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Review Article

Lean Implementation in Indonesian Small and Medium Enterprises: A Systematic Literature Review

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ABSTRACT

Lean implementation focuses on reducing waste and improving efficiency in business operations, a strategy widely embraced in developed countries. However, its adoption among Indonesian SMEs is limited and lacks adequate research. Understanding how lean practices can effectively enhance competitiveness and productivity in this vital sector of the Indonesian economy is crucial. Despite its widespread use in Western countries, there's a noticeable gap in research specifically examining how lean principles are applied within SMEs, especially in developing countries like Indonesia. Furthermore, there's a clear scarcity of studies detailing the current state of lean implementation in Indonesia, particularly within SMEs. This study conducted a systematic literature review (SLR), thoroughly searching peer-reviewed journals and conference papers. We identified 441 articles related to lean practices in Indonesia, with 40 focusing specifically on SMEs. Through this review, we uncovered key themes and trends in lean implementation, offering valuable insights into current practices and highlighting areas for future research. This paper represents one of the first comprehensive SLRs exploring lean practices within Indonesian SMEs. It aims to deepen our understanding of how lean methodologies impact SME operations in Indonesia and provides practical guidance for researchers and practitioners interested in lean implementation. By bridging these research gaps, we hope to contribute to the body of knowledge on lean implementation in Indonesian SMEs, suggesting strategies for effective implementation and paving the way for further study in this important area.

Keywords: lean implementation, Indonesian SMEs, efficiency, competitiveness, systematic literature review

INTRODUCTION

Lean manufacturing has emerged as a critical management philosophy focused on enhancing customer value by eliminating waste and promoting continuous organizational improvement [1] [2]. Implementing Lean can lead to significant improvements in productivity, cost reduction, and overall competitiveness by streamlining processes and fostering a culture of continuous improvement and team collaboration [3], [4]. Its significance lies in its ability to create more value with fewer resources, making it a crucial strategy for organizations aiming to remain competitive and responsive to market demands [5].

The foundation of lean manufacturing traces back to Henry Ford's innovations in 1913. In Highland Park, Michigan, Ford implemented interchangeable parts, standard work, and moving conveyances, creating what he termed flow production [6]. This emphasis on consistency and rapid inventory turnover laid the groundwork for future manufacturing advancements. The evolution continued in the 1930s with Toyota's significant contribution. Taiichi Ohno and Shigeo Shingo developed the Toyota Production System (TPS), emphasizing just-in-time inventory, quality control, and continuous improvement [7]. TPS integrated process flow, waste reduction, and employee involvement, marking a new era in production efficiency. John Krafcik coined the term "Lean Manufacturing" in 1988, encapsulating principles of efficiency, waste elimination, and value creation [8]. The publication of "The Machine That Changed the World" in 1990 by James Womack documented Toyota's lean practices and their global

impact, further popularizing the lean philosophy. Womack later refined these principles into five key pillars in his book "Lean Thinking" (1996). Since then, lean manufacturing has gained widespread recognition and implementation across various industries globally, continually promoting waste reduction and enhancing operational efficiency [9].

Lean manufacturing aims to minimize waste in processes, materials, and labor, yielding both short-term cost savings and long-term sustainability objectives [10]. By eliminating non-value-added activities such as excess inventory, waiting time, overproduction, and defects, organizations can operate more sustainably and make their resources more effective and efficient. These lean practices enhance efficiency by streamlining processes, optimizing workflows, utilizing resources effectively, and minimizing costs and unnecessary steps [11] leading to enhanced product quality and customer satisfaction [12]. Lean organizations can swiftly respond to market fluctuations, customer preferences, and supply chain disruptions due to reduced lead times, enabling rapid business responses. Additionally, lean principles prioritize people, recognizing that satisfied employees contribute to productivity and innovation. By adopting lean principles, organizations can enhance competitiveness, operational efficiency, and overall business performance.

Lean principles have been applied across diverse organizational types. Manufacturing organizations, including those in automotive, electronics, and aerospace fields, have embraced lean practices. For instance, Amrani [13] studied lean implementation in the aerospace industry, revealing that practices such as cell layout, one-piece flow, visual management, standardization, and multiskilling resulted in reduced defect rates, waste elimination, and decreased inventory. Similarly, in the automotive industry, Nallusamy [14] identified and eliminated non-value-added activities through lean tools such as 5S, VSM, and line balancing, enhancing manufacturing efficiency.

In addition to manufacturing, service organizations have also adopted lean methodologies to enhance performance. In the health sector, lean has been implemented in clinics and hospitals to improve patient services. Mozola et al. [15] demonstrated significant improvements in hospital function through the application of lean management tools. Service businesses such as retail, banking, and hospitality sectors utilize lean to enhance customer experience. Marques's study on lean retail stores showcased reduced out-of-stock events and increased order fulfillment rates achieved by online trading services [16]. Hidayati [17] examined lean implementation in the banking sector, focusing on reducing non-value-added activities and process time, thereby enhancing banking operations. In the hospitality sector, Sztorz [18] illustrated the use of lean management tools to improve efficiency, standardize service delivery processes, and enhance service quality, attracting new guests. Moreover, lean principles have extended to the administrative sector, optimizing administrative processes in lean offices. Sunaryanto [19] found that lean administration resulted in improved document turnaround times and service processes. Additionally, lean methodologies have penetrated the construction industry, aiming to increase project efficiency by eliminating waste that causes delays and inefficiencies [20].

Lean has emerged as a critical tool for SMEs, serving as a philosophy for continuous improvement and waste reduction [21], [22]. By enabling SMEs to optimize their resources, lean practices help these organizations operate more efficiently and competitively. Additionally, lean tools and techniques empower SMEs to optimize their core processes. Lean practices also enable SMEs to compete effectively with larger organizations by ensuring efficient product and service delivery that meets customer expectations [23], [24]. However, despite these benefits, SMEs face unique challenges in implementing lean principles, such as limited resources, constrained budgets, and a lack of specialized expertise [25]. These constraints can hinder SMEs from fully leveraging the potential of lean methodologies, highlighting a gap in the current understanding of how lean manufacturing can be effectively applied in smaller-scale settings.

Most researchers agree that SMEs play a crucial role in enhancing the wealth of both developed and developing countries. SMEs are vital not only for the global economy but also for regional economies such as that of Europe, where their competitiveness is essential [26]. Lean methodologies have been implemented in SMEs across various countries, improving their efficiency and competitiveness. Manufacturing often serves as the core competence of SMEs, making lean practices particularly relevant. In Finland, Majava and Ojanpera [27] conducted a study on a

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lean development project in a Finland-based manufacturing SME. They applied a framework to identify areas for improvement and proposed solutions to enhance production efficiency. The study highlighted challenges such as a large amount of work-in-progress (WIP) production, an extensive product portfolio, and an unproductive production layout, demonstrating that implementing lean methods is not straightforward. Resource constraints, such as limited financial and human resources, further complicate lean implementation for SMEs.

In the United States, Buehlmann [28] examined the awareness, implementation status, and outcomes of lean practices among SMEs in Virginia's manufacturing industry. The study found that SMEs were only slightly aware of lean and its potential benefits, leading to lower implementation rates. This suggests a lower need for lean implementation support from third parties compared to other enterprises. However, studies consistently show that SMEs that do implement lean practices report significant improvements in their business results. Similar to many developed countries, some developing countries have also explored the implementation of lean practices in their SMEs. For instance, the African continent has shown interest in lean methodologies. Mapfaira and Mutingi [29] focused on Botswana manufacturing companies to investigate the adoption and barriers of lean manufacturing. Their study revealed that many manufacturing SMEs are unfamiliar with productivity improvement tools or lack the technical skills required to implement them. Key challenges included resistance to change, a shortage of skilled employees, and inadequate financial resources.

In Asia, most studies have been conducted in India, where SMEs face challenging environments but remain a backbone of the economy, playing a crucial role in its growth. Verma and Sharma [30] developed a lean manufacturing implementation model to enhance productivity and quality in a small-scale industry in Ranchi, Jharkhand, India. Their model focused on identifying waste and using value stream mapping to address these issues. Notably, they achieved significant reductions in time consumption without purchasing new machinery or forcing operators to work harder or faster. Instead, the improvements came from changing procedures and layouts to facilitate smoother product flow through the manufacturing process. This approach reduced manufacturing lead times and increased productivity in the SMEs.

These case studies examined the conditions and outcomes of lean implementation in SMEs across various countries. Although every organization faces unique challenges, they can all benefit from lean practices tailored to their specific needs. SMEs in Indonesia form the backbone of the country's economy, significantly contributing to employment and GDP [31]. Understanding lean implementation within this context is vital for sustainable growth. With over 4.4 million SME business units accounting for more than 99% of Indonesia's manufacturing firms and employing 10.5 million workers, or 65% of the total industrial labor force, SMEs are crucial to Indonesia's industrial sector [32]. Despite their significant contributions, Indonesian SMEs face substantial hurdles, including limited capital, low-quality human resources, restricted market access, and insufficient technological capabilities [33]. As a developing country with a rapidly growing industrial sector, Indonesia provides a compelling context for studying lean manufacturing within SMEs. However, the adoption of lean practices in Indonesian SMEs remains limited and under-researched. Unlike in developed countries, where lean practices are well-documented, Indonesian SMEs lack comprehensive research on lean adoption [34]. The scarcity of studies means that there is a need for more in-depth research to understand how lean can be adapted to the Indonesian context, taking into account the specific challenges and opportunities that exist within the country's SME sector. This presents an opportunity for further exploration and study of lean implementation in Indonesian SMEs.

This study attempts to explore the opportunity by conducting a systematic literature review (SLR) of the existing literature on lean implementation in Indonesian SMEs. The SLR helps identify what is already known and remains unknown about lean implementation in Indonesian SMEs and can highlight areas where further research is needed. The objective is to identify prevailing themes, challenges, and best practices, and to propose strategies for successful lean adoption in this context. By examining the unique conditions faced by SMEs in Indonesia, this study intends to contribute valuable insights that can inform practical applications in the field of lean manufacturing. Ultimately, it is expected that this research could pave the way for SMEs in Indonesia to achieve greater competitiveness and sustainability through the effective implementation of lean principles.

METHODS

The SLR in this research focuses on lean research trends and potential research opportunities, especially in Indonesian SMEs' scope. Searching from databases such as Google Scholar, Science Direct, etc., with the keywords "Systematic literature review" and "lean Indonesia SMEs," there will be no articles about it. The aims of this study on a review of lean implementation in Indonesia are (1) What are the main categories or themes in Indonesia SME's lean studies trends? (2) What are the possibilities for potential Lean implementation study in Indonesian SMEs?

In achieving the aim of the present study, an SLR is conducted. The SLR method consists of the version proposed by Tranfield et al. [35]; it was deemed the most appropriate [26], which includes the planning stage, the conducting stage, and the reporting and dissemination stage. It is a structured approach for critically reviewing and analyzing published academic research [35]. This methodology has advantages over classical narrative reviews [36] as it offers a more transparent, scientific, and reproducible result [35], [37]. It is presented in articles published in many high-quality scientific journals [38], and it is in line with that used by [26], [38]-[41]. It was chosen because it expanded the medical science systematic review method and applied it to management research, including more significant descriptive details on exhibiting results and evaluating the literature [42]. The flowchart of the SLR phase, objective, and method can be seen in Figure 1.

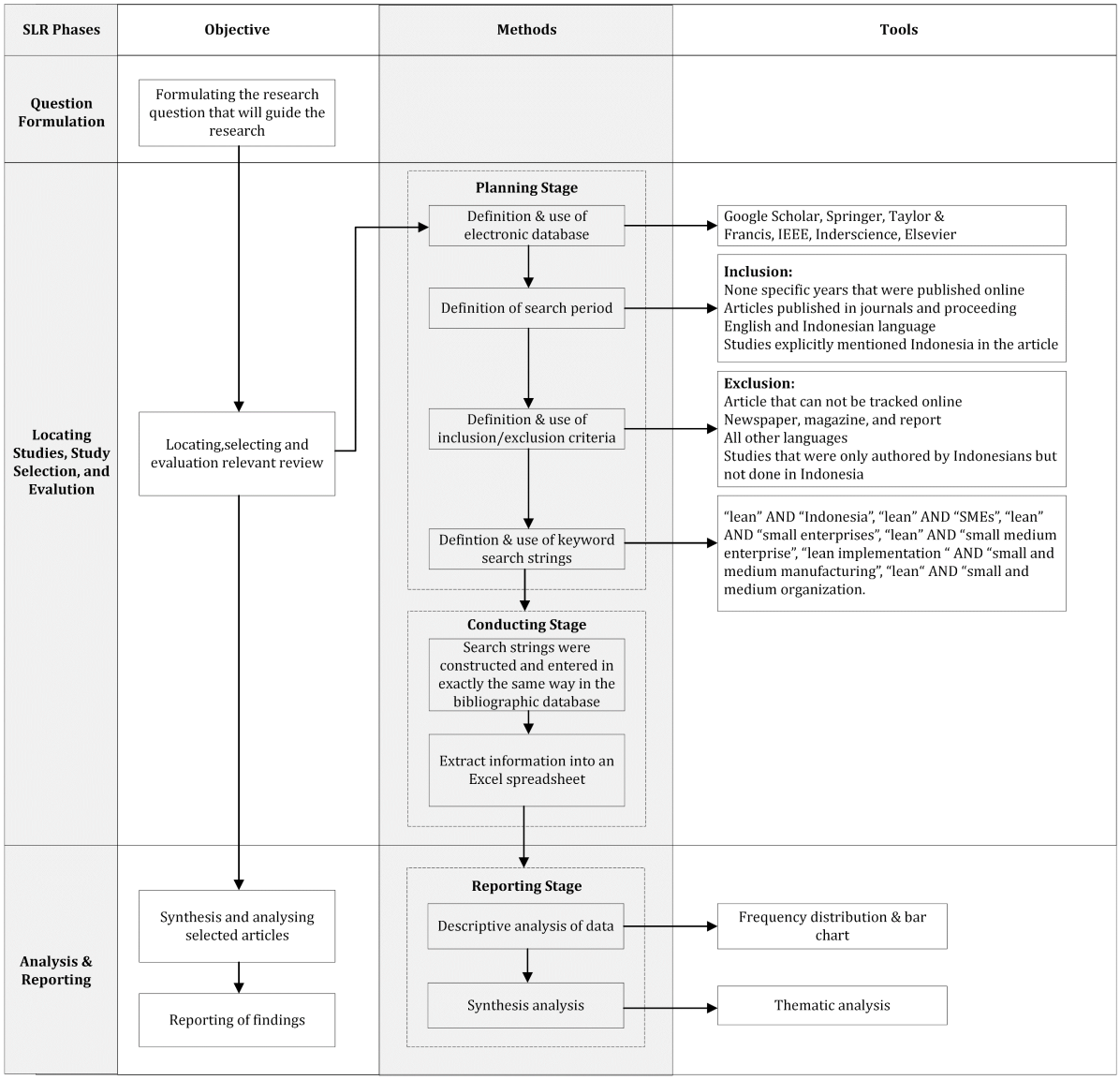

Figure 1. Figure 1. SLR Stages of The Proposed Research

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Table 1. Inclusion and exclusion Criteria for the literature review

Criteria	Inclusive	Exclusive
Year	None specific years that were published online	Articles that can not be tracked online.
Types of Publication	Articles published in journals and proceeding	Newspaper, magazine, and report
Language	English and Indonesian Language	All other languages
Approaches	Studies that explicitly mentioned Indonesia in the article	Studies that were only authored by Indonesians but not done in Indonesia

The first stage of the planning review involves preparing and reviewing protocol development [35]. During this stage, trade-offs between the comprehensiveness, practicability, and reproducibility of the review must be considered. Inclusion and exclusion criteria for selecting articles within the study's scope were formulated, as shown in Table 1. Since the study aims to examine the unique conditions faced by Indonesian SMEs in lean practices, no specific publication years were targeted. This approach provides information on how lean has been implemented in Indonesia. For practical, representative, and reproducible research, it is necessary to conduct systematic searches in several defined databases [43]. This step involves finding as many relevant articles and specifics as possible to ensure the articles' relevance.

The review team, consisting of the authors of this paper, selected journals for this study. The databases considered were Emerald, Elsevier, Springer, and Taylor & Francis, as suggested by Psomas and Antony [41] in SLR studies. This selection aligns with similar studies in the context of Lean [22], [24], [44], [45]. To ensure a comprehensive search scope, this study also included publishers from Inderscience, IEEE and Google Scholar as of [46]. Furthermore, articles written in English were included, as well as scholarly papers on Lean published in international and national journals written in Indonesian. However, articles from newspapers, magazines, and reports were excluded because they only offer a general outline of lean implementation rather than a comprehensive and in-depth analysis. Working papers were also excluded, as they often represent researchers' preliminary thoughts and are subject to change.

The literature search focused on the keyword "lean Indonesia," as it was essential to meet the study's objectives [47]. We applied various search strings, including "lean" AND "Indonesia," "lean" AND "SMEs," "lean" AND "small enterprises," "lean" AND "small medium enterprise," "lean implementation" AND "small and medium manufacturing," and "lean" AND "small and medium organization". Articles specifically discussing lean techniques or tools were not included. Since lean manufacturing is an evolution of the Toyota Production System (TPS) [48], which is more general and culturally less specific than the Japanese TPS [49], it was also excluded from the study. Finally, the review team ensured there were no significant omissions or oversights related to the selected terms, databases, time periods, and other relevant factors.

The second stage involves conducting the review. During this stage, the search was performed using the same method as in the bibliographic database. The review focused on the search terms identified during the planning stage. The information gathered from the sample articles included the title, year of publication, journal, and authors. Additionally, other details such as the paper type, industry sub-sectors, and the number of companies participating in the research were collected. Statements of the research gaps were also extracted and organized in an Excel spreadsheet.

Due to differences in the screening mechanisms between Google Scholar and other databases, the screening process in Google Scholar required more diligence due to its inadequate filtering capabilities. Each article obtained from GS was initially filtered by title, and if it contained the words "lean" and "Indonesia," it was downloaded. Even if the word "Indonesia" did not appear, the article was included if it contained one of the keywords or if the context matched the reviewer's knowledge. Common issues encountered with Google Scholar included articles with the same title, articles with titles but no files, or links that could not be found. Occasionally, downloaded articles turned out to be student theses or dissertations; these were then moved to a separate table for unreviewed items. For articles from other

databases, all entries containing the words "lean" and "Indonesia" were individually checked, as many contained only one of the keywords. In total, 441 articles were selected from all databases and entered into an Excel spreadsheet. These articles underwent further review, with the title, author, year, database, and publication name directly entered into the spreadsheet, as they were already part of the article.

The information collected encompassed various crucial aspects for the study's focus. Firstly, businesses were categorized as manufacturing or service based on industry classification [50], with a specific emphasis on SMEs. Additional details were gathered to differentiate between large enterprises and SMEs, and to identify specific lean topics discussed, such as lean construction or lean six sigma [51], [52]. Articles were categorized based on their abstracts into types like case studies, conceptual studies, literature reviews, or surveys [53]. The focus of each research was then analyzed to identify the sectors predominantly discussed in relation to lean practices in Indonesia, aiming to pinpoint potential areas for further investigation. Specifically, a detailed analysis was conducted on 40 articles related to SMEs, examining factors such as the number of participating companies, statements about research gaps, and research objectives. This comprehensive approach ensured a thorough understanding of how lean methodologies are applied and studied within the Indonesian SME context.

The third stage, reporting and dissemination, represents the final phase in this systematic literature review (SLR) methodology. Building upon the Excel spreadsheet developed during the review stage, which provided a comprehensive overview of the sampled articles, this stage comprises two main components: descriptive analysis and thematic analysis [35]. The descriptive analysis utilized data from the second stage to portray the current landscape of the reviewed literature. This included generating frequency distributions and bar charts to illustrate various aspects such as the number of publications per year, distribution across journals and conferences, types of journals (national vs. international), business sectors (manufacturing vs. services), frequently used keywords, and the percentage of lean implementation in both large enterprises and SMEs. Specifically focusing on SMEs, the descriptive analysis examined the distribution of article types and identified the database with the highest number of publications related to SMEs.

Thematic analysis, the second component of this stage, involved identifying and categorizing themes based on the groups established in the earlier stages of the review process. This analytical approach aimed to extract deeper insights from the reviewed literature, highlighting recurring patterns, emerging trends, and areas of consensus or divergence within the field of lean implementation in Indonesian SMEs. Together, these analytical approaches provided a structured and comprehensive examination of the literature, facilitating a nuanced understanding of the current state and trends in lean practices within the context of Indonesian SMEs.

RESULT AND DISCUSSION

The Profiles on Lean Implementation in Indonesia

The SLR conducted by [54] and [55] categorized articles based on several criteria including year of publication, journal, research methods, and subject matter [35], [55], mirroring the structure followed in this study. Initially, articles were categorized according to their database source to identify where lean studies in Indonesia were predominantly published. The search was limited to articles containing the keywords "lean" and "Indonesia." The electronic databases yielded the following initial numbers of articles: Elsevier (sciencedirect.com) with 3,157 articles, Emerald (emeraldinsight.com) with 659 articles, Taylor & Francis (tandfonline.com) with 3,991 articles, IEEE (ieeexplore.ieee.org) with 57 articles, Springer (springerlink.com) with 5,175 articles, Inderscience (inderscienceonline.com) with 262 articles, and Google Scholar (scholar.google.com) with 94,200 articles. This categorization strategy helped establish a foundation for analyzing lean implementation research trends specific to Indonesian SMEs, drawing insights similar to previous SLRs while emphasizing the breadth and depth of available literature in the field.

Reviewing the keywords, titles, and abstracts of articles resulted in identifying a total of 441 articles. The majority of these articles, 385 (87.3%), were sourced from Google Scholar, underscoring its extensive coverage and broad

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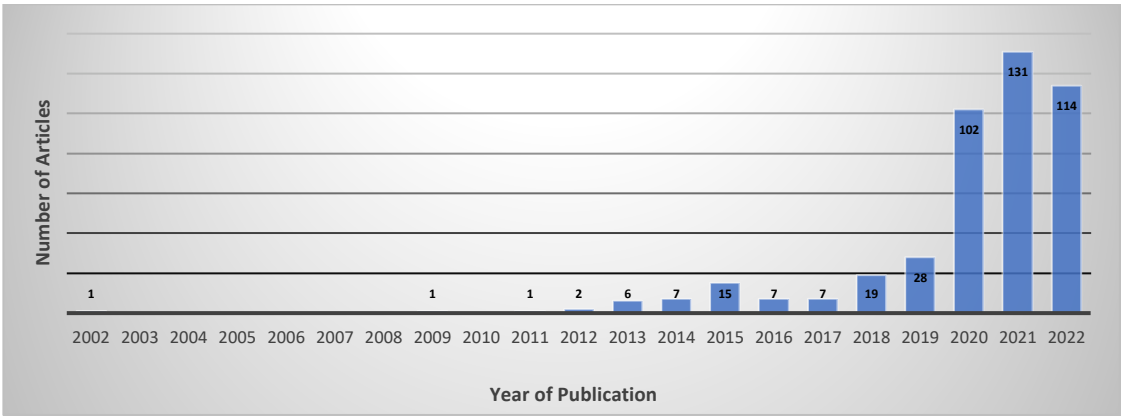

Figure 2. Categorization of articles that implemented lean in Indonesia according to the year of publication

inclusion of scholarly literature [56], [57]. Google Scholar has evolved into a robust database over the years, encompassing not only formally published works but also a considerable amount of grey literature. This inclusion of grey literature can be both advantageous and challenging for systematic reviews, as highlighted by Haddaway et al. [56], who cautioned against relying solely on Google Scholar due to variability in search results. However, for this review's purposes, Google Scholar proved essential in capturing a comprehensive range of relevant studies. Additionally, 25 articles (5.7%) were retrieved from the IEEE database, all sourced from conferences, highlighting its specialized focus within the academic community. Emerald contributed 13 articles (2.9%), Taylor & Francis (T&F) and Elsevier each provided 6 articles (1.4%), Inderscience contributed 4 articles (0.9%), and Springer yielded 2 articles (0.5%). These findings demonstrate varying degrees of representation across databases, emphasizing the importance of using multiple sources to ensure a thorough literature review.

The analysis of articles based on their publication venues reveals a significant preference among researchers for journal publications (68%) over conference proceedings (32%) when discussing lean implementation in Indonesia. Within these publications, approximately 47% were found in national journals that use either Indonesian or English, while the remaining 53% appeared in international journals. Across different databases such as Elsevier, Emerald, Inderscience, Springer, and Taylor & Francis (T&F), a few journals and proceedings accounted for the majority of the sample papers. The IOP Conference Series: Materials Science and Engineering emerged as the most prominent venue. Figure 2 illustrates the timeline of publications on Indonesia's lean practices, noting an initial appearance in 2002, followed by a gap until 2009, after which interest steadily increased. Notably, the bulk of the articles (99.5%) were published between 2011 and 2022, with a marked surge observed from 2020 onwards. This trend underscores the growing scholarly interest and activity in exploring lean methodologies within the Indonesian context over recent years.

About 84% of the sample articles analyzed in this study focused on case studies, highlighting a predominant preference for practical application and real-world examples [58]. Conceptual studies accounted for 8% of the articles reviewed, indicating a lesser emphasis on theoretical frameworks within the field of lean implementation in Indonesia. Notably, there was a scarcity of survey studies and literature reviews, comprising only 4% each, suggesting a gap in comprehensive assessments and broader analyses of lean practices in the country. Despite lean methodologies originating in manufacturing, they are increasingly recognized as beneficial for service organizations as well, aiming to enhance efficiency and customer satisfaction [58]. This dual applicability is reflected in the distribution of research efforts, with 67% of studies focused on manufacturing and 33% on services. This emphasis on manufacturing aligns with Indonesia's industrial profile, where the sector plays a pivotal role in the national economy, contributing more than 20%. Moreover, the prevalence of keywords related to lean manufacturing in the reviewed articles further underscores this sector's dominance in lean research conducted in Indonesia. Figure 3 visually illustrates the frequency and usage of these keywords, highlighting their consistent application across various studies.

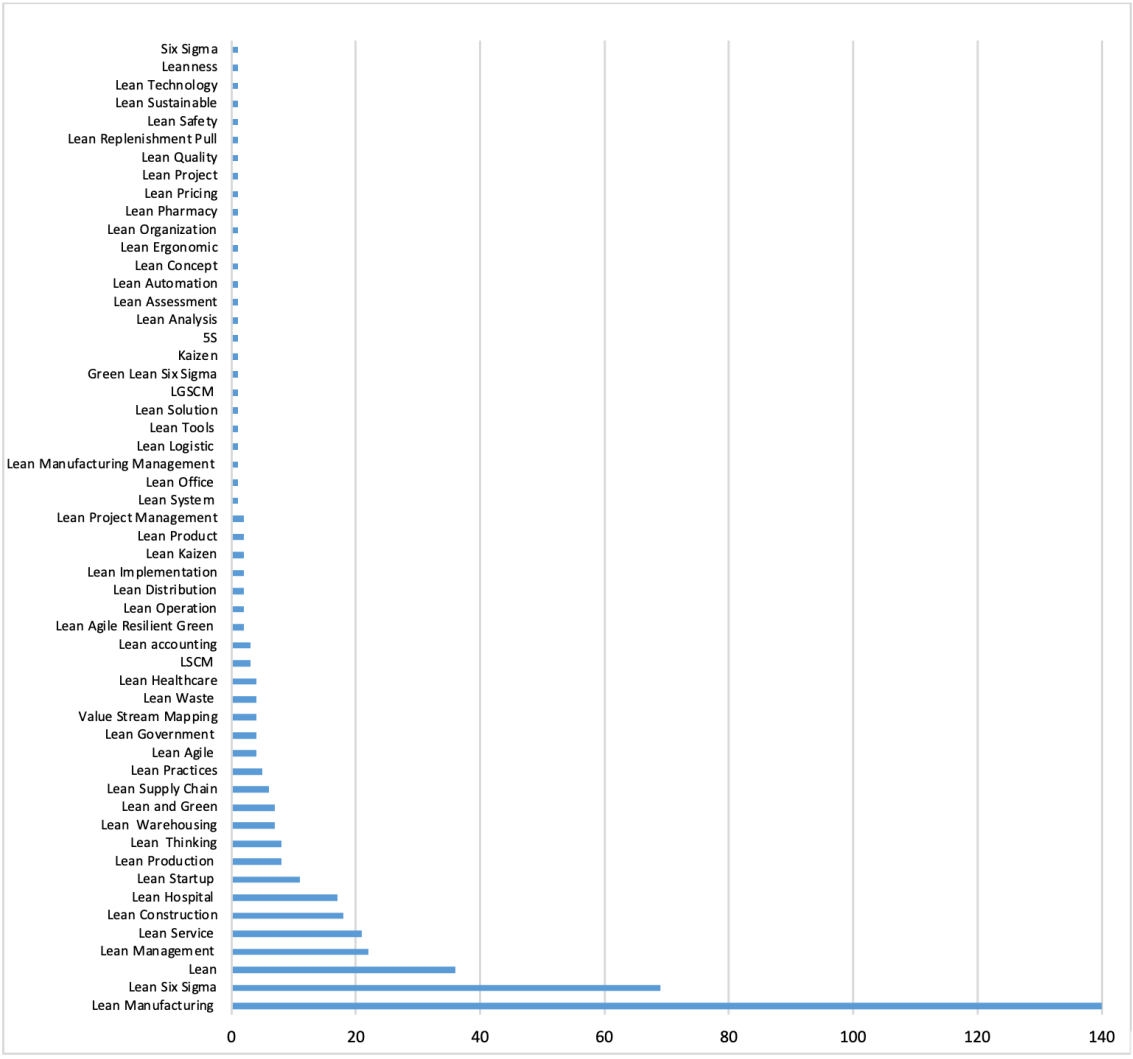

Figure 3. Articles Categorization on Lean in Indonesia

The Profiles on Lean Implementation in Indonesia SMEs

The study examined 441 articles focused on lean practices in Indonesia, specifically categorizing them based on their relevance to small and medium enterprises (SMEs). From this review, 40 papers were identified that addressed SME-specific issues. Figure 4 illustrates the timeline of these articles, revealing an initial appearance in 2013 with a peak of 10 articles in 2021. Interestingly, Figure 4 also highlights that the majority of the articles predominantly discuss lean practices within large industries. Only 9% of the total articles (40 out of 441) specifically studied lean implementation in SMEs, while the remaining 91% focused on larger companies. This discrepancy underscores a significant gap in research, considering that SMEs constitute 99% of manufacturing firms in Indonesia and employ nearly two-thirds of the manufacturing workforce. Therefore, there is a clear need for more extensive research in lean practices tailored to SMEs in Indonesia to address this critical sector of the economy.

Out of the 40 articles pertaining to SMEs in Indonesia, a significant majority, 87.5%, were sourced from Google Scholar. Interestingly, the distribution across databases did not vary substantially for articles focusing on 'lean,' 'Indonesia,' and 'SMEs.' Each of T&F, IEEE, Elsevier, Emerald, and Inderscience hosted one article, with none appearing in Springer. This dearth suggests a notable absence of dedicated journals or conferences specifically addressing lean practices within Indonesian SMEs.

The publications predominantly feature in international journals rather than conferences, comprising 40% and 3% respectively, with national journals contributing the remaining 25%. Within these articles, a substantial portion of

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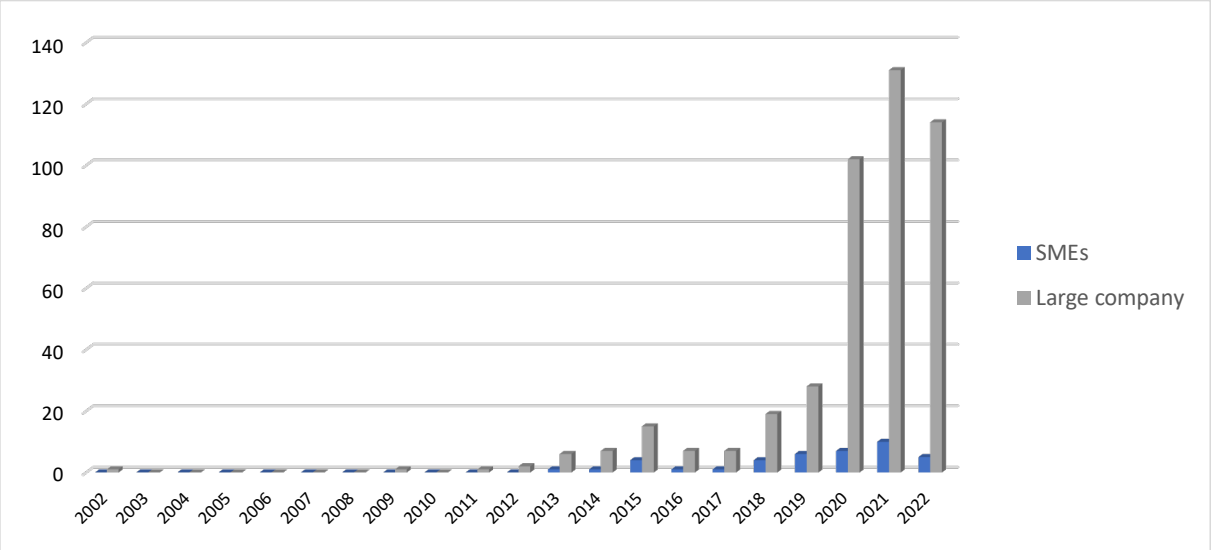

Figure 4. Articles Categorization on Lean Implementation based on Industry Size in Indonesia (Large/SMEs)

75% predominantly presents case studies on lean manufacturing implementations in Indonesian SMEs. However, there is a noticeable scarcity in survey studies (1%), conceptual studies (5%), and literature reviews (5%) focusing on lean implementation in SME contexts. This highlights an opportunity for future research to expand the theoretical frameworks underpinning lean practices in SMEs. Moreover, there is a clear need for more comprehensive studies employing diverse methodologies such as ethnography, mixed-method approaches, and grounded theory. These avenues could enrich the understanding and applicability of lean principles within the Indonesian SME landscape, addressing crucial gaps in current literature.

Thematic Analysis

This This study also reports the findings of a thematic analysis, aiming to clarify the insights gained from the data extraction process [35]. It focuses on evaluating the level of consensus across various themes to identify significant emerging topics and research questions. Additionally, researchers are advised to maintain a detailed audit trail back to the core contributions to substantiate and ground their conclusions.

In the review of lean practices within Indonesian SMEs, three main themes stand out. The first theme examines the specific methods and approaches used to implement lean in these enterprises. The second theme explores how lean practices in Indonesian SMEs are combined with other supporting initiatives to enhance their effectiveness. The third theme investigates how the manufacturing sector applies lean principles within Indonesian SMEs, highlighting practical applications and challenges. Within the exploration of lean practices in Indonesian SMEs, three primary themes emerge. Firstly, it examines How lean is implemented in Indonesia SMEs (Theme 1). Secondly, it investigates how lean practices are integrated with complementary initiatives in Indonesian SME (Theme 2). Lastly, the study explores case studies of lean implementation in various business sector in Indonesian SMEs (Theme 3).

Theme 1: How lean is implemented in Indonesia SMEs

Several studies highlight various reasons for the failure of SMEs to implement lean practices. These reasons include the use of inappropriate tools, reliance on a single tool to solve all problems, lack of understanding, and poor decision-making. Bhasin [23] discussed how some lean tools are less popular among SMEs compared to large enterprises. Despite this, SMEs have a more varied selection of tools available when implementing lean.

In Indonesian SMEs, Value Stream Mapping (VSM) is the most commonly used tool, implemented in 70 percent of the studies. VSM helps identify and eliminate waste while increasing flexibility. Previous work has focused on using VSM in Indonesian SMEs to pinpoint and minimize non-value-added (NVA) activities [59]. Studies have used VSM

to create current state maps that represent the actual process flow, aiding in the identification of production waste [60]. This mapping process involves observations and interviews to accurately capture the company's current operating conditions. VSM provides a ratio of value-added time to non-value-added time, which is crucial for understanding and improving processes [61][62]. Additionally, VSM has been used to score the degree of lean implementation [63] and to examine mid-scale manufacturing production development. Research has evaluated the practical application of VSM in mid-scale manufacturing in Indonesia [64], and some studies have combined VSM with the 5S methodology for direct implementation in companies [65]. These applications demonstrate the versatility and effectiveness of VSM in enhancing lean practices within Indonesian SMEs.

Other studies on SMEs in Indonesia highlight the use of 5S and Six Sigma methodologies. For instance, Irawan and Naresti [66] implemented only 5S to achieve efficiency and optimal operations. This indicates that many other lean tools are still underutilized among Indonesian SMEs. According to Susilawati and Tan [67], lean techniques or tools are used to a limited extent in Indonesian SMEs, with 5S being the most frequently applied. SMEs can implement various lean tools and techniques, depending on their specific needs. For instance, tools like Total Productive Maintenance (TPM) are suitable for high production volumes, while kanban systems are recommended for managing pull flow in high production volumes with low product repeatability (high variation). Single-Minute Exchange of Dies (SMED) is suggested for reducing turnover time in low repetition production environments [68]. Lean tools such as 5S, quality circles, quality control, visual management, and standardization are low-cost investments and accessible for SMEs to execute [69].

Belhadi et al. [68] identified VSM, 5S, and cellular systems as applicable tools across all types of SMEs. Rose et al. [70] stated that SMEs could utilize 17 different lean manufacturing tools and techniques, including multifunctional employees, preventive maintenance, 5S, quality circles, reduced setup time, kanban, continuous flow, and small lot sizes. Alkhoraif [26] noted that there is still a lack of literature discussing the justification for choosing specific methods or tools. Given their limited time and budgets, SMEs are advised to select easier and less expensive tools [71]. Furthermore, the choice of lean tools also depends on the type of SME, highlighting the need for tailored approaches to lean implementation.

Theme 2: How lean practices are integrated with complementary initiatives in Indonesian SME

Indonesian SMEs can enhance their lean implementation by integrating it with supporting initiatives such as Six Sigma [72][73], fuzzy logic [63], and green practices [61]. Over the last decade, organizations have faced increasing pressure to manage their operations responsibly, improving both environmental and social performance. The green paradigm has emerged as a significant concern for companies, focusing on reducing the environmental impact of their services and products while enhancing ecological sustainability [9]. Since lean and green methodologies share similar operational management strategies, many researchers see them as complementary [74][75]. Consequently, there is a growing consensus that combining lean and green approaches can positively impact both environmental and operational performance [76].

Despite the potential benefits, the adoption of lean-green practices in SMEs remains limited, mainly due to concerns about implementation costs and perceived benefits [77]. However, SMEs significantly contribute to industrial waste and environmental degradation, making it imperative for them to address economic, environmental, and social issues through lean and green initiatives. According to research, adopting these initiatives can enhance the competitiveness of SMEs in a sustainable manner [78]. This presents a valuable opportunity for Indonesian SMEs to implement lean-green strategies.

Hu et al. [38] and Alkhoraif et al. [26] reviewed additional supporting approaches for implementing lean in SMEs, which include Six Sigma, IT systems (such as MRP, ERP, fuzzy systems, CAD/CAM, and computer simulation), project management, cellular manufacturing, accounting methods (such as ABC and VSM accounting), Quality Function Deployment (QFD), Theory of Constraints (TOC), and quick scan methods. Integrating these approaches can further strengthen lean implementation, providing SMEs with robust tools to improve their operational efficiency and sustainability.

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Theme 3: Business Sectors of Lean Implementation in Indonesia SMEs

The topic of lean implementation in SMEs in Indonesia predominantly revolves around the manufacturing sector [59], [60], [63], [64], [67], [79]–[89]. In addition to lean manufacturing, other lean-related concepts explored include lean agile [90]–[92], lean logistics [34], lean operation [65], lean production [62], lean Six Sigma [72], [73], [93], [94], and value stream mapping [61]. The focus on lean manufacturing is consistent with survey results that show varying degrees of lean manufacturing practices across different impact areas within the Indonesian manufacturing industry [67]. Overall, most studies on SMEs in Indonesia are concentrated in the manufacturing sector.

According to Tambunnan [95], Indonesian SMEs are primarily concentrated in agriculture, trade, hotels, and restaurants. The manufacturing industry mainly involves traditional activities such as wood products, furniture, textiles, garments, footwear, food and beverages, machinery, production tools, and automotive components. Lean implementation studies in Indonesian SMEs are limited to a few sectors. In the food industry, research has focused on optimizing workstation layouts for chocolate SMEs to increase output while reducing production costs [59]. Other studies have identified critical indicators to improve performance using lean and agile approaches, and have examined Lean, Agile, Resilient, and Green (LARG) practices in chocolate SMEs [91], [92]. Additionally, there is interest in operational strategies of Indonesian coffee companies [73], [86], and studies have been conducted on the small crackers industry [96], tofu industry [89], and tempe production [83]. In the textile industry, particularly batik, research has combined the SCOR model and system dynamics to predict complex activities [62]. Other studies have developed lean action plans to reduce production waste [60], minimize waste in the batik production process [61], and address waste reduction in specific types of batik, such as batik motive painted on wood [88], cap batik [79], and tie-dye of batik jumputan [97]. Waste identification in both cap batik and writing batik production processes has also been explored [81], [98]. In the fashion industry, one study explored how lean-agile operations and supplier-firm partnerships can enhance supply chain performance in garment SMEs [90]. In the footwear industri, Antonio and Kusumastuti [65] studied the impact of lean operations on the performance of an Indonesian shoe producer.

Beyond the manufacturing sector, the development of SMEs forms the backbone of Indonesia's economy, as they constitute the majority of businesses in the country, absorb a significant amount of labor, and utilize domestic resources. The government's focus on the growth of creative industries within SMEs is a key strategy to advance the national economy. These industries, recognized as a high-potential sector in Indonesia, thrive on innovation and creativity, offering a competitive advantage and providing positive social impacts [99]. Indonesia's creative industries are diverse, encompassing 16 sub-sectors: application and game development, architecture and interior design, visual communication design, product design, fashion, film, video animation, photography, craft, culinary, music, publishing, advertising, performing arts, fine arts, television, and radio [100]. SMEs operate across a broad spectrum, including culinary, crafts, and fashion, among others.

Developing SMEs within the creative industries has numerous positive impacts on social life, business advertising, and the economy. It also enhances the image of regions, contributing to the development of the creative economy in Indonesian cities. The growth of creative industries leverages each region's superior products, aligning development with regional strengths. In the context of the Industrial Revolution 4.0, the creative economy has become a strategic focus, emphasizing continuous innovation and creativity. This approach aims to increase economic value by capitalizing on creative ideas, positioning the creative economy as a crucial player in global competition.

Further Studies in Lean Implementation in Indonesia SMEs

Numerous journals and proceedings have published articles on lean implementations, primarily comprising case study research conducted in Indonesian SMEs. These studies typically applied one or more lean methods to service or manufacturing companies, resulting in observed and measurable improvements. The study reveals that, despite the potential for lean implementation in the Indonesian SME manufacturing sector, there are still relatively few publications on the subject. While the existing papers demonstrate a positive correlation between lean

implementation and performance improvement, further research is needed. To address the weaknesses of SMEs and enhance their global competitiveness, implementing lean manufacturing systems is crucial. It is important to tailor lean techniques and tools to the specific circumstances of individual companies, considering their size, environment, technology, complexity, and corporate culture.

The theme of the articles analyzed in this study depicts the literature on lean implementation in Indonesian SMEs as relevant but limited. The systematic literature review (SLR) highlighted that, although there is potential for lean implementations within the Indonesian SME manufacturing sectors, there are still limited articles focusing on this area. This study's limitations include its restriction to 441 articles sourced using only the keywords "lean" and "Indonesia," which may exclude research that directly names specific companies. Additionally, the review was based on seven academic journal publishers, potentially missing other relevant publishers. Future literature review studies should address these limitations.

Indonesia, as a developing country with 99 percent of its manufacturing firms classified as SMEs, has fewer studies on lean implementation compared to global trends. This gap highlights the need for more focused research in this area. Future studies should aim to develop conceptual methods based on theoretical frameworks for lean implementation in Indonesian SMEs, including the design of models or guides to facilitate their adoption of lean practices. Utilizing methodologies such as mixed-method, grounded theory, and ethnography through surveys and literature reviews will provide a deeper understanding. Moreover, it is essential to tailor lean tools to the specific types of SMEs in Indonesia and to investigate supportive initiatives that can be integrated with the lean approach. Additionally, exploring the development of SMEs within the creative industries, especially in the context of the creative economy's growth in Indonesian cities, will further enhance this research.

CONCLUSION

This study contributes to the literature by examining the development of lean implementation in Indonesian SMEs and identifying key themes in these implementations. The descriptive analysis highlights the number of publications per database, journal/conference, and year, as well as the research methods used and the industry sectors involved in lean implementation in Indonesia, particularly within SMEs. The thematic analysis reveals main themes related to the implementation process, the integration with other support initiatives, and the specific manufacturing sectors that adopt lean practices. The review findings suggest several research opportunities that can guide future studies on lean implementation in Indonesian SMEs. This study provides valuable insights for academics, researchers, practitioners, and policymakers. Based on the descriptive analysis and the developed themes, researchers and scholars can establish unique and valuable studies to further the development of lean practices in Indonesian SMEs. However, this research has some limitations. The current systematic literature review (SLR) is based only on proceedings and journals from several databases and uses specific keywords. Consequently, some relevant databases, publishers, and publications focused on particular lean principles, techniques, or tools may have been missed. Future literature review studies should address these limitations to provide a more comprehensive understanding of lean implementation in Indonesian SMEs.

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CONFLICT OF INTEREST

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