total number of vehicles in Indonesia (Statistik, 2023). AISI (Asosiasi Industri Sepeda Motor Indonesia) also reported that domestic motorcycle sales reached 6.236.992 units in 2023. This figure increased by 19.44% compared to the previous year.

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In 2022, motorcycle sales reached 5.221.470 units (AISI, 2023). From this data, it shows the high demand for motorcycles and the increasing importance of a reliable, efficient, and quality automotive component supply chain. The growth of the automotive industry has driven the need for product quality models that are able to answer the complexity of modern supply chains. However, before product quality models are developed in the automotive industry in Indonesia, it is necessary to map global research trends. This mapping is important to understand the development of publications, dominant themes, relationships between themes, and research gaps. Therefore, bibliometric analysis is the approach used to identify how product quality, Substantiable Supply Chain Management, digital technology, Industry 4.0 has developed in the international literature (Kurnia et al., 2025). The automotive component supply chain creates increasing challenges in managing product quality, supplier reliability, and component traceability (Heldt & Pikuleva, 2025). Automotive manufacturers rely on suppliers to provide high-quality and timely materials. Therefore, strong supplier relationships and effective quality control are essential to maintain product quality (Imansuri et al., 2024; Nur Janah et al., 2024; Rahmawati & Maharani, 2023; Tronnebati et al., 2024). Valdez-de la Rosa et al. (2021) emphasizes that cost reduction and quality maintenance in the automotive component industry depend on the functional capabilities of component suppliers. This condition shows the high growth of the automotive industry in Indonesia which demands a reliable, efficient, quality, and sustainable supply chain.

Product quality is a factor in the long-term sustainability of the business because competition is determined by product value, safety, reliability, and conformity to specifications, not just by cost. Quality control is necessary to ensure that the production process goes as planned, meets product specifications, and provides opportunities for continuous improvement (Escobar et al., 2022; Maganga & Taifa, 2023). However, product quality in the supply chain is often limited by limited, limited, and uncertain information regarding the origin of the condition, and movement of components (Yu & Huo, 2018). This challenge is particularly relevant in the automotive components industry, where product quality must be maintained from the incoming raw materials and production process to the product that comes out and is used by customers.

At the same time, the automotive supply chain is being reshaped by sustainability requirements and digital transformation. Sustainable supply chain management (SSCM) encourages companies to manage the flow of materials, information, and finances by considering the economic, environmental, and social (Yueyang Liu & Jiang, 2025; Shokouhyar et al., 2019). Industry 4.0 Technologies, including digital platforms, data analytics, and blockchain, offering new opportunities to improve transparency, traceability, and decision-making in quality management (Duong et al., 2026; Fitriana et al., 2020; Sheel & Nath, 2019). Previous studies have shown that improving quality systems supported by digital technology and considering sustainability can improve product quality and supply chain performance.

However, several research gaps remain. Theoretically, the relationships among product quality, sustainable supply chain management (SSCM), and digital technologies in the automotive component supply chain have not yet been fully established. Methodologically, previous studies have primarily employed case studies, conceptual analyses, or empirical approaches, whereas bibliometric analyses of publication trends, influential articles, keyword co-occurrence, and thematic evolution remain limited. Empirically, studies focusing on the automotive component industry, particularly the motorcycle component sector in Indonesia, are also scarce. These gaps highlight the need for a bibliometric analysis to synthesize existing knowledge, clarify the intellectual structure of the field, and identify emerging research directions for the development of product quality models within sustainable automotive supply chains.

Several research gaps can be identified in the existing literature. Theoretically, previous studies have not yet established a clear conceptual relationship among product quality, sustainable supply chain management (SSCM), and digital technologies in the automotive component supply chain. Methodologically, much of the existing research has relied on case studies, conceptual analyses, or empirical investigations, while systematic bibliometric mapping of publication trends, influential

publications, keyword co-occurrence networks, and thematic evolution remains limited. Empirically, studies focusing specifically on the automotive component industry, particularly motorcycle components in Indonesia, remain scarce. These gaps highlight the need for a bibliometric analysis to synthesize existing knowledge, clarify the intellectual structure of the field, and identify future research directions. Accordingly, this study aims to conduct a systematic literature review (SLR) and bibliometric analysis of research on product quality models in sustainable automotive supply chains. The analysis examines publication trends, highly cited and influential articles, keyword co-occurrence networks, research gaps, and future research directions. This approach extends beyond descriptive reviews by examining the relationships among quality management, SSCM, Industry 4.0, blockchain technology, and supply chain performance within the existing body of knowledge.

The novelty of this study lies in its integrated mapping of the relationships among quality management, SSCM, and digital technologies in the automotive component industry. Unlike previous bibliometric studies that have tended to examine sustainability, supply chain management, Industry 4.0, or quality management as separate research domains, this study brings these domains together to highlight the need for an integrated product quality framework. This research makes three main contributions: (1) identifying the thematic structure of the existing literature; (2) clarifying theoretical, methodological, and empirical research gaps; and (3) proposing future research directions for developing integrated product quality models that support sustainability, digital traceability, and supply chain performance in the automotive component industry.

The remainder of this article is organized as follows. The Introduction presents the research background, rationale, research gaps, objectives, novelty, and contributions. The Methods section describes the procedures used for the systematic literature review and bibliometric analysis. The Results and Discussion section presents the bibliometric findings, including publication trends, influential articles, keyword co-occurrence networks, thematic evolution, and relationships among key concepts such as product quality, SSCM, and digital technologies. Finally, the Conclusion section summarizes the main findings, research contributions, limitations, and recommendations for future research.

2. Method

The methods used in this study are Systematic Literature Review (SLR) and Bibliometric analysis. The steps in this study are to formulate a research question, search the literature for a systematic review, select appropriate and relevant research articles, analyze the findings of those qualitative articles, and finally compile or create a research report (Gohoungodji, 2024; Kovaitė et al., 2022; Nur Janah et al., 2024). The stages of this research are shown in Fig. 1.

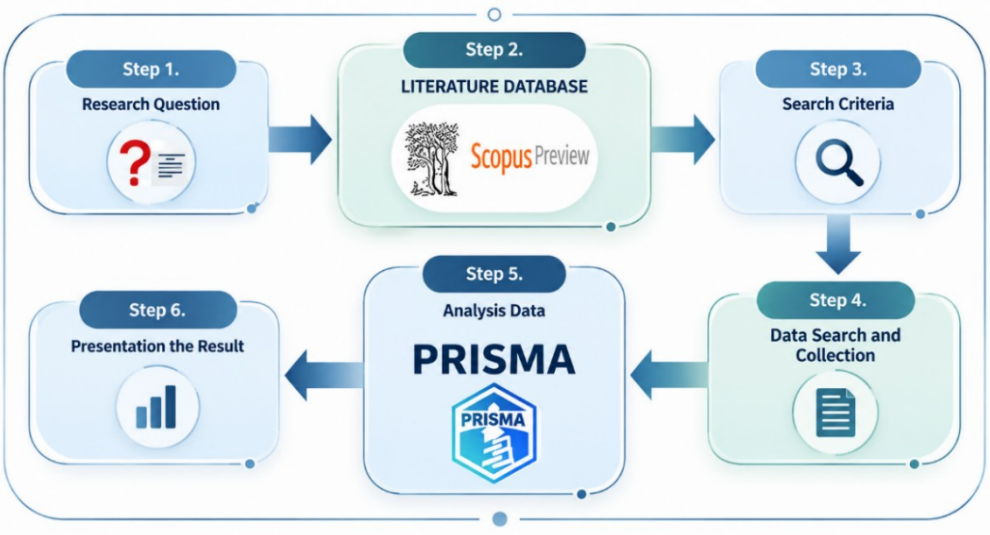


Fig. 1. Research Flow

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Step 1. Research questions. To achieve the objectives of this research, there are 4 research questions.

1. RQ1: What are the output trends and publications of product quality in the automotive component industry?
2. RQ2: Which authors and journals are most prolific in product quality in the automotive components industry?
3. RQ3: What are some keywords or themes that often appear in product quality research in the automotive component industry?
4. RQ4: What are the gaps and prospects for future research on product quality in the automotive components industry supply chain?

Step 2. Literature database. The study collected scientific literature data from Scopus because Scopus is one of the largest multidisciplinary databases of abstracts and citations, which includes peer-reviewed journals, conference proceedings, and scientific publications. Scopus was chosen because it provides comprehensive bibliographic metadata, stamp information, author affiliations, keywords, and publication details suitable for bibliometric analysis. Additionally, Scopus implements strict indexing standards, which help ensure the quality and reliability of the articles included in the analysis. Therefore, the use of Scopus is considered appropriate to obtain relevant and high-quality literature related to product quality, supply chain, sustainability, Industry 4.0, and the automotive industry.

Step 3. Search Criteria. This paper analyzes the scientific literature on product quality search criteria using the keywords ("product quality" OR quality control") AND ("Supply chain OR "SCM") AND ("automotive industry") AND ("sustainability" OR "Industry 4.0"). Step 4. Search and data collection. The search and data collection were carried out during the period 2018 to 2024. Based on the results of the literature database, 535 articles were obtained that matched the keywords.

Step 5. Data analysis. The selected articles were analyzed using VOS viewer and RStudio through bibliometric. PRISMA is used to transparently document the screening process, while bibliometric analysis is used to reveal the intellectual and thematic structure of the literature. Several bibliometric indicators were examined. Annual scientific production is used to identify publication trends over time. Citation analysis is used to determine influential articles and sources based on the number of global citations. Co-occurrence analysis is used to identify frequently occurring keywords and their relationships, thus indicating the conceptual structure of the field. Thematic mapping is used to classify themes based on their density and centrality, indicating whether a theme is motor, basic, emerging, or decreasing. Collaborative network analysis is used to examine the relationship between authors, institutions, and countries. Additional analyses, including the most relevant affiliations, the countries of the related authors, the three-plane plot, the tree map, and the co-emergence network, were used to strengthen the interpretation and identify research gaps. Step 6. Presentation of Results. The results of detailed data analysis including the identification of gaps from previous research are presented to answer the research objectives.

3. Results and Discussion

3.1. PRISMA

Bibliometric analysis is carried out using relevant references. The search tool generates data consisting of worldwide research published in leading journals, and Vos's viewer is used to visualize selected publications. The initial phase follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analysis) method which consists of three stages. Fig. 2 shows the flow of the stages of the PRISMA process in the study. The literature selection process in this study follows the PRISMA guidelines to ensure transparency, consistency, and replicability in the identification and selection of relevant studies. The initial stage involves searching for the selected database using a combination of keywords. Through this process, a total of 535 articles were initially identified as potentially relevant to the research topic. The next step involves the initial screening stage, where

duplicate records and articles that are not directly related to the focus of the research are removed through the evaluation of their titles and abstracts. After this initial screening process, the number of articles that met the initial criteria was reduced to 312 articles.

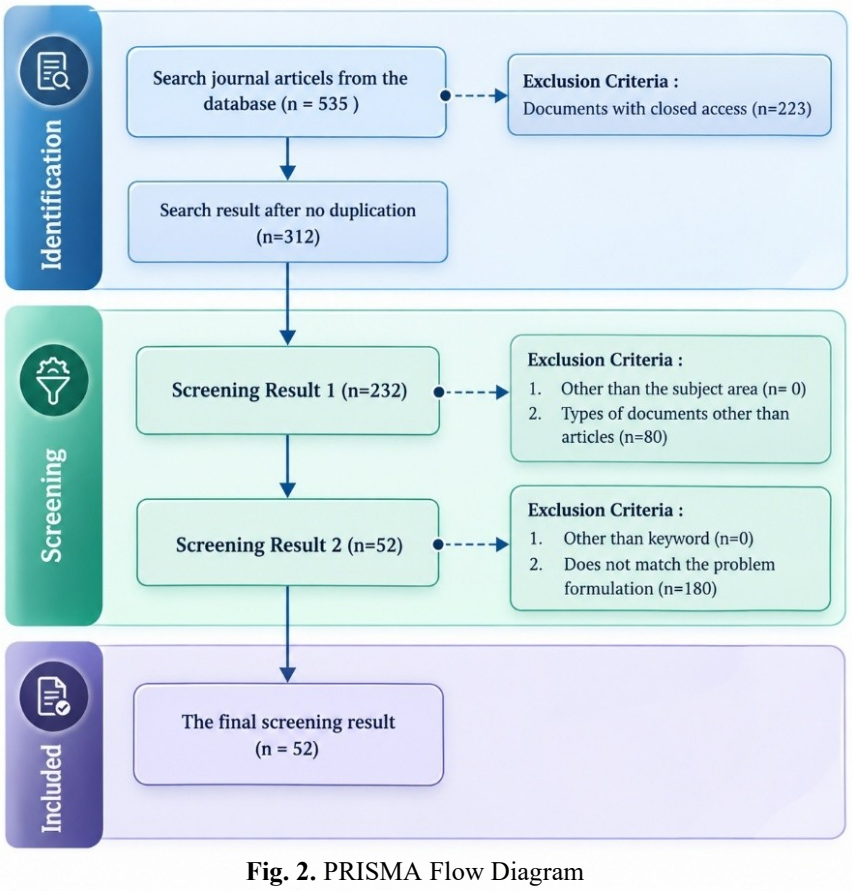


Fig. 2. PRISMA Flow Diagram

Furthermore, a full-text assessment was carried out to evaluate the suitability of each article in relation to the research objectives. At this stage, several inclusion criteria are applied. Articles are retained if they discuss product quality, supply chain management, sustainability, or digital technologies in an industry context, are published in peer-reviewed academic journals, are written in English, and are published within a predetermined research time frame.

Instead, certain articles are excluded based on pre-defined exclusion criteria. Studies that are not directly related to product quality or supply chain context are removed from further analysis. In addition, documents such as conference proceedings, book chapters, editorials, and other non-peer-reviewed publications are excluded. Articles with incomplete bibliographic information or whose full text is not accessible are also omitted. In addition, studies that do not contribute to the conceptual discussion of quality models in the supply chain are not included in the final analysis. After systematically applying all stages of selection and criteria, 52 articles were identified as the most relevant and suitable for research. These articles are then used as the primary source for the bibliometric analysis and thematic analysis conducted in this study.

3.2. Bibliometric Analysis

3.2.1. Publication Trends

The results of the screening from the PRISMA stage produced 52 selected articles which were the results of research from 2018-2024. However, research that addresses this issue has only begun to emerge since 2019. Based on the Fig. 3, the number of publications increased from 2 articles in 2019 to 6 articles in 2020, then increased sharply in 2022 and reached a peak in 2023 as many as 21 publications.

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The increase in publications shows that the issue of product quality in the automotive supply chain is increasingly receiving academic and industry attention. This is in line with the increasing complexity of the automotive supply chain, the need for quality control in the supply chain, and the industry's demands to produce quality, efficient, and traceable products. In addition, the development of Industry 4.0 has also encouraged the growth of research because digital technologies such as the Internet of Things, big data analytics, blockchain, and integrated information systems are starting to be widely used to support traceability, transparency, and data-based decision-making in quality management.

The trend of increasing publications is also related to the growing global attention to sustainability. The automotive industry is not only required to improve product quality, but also reduce environmental impact, increase resource efficiency, and pay attention to social aspects in the supply chain. These results suggest a shift in the focus of research from quality control to a broader one, namely the integration between quality management, SSCM, and digital technology The decrease in the number of publications in 2024 to 5 articles cannot be directly interpreted as a decrease in research interest. The decline is likely influenced by limited data because in 2024 it has not been fully completed or before all articles are indexed at the time of data collection. Overall, the trend of these publications shows that research is evolving from a traditional quality control focus towards a more integrated, sustainable, and digital-transformation-based supply chain quality model in the automotive industry.

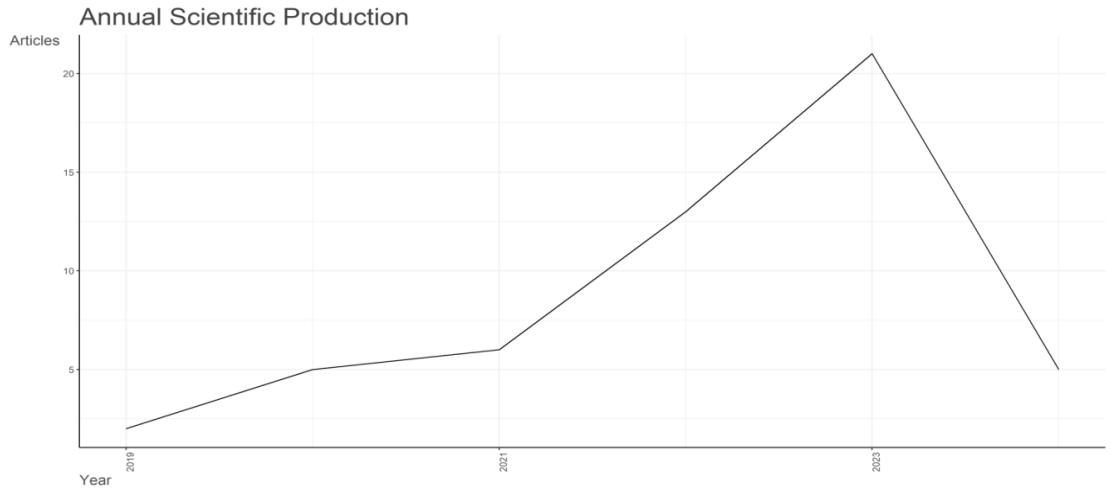


Fig. 3. Annual Scientific Production

3.3. Analysis of the most cited and influential articles

The analysis showed that the most cited article Abbasi et al. (2023) is published by Springer Science and Business Media Deutschland GmbH with a total of 142 citations. This study presents a mathematical model used in the automotive industry supply chain in Iran during the COVID-19 pandemic. The suggested model can explain the trade-off between environmental (minimizing CO2 emissions) and economic (minimizing total costs) aspects during the COVID-19 outbreak. Considering the guidelines for hygiene during the outbreak helps us design a new sustainable hygiene supply chain (SC). This model considers the cost structure. The findings of the proposed network illustrate that SC has become greener during the COVID-19 pandemic. Total network costs increased during the COVID-19 pandemic, but geofencing had a direct positive impact on emissions and air quality. The second order of article with the most citations is by Ciliberto et al. (2021) with 141 citations. The article, published in the journal Business Strategy and Environment, contributes to the field of manufacturing by recognizing the important role of lean implementation, the application of Industry 4.0 technology, and sustainability in company development.

The third most cited article published by the Sustainability journal revealed that most dimensions of the digital supply chain have a positive impact on lean manufacturing, except those digital suppliers and digital client have no effect on lean manufacturing in the Electronics Industry in Jordan. The 4th most cited article is Treiblmaier & Garaus (2023) with 128 citations published in the International Journal of Information Management journal with research results explaining the role of applying digital technology in the form of blockchain in the food industry. The fifth article is Nayak & Dhaigude (2019) published in Cogent Economics & Finance with 77 citations. In this article, the authors designed a conceptual model of sustainable supply chain management (SSCM) in small and medium enterprises (SMEs) in India using blockchain technology. The study identifies the factors influencing the adoption of SSCM in SMEs and examines the relationships among these factors. The results of the analysis of articles published from 2019-2023 have been widely cited (Fig. 4). This shows that research in this field is growing rapidly.

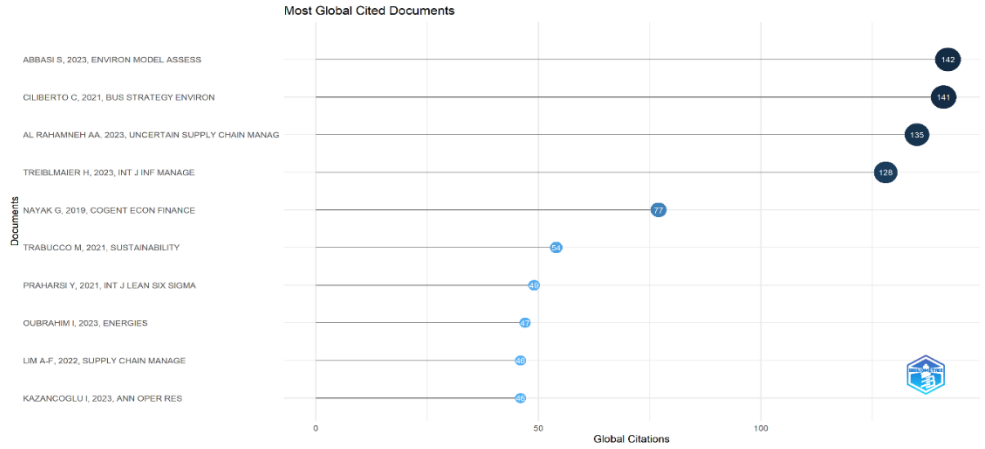


Fig. 4. Most Global Cited Document

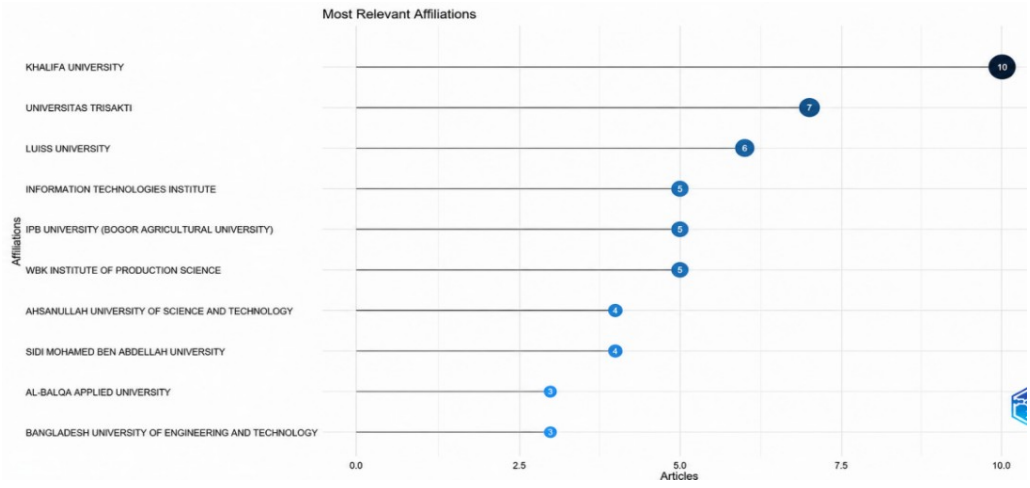


Fig. 5. Most Relevant Affiliations

Research on product quality models has been conducted by various institutions and countries as shown in the Fig. 5. The most productive institutions are Khalifa University (10), followed by Trisakti University (7), then Luiss University (6), Institute of Information Technology (5), IPB University (Bogor Agricultural University) (5), WBK Production Science Institute (5), Ahanullah University of Science and Technology (4), SIDI Mohamed Ben Abdellah University (4), Al-Balqa Applied University (3), Bangladesh University of Engineering and Technology (3). A total of 123 universities from 35 countries have contributed to quality control research, showing that this research topic has a global reach. China and India are the most productive countries, followed by Italy, Indonesia, Poland, Austria, Germany, Malaysia, the Netherlands, the United Arab Emirates, etc. (Fig. 6).

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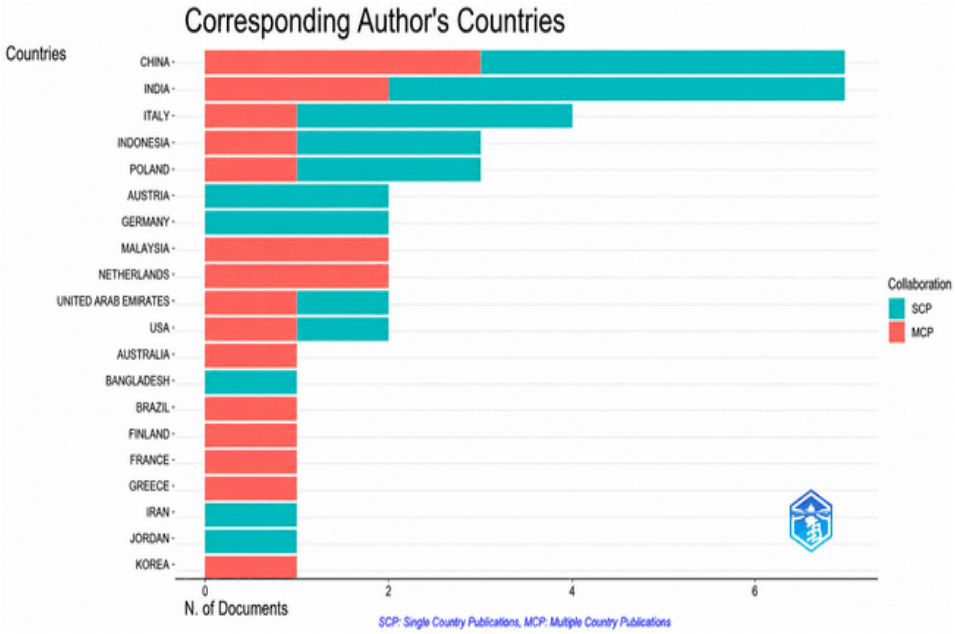


Fig. 6. Corresponding Author' Countries

Fig. 7 describes the author flow, country, and search topic/keyword. This chart provides information on the most prolific authors for each country and the top topics for each country. The left side of the image shows the relationship between the author and the country. Each country has a dominant field of research. Countries like the United Arab Emirates are more focused on Industry 4.0 or Supply Chain Management, China seems to be more prominent in Lean Manufacturing and Circular Economy. Countries in Europe such as Germany and Italy tend to be involved in Quality Control and Blockchain Technology. India is associated with topics such as Lean Six Sigma and the automotive industry, which reflects the country's role as a global manufacturing hub. These trends can reflect local or national priorities driven by each country's industry needs. Certain authors seem to have expertise in certain areas such as Antony J who is connected to various topics such as Lean Manufacturing and the automotive industry that are relevant to the development of operational efficiency. Al-Hawary SIS has a focus on areas such as Artificial Intelligence or Resilience, which are part of innovation in the modern era.

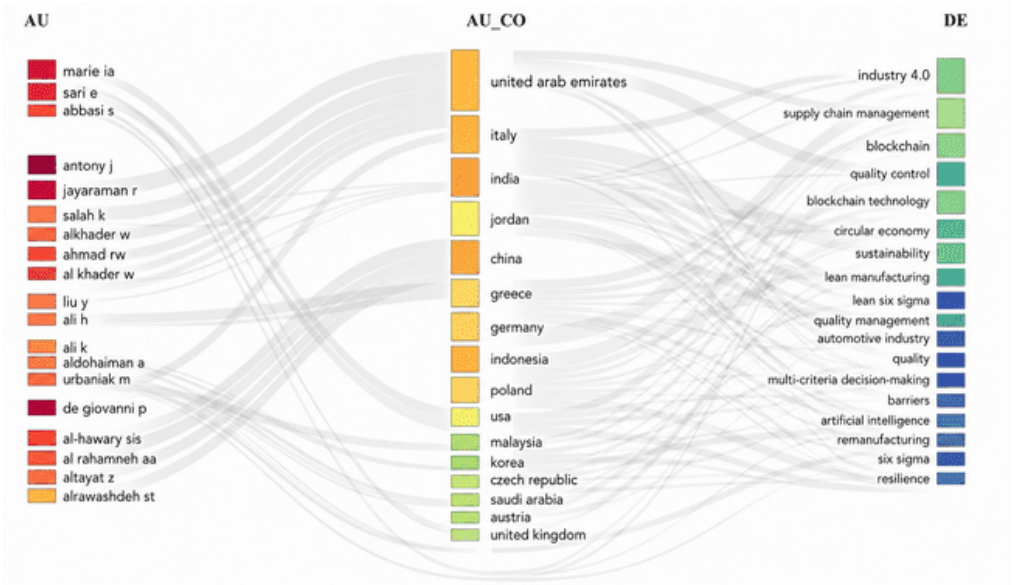


Fig. 7. Three-Field Plot

3.3.1. Keyword Analysis

The total number of keywords identified in the 52 published articles was 50 keywords. Based on the Fig. 8, the most frequently cited keywords are supply chain management as many as 16 emergences, Blockchain 9 emergences, Supply Chain 9 emergences, Sustainable development 8 emergences, quality control 7 emergences, sustainability 6 emergences, automotive industry 4 emergences. These findings show that research on product quality in the automotive industry is no longer just focused on internal quality control, but has evolved towards quality management in the context of the broader supply chain.

The relationship between quality control, quality management, and supply chain management shows that product quality is understood as the result of coordination between supply chain actors, from raw material suppliers, production processes, to distribution. Thus, quality management evolved from a technical-operational approach to supply chain quality management that emphasizes collaboration, integration, information, and consistency of processes between organizations. The emergence of keywords such as blockchain, blockchain technology, digital manufacturing, and industry 4.0 shows that the theme of quality management is starting to move towards digitalization. Digital technology is instrumental in improving the transparency, traceability, and accuracy of quality data, so that quality control no longer relies solely on final inspections, but also on data-driven monitoring along the supply chain. In addition, the keywords sustainable development, sustainability, circular economy, and energy efficiency show that product quality is increasingly associated with sustainability. Quality is not only understood as conformity to specifications, but also as the company's ability to produce products that are efficient, environmentally friendly, and socially responsible.

Fig. 9 shows that the development of keywords over time leads to the strengthening of blockchain themes, supply chain management, and sustainable development. This confirms that there is a shift in the global research focus from traditional quality control to a quality management system that is integrated with digitalization and sustainability. The relative decline in the term quality control does not indicate that quality has become less important, but it does indicate that approaches to quality have evolved. Quality is now more discussed through broader concepts, such as supply chain management, industry 4.0, blockchain, and sustainability.

Conceptually, the relationship between keywords shows the existence of three main directions of research development. First, quality management is at the core in ensuring the consistency and reliability of automotive products. Second, sustainability expands the scope of quality to include economic, environmental, and social dimensions. Third, traceability, and data-based decision-making in the supply chain. Therefore, the results of the keyword analysis show that the development of the quality management theme is moving towards a more integrated model, which combines quality management, Sustainable Supply Chain Management, and digital technology in the context of the modern automotive supply chain.

Fig. 10 shows the strength of the relationship between keywords. Each relationship describes the relationship between two keywords (for example, two keywords are considered to be quoted together when they appear together in the same subsequent manuscript). The size of the node reflects the frequency of the keyword. The larger the size of the node, the higher the frequency of the keyword. The meaning of the Main Node 'Supply Chain Management' is the largest, suggesting that this is a central theme. All other topics are directly or indirectly related to it. The color of the nodes indicates the grouping of the theme. For example, green nodes (Digitalization and Technology Innovation), are made up of blockchain keywords, smart contracts, IoT, and quality assurance. Technology plays a crucial role in transforming supply chains to be more transparent, efficient, and automated. Blockchain, for example, promises solutions for product tracking and error reduction. The red color (Sustainability and Decision Making) with the keyword’s sustainability, environmental economics, and decision-making, indicates a high interest in the environmental and sustainability impacts of supply chain management, including how decision-making affects efficiency and sustainability.

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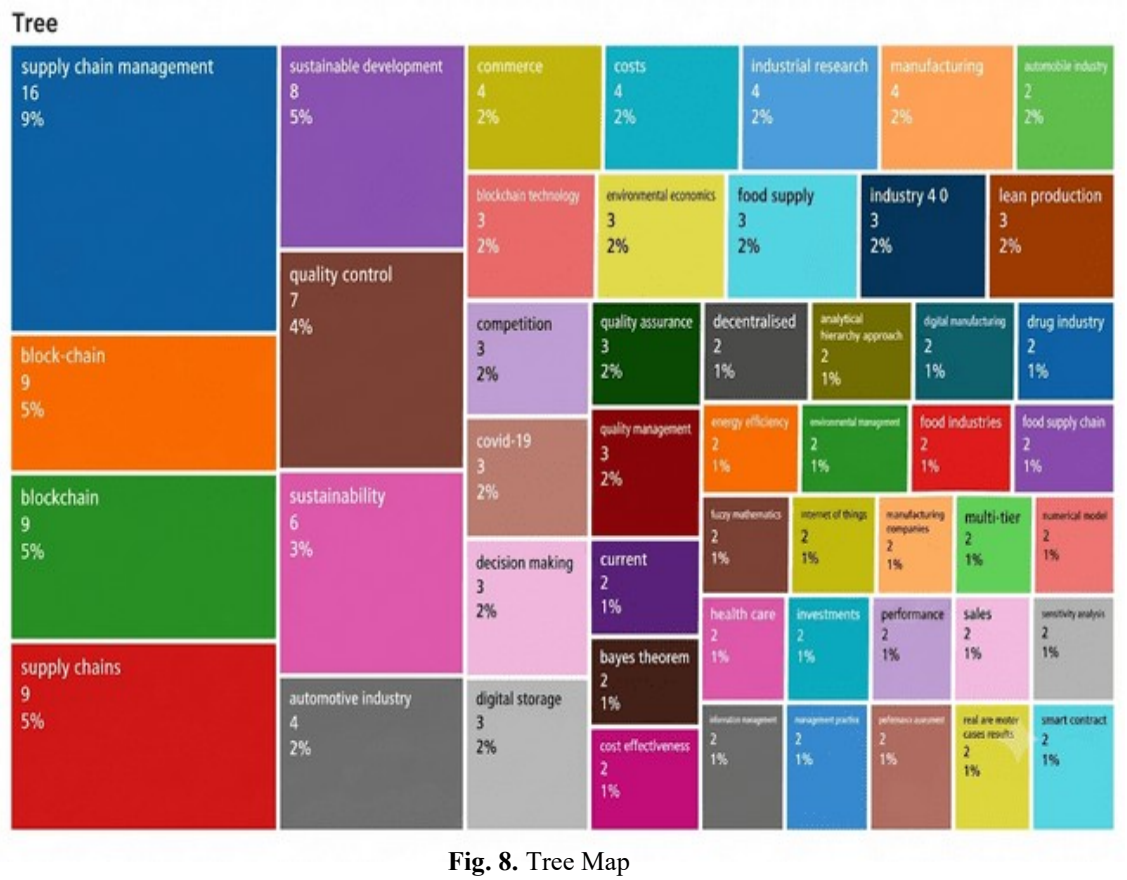


Fig. 8. Tree Map

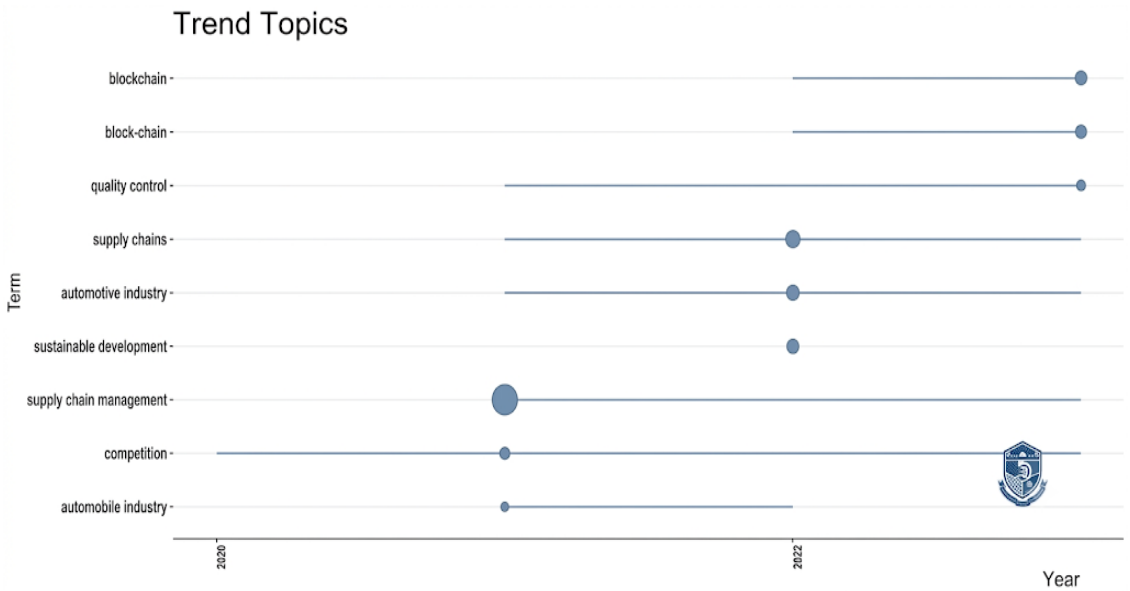


Fig. 9. Trend of Topics

The purple cluster (Efficiency, Quality, and Industry) includes keywords such as quality management, digital storage, and cost. The blue color (Manufacturing and SMEs), which consists of keywords such as manufacturing, small and medium enterprises (SMEs), highlights the focus on the manufacturing industry, especially in the SME sector, which often faces challenges in implementing advanced technologies such as blockchain or IoT. It can be concluded that the parameters of the quality model in this study consist of 4 main aspects, namely quality, sustainability, SCM, and

blockchain/digital technology. These four parameters show that the development of quality models does not only focus on product quality control, but also includes supply chain integration, the application of sustainability principles, and the use of digital technology to increase transparency and traceability. Thus, the resulting quality model is directed to support a more effective, adaptive, and sustainable automotive supply chain.

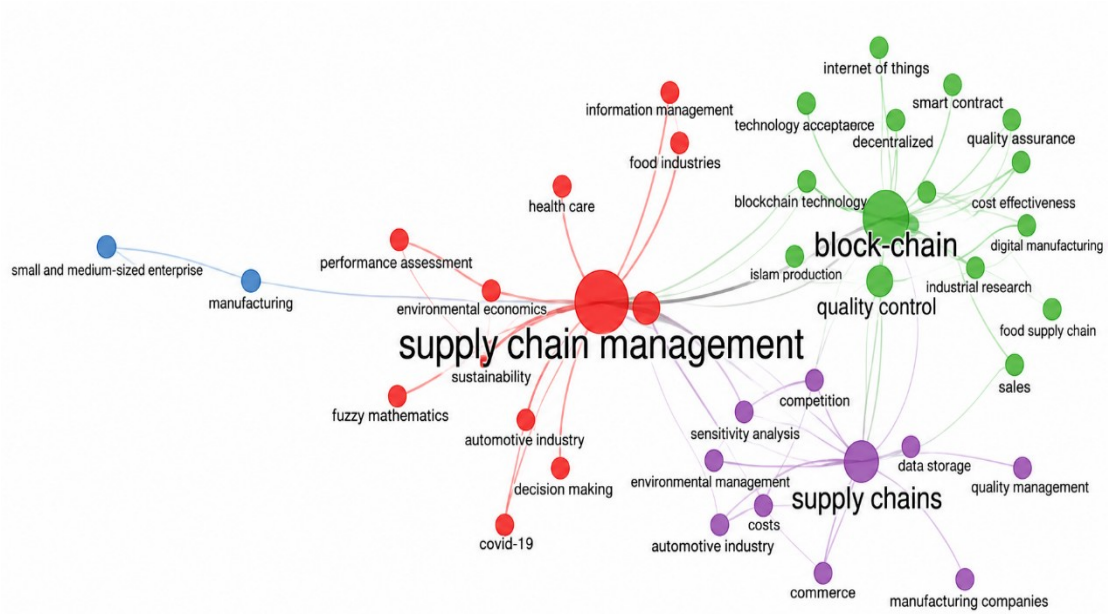


Fig. 10. Co-Occurrence Network

3.4. Quality and Industry 4.0

The development of Industry 4.0 has changed the quality management approach from traditional quality control systems to a more digital, integrated, and data-driven quality system. Conventional quality management, such as Statistical Process Control (SPC), Total Quality Management (TQM), and Six Sigma, remains an important foundation in process control. However, such approaches have limitations in responding to the complexity of modern production, the variation of customer needs, and the need for quick and accurate decision-making (Kannan & Garad, 2020). The integration of Industry 4.0 with quality management is known as Quality 4.0 (Sony et al., 2020). Quality 4.0 is emerging as a quality management development that utilizes digital technologies such as the Industrial Internet of Things (IioT), big data, artificial intelligence, RFID, sensors, and blockchain (Maganga & Taifa, 2023).

The first theme that stands out in Quality 4.0 is the integration of digital technology into the quality management system. Digital technology in companies connects data from suppliers, production processes, distribution, customers in one transparent information system (Sharma & Joshi, 2023; Treiblmaier & Garaus, 2023). In the context of the automotive industry, this integration is important because the quality of the product is influenced by many factors in the supply chain. Like blockchain, it can be used to record the history of raw materials, production processes, inspection results, and distribution in a secure and transparent manner (Ahmad et al., 2023; Burgess et al., 2022; Yang Liu & Shen, 2020). Thus, digital technology not only serves as an operational support tool, but also as a mechanism to strengthen coordination, accountability, and quality traceability along the supply chain (Ramkumar et al., 2022; Van et al., 2024). The second theme is real-time quality monitoring. The company's use of sensors, RFID, big data analytics, and machine learning to detect process irregularities, product defects, and quality risks early. This approach differs from traditional quality systems that tend to be reactive once defects are discovered. Through real-time monitoring, companies can take corrective action faster, reduce waste, and support the achievement of Zero-Defect Manufacturing (Duan & Yan, 2020; Leontaris et al., 2023).

In the automotive industry, this is especially important because defects in a single component can affect the overall assembly process, quality cost, and customer satisfaction (Escobar et al., 2022; Van Nguyen et al., 2024; Westphal et al., 2023). The third theme is quality management by considering sustainability factors. The implementation of Quality 4.0 is not only directed at reducing product defects, but also at improving resource efficiency, reducing waste, reducing quality failure costs, and improving environmental and social performance (Ahmad et al., 2023). The integration of Lean Six Sigma with digital technologies shows that quality recall can go hand in hand with reducing waste and strengthening supply chain sustainability (Duan & Yan, 2020; Praharsi et al., 2021). Thus, quality in the industry 4.0 era is no longer only interpreted as the conformity of products to specifications, but also as the ability of production systems and supply chains to create value in a sustainable manner (Asha et al., 2023; Sharma & Joshi, 2023).

Based on this integration, the relationship between quality and Industry 4.0 can be interpreted as a conceptual framework that complements each other. Digital technology is used as a tool to increase transparency and traceability, real-time monitoring plays a role in accelerating quality detection and control, while sustainability is a strategic direction in developing a modern quality system (Lim et al., 2022). Therefore, Quality 4.0 needs to be placed as an integration between quality management, digital transformation, and supply chain sustainability. This approach is relevant for the automotive component industry that requires a quality system that is adaptive, efficient, transparent, and able to support long-term competitiveness (Ali et al., 2022; AlKhader et al., 2023; Sony et al., 2020).

3.5. Quality and Supply Chain Management

Supply chain management (SCM) is defined as the systematic strategic coordination between traditional business and cross-functional approaches within a company and across companies in the supply chain to improve the performance of the company and the supply chain in the long term (Van Nguyen et al., 2024). In that context, the integration of quality management philosophy in SCM facilitates internal relationships within the company and improves interconnection across supply chain networks called SCQM (Supply Chain Quality Management) (Lim et al., 2024). Parast (2019) considers SCQM to be the integration and coordination of operational processes that involve all stakeholders in the channel in analyzing and improving their processes, products, and services to generate value and customer satisfaction. SCQM aims to help companies optimize operations while deepening their supply chain integration, cooperation, and collaboration beyond the company's boundaries. In addition, there have been various studies on the practice of SCQM activities that identify the key characteristics of the structure and assess the impact of SCQM on business performance (Bui et al., 2025).

SCQM shows that product quality is not only determined by the internal production process, but is also influenced by material quality, supplier reliability, communication between partners, and the ability of the supply chain to manage quality information in a timely manner (Parast, 2019). By doing so, SCQM can improve operational performance, cost efficiency, sales, market share, and sustainability performance through supplier and customer integration, process control, and improved collaborative relationships throughout the supply chain (Lim et al., 2022).

However, the results of the literature synthesis also show that the relationship between quality, sustainability, SCM, and digital technology has not been fully presented in one integrative model. Some of the research still discusses quality management, sustainability, SCM, and digital technology separately. In fact, in the automotive component supply chain, the four concepts are interrelated. Quality is the main object to be controlled, SCM is an integration mechanism between supply chain actors, sustainability is the orientation of economic, environmental, and social performance, and digital technology is a tool to improve traceability, data transparency, quality monitoring, and data-based decision-making.

3.6. Recommendations for Future Research

Based on the results of a literature review of 52 articles, no articles were found specifically as a product quality control framework for the supply chain in the automotive component industry in

Indonesia. Research on quality control models has been conducted extensively. Improvements to the production process to improve product quality using the Six Sigma and Data Mining approach can be found at. The research conducted Fitriana et al. (2020) quality control using the lean six sigma concept, but there were no additional sustainability factors and the application of digital technology needed to control product quality in real time and accurately. Several studies have investigated lean sustainability to eliminate waste in the form of product quality (defects) but no digital technology is used to integrate important aspects of manufacturing. (Lestari et al., 2021; Marie et al., 2022; Marie et al., 2022; Orji & U-Dominic, 2022; Praharsi et al., 2021). There has been research focusing on the role of digital technology or blockchain to improve quality, but no sustainability factors have been considered (Ahmad et al., 2023; Burgess et al., 2022; Duan & Yan, 2020; Escobar et al., 2022; Leontaris et al., 2023; Ramkumar et al., 2022; Westphal et al., 2023).

A supply chain quality management system based on digital technology makes the supply chain more transparent (Sony et al., 2020). Because transparency encourages proactive behavior in supply chain actors by allowing them to identify and respond to changes and customer needs, it increases the responsiveness and flexibility of supply chain processes (Lim et al., 2024). The system also supports sharing information about upstream and downstream operations, allowing for more efficient resource allocation. Sharing real-time information about raw materials helps customers confirm product quality issues, reduce return rates, and improve process performance (Salikhov et al., 2023; Westphal et al., 2023).

Quality Management not only requires digital technology to monitor every process, but it also requires a sustainability dimension for supply chain flows. In recent years, sustainable supply chain management (SSCM) has been considered a solution to the unintended environmental, economic, and social impacts of supply chains and a facilitator in adopting profitable production methods in the midst of the product life cycle. Rupasinghe & Wijethilake (2021); Zhou et al. (2024) defines SSCM as the governance of capital, information and material flows and cooperation between organizations along the supply chain taking into account the objectives of each aspect of sustainable development, i.e., the social, environmental and economic dimensions derived from stakeholders and stakeholders (Rana & Jani, 2023).

From a theoretical perspective, the existing literature does not provide a comprehensive conceptual framework capable of explaining the linkages between product quality, supply chain management, sustainability principles, and digital technologies in one integrated model. In particular, there is still no model that explicitly integrates Quality, Sustainable Supply Chain Management (SSCM), and Digital Technology in a unified analytical framework. Most previous studies have tended to examine these elements in isolation, resulting in a limited understanding of how these variables interact in a cohesive conceptual structure.

From a methodological point of view, previous research generally adopted a partial approach that emphasized a single perspective. Many studies focus primarily on specific approaches such as Lean Six Sigma, blockchain-based systems, or sustainability practices in supply chains. While these studies contribute valuable insights, they are typically investigated independently and have not been integrated into a comprehensive model that simultaneously captures quality management, sustainability, and digital technology adoption. As a result, systematic efforts to map the thematic structure of the field and examine the integration of these various dimensions in product quality models remain limited.

In terms of the research context, empirical studies that specifically investigate supply chain practices in the automotive component industry, especially in the Indonesian context, are still relatively rare. These limitations suggest that the development and implementation of integrated product quality models that reflect the characteristics of the local industrial environment have not been sufficiently explored. Therefore, further research is needed to develop a more comprehensive model that integrates quality management, sustainable supply chain practices, and digital technologies, while also considering the specific conditions of the automotive component supply chain in Indonesia.

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4. Conclusion

This study shows that the study of product quality in the automotive component supply chain is still developing and needs further exploration. Through a combination of SLR and bibliometrics, showing the highest publication trend in 2023. The study also identifies the most prolific institutions and countries that contribute to this area of research, including China, India, and Italy. In addition, the study identified that the main themes that emerged included quality management, supply chain management, sustainability, as well as digital technologies such as blockchain and data-based monitoring systems. These findings confirm a shift in research focus from conventional quality control to a more integrated, transparent, and sustainability-oriented quality model.

The theoretical contribution of this research lies in mapping the relationship between Supply Chain Quality Management, Sustainable Supply Chain Management, and digital technology in a more integrated study framework. This research makes it clear that product quality is not only influenced by the company's internal processes, but also by coordination between supply chain actors, information integration, traceability, and the ability of systems to support sustainability practices. Thus, the results of this research can be a conceptual basis for the development of a sustainable automotive supply chain quality model. Practically, the results of this study provide direction for automotive component companies to strengthen quality management through supplier collaboration, the application of digital technology, and the integration of sustainability principles. The use of blockchain, artificial intelligence, sensors, and real-time quality monitoring can help increase transparency, reduce the risk of product defects, and improve overall supply chain performance. These findings are relevant for the automotive industry that requires a quality system that is adaptive to technological changes and market demands.

This research has several limitations. First, the data source comes from only one database, so it does not fully represent all relevant publications in other databases. Second, the publication period analyzed is limited to a certain range of years, so the latest research developments outside that period have not been comprehensively covered. Third, the bibliometric approach emphasizes more quantitative mapping of trends, keywords, and publication relationships, so that it has not explored in depth the empirical aspects of the implementation of quality models in industry. Further research is suggested to expand the data source, extend the period of analysis, combine bibliometrics with empirical approaches such as case studies, market surveys, or decision modeling. In addition, the development and validation of product quality models that integrate quality management, sustainability, and digital technology in the Peruvian automotive component supply chain is carried out so that the results of the study can make a strong contribution, both academically and practically.

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