

Research Article

Circular Economy Implementation in Indonesian Manufacturing: A Systematic Literature Review of Drivers, Barriers, and Future Research Directions

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Abstract: The circular economy (CE) has emerged as a crucial paradigm for achieving resource efficiency and sustainability within Indonesia's manufacturing sector. However, its implementation faces structural, technological, and regulatory challenges that hinder sustainable transformation. This study systematically reviews literature on CE implementation in Indonesian manufacturing to identify its drivers, barriers, and future research directions. Using the Systematic Literature Review (SLR) method guided by the PRISMA 2020 framework, data were collected from Scopus, Web of Science, and Google Scholar covering 2018–2024. Out of 462 records, 32 studies met the inclusion criteria after screening and quality assessment. Findings indicate that government policy support, digital technology readiness, and supply chain collaboration are key drivers, while limited funding, low organizational awareness, and fragmented regulation remain major barriers. This review contributes by proposing an integrative conceptual framework and outlining future research on circular business models and cross-sectoral policies to accelerate in Indonesia's green economy transition.

Keywords: Circular Economy; Implementation Barriers; Industrial Policy; Manufacturing Sector; Sustainability.

1. Introduction

The concept of circular economy (CE) has developed rapidly in the last decade as a new paradigm to deal with environmental crises and global natural resource pressures. CE is oriented towards material efficiency through the principles of reduce, reuse, recycle, repair, and remanufacture, which replaces the traditional linear system of "take-use-throw away" (Kirchherr et al., 2023; Geissdoerfer et al., 2023). Institutions such as the European Environment Agency (EEA) and the OECD emphasize that CE functions not only as an environmental strategy, but also as a new economic system that supports industrial innovation and long-term sustainability (Murray & Skene, 2022; Prabowo et al., 2023).

In the context of Southeast Asia, especially Indonesia, the urgency of implementing CE is increasing due to rapid industrialization and high volumes of industrial waste. A report by the World Bank and the Ministry of Industry (2023) shows that the industrial sector accounts for almost 30% of the total national carbon emissions, while the recycling rate of industrial materials is still below 15%. The implementation of CE has the potential to increase national GDP by up to Rp 638 trillion by 2030, through resource efficiency and green job creation (Wikurendra et al., 2024; Wulandari & Rahman, 2023). However, this potential is hampered by weak recycling infrastructure, capacity gaps between regions, and suboptimal synergy between government policies and industry players (Setiawan et al., 2023; Lestari & Nugroho, 2022).

The manufacturing sector is a strategic focus in the implementation of the circular economy because of its contribution to 19% of national GDP and the absorption of more than 18 million people (BPS, 2024). However, research shows that most manufacturing companies in Indonesia are still operating with a linear economy model and have not fully

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switched to circular production practices (Purwanto & Yuliani, 2023; Siregar et al., 2023). Sustainability initiatives are still partial, focusing more on energy efficiency or waste reduction than on systemic transformation of the supply chain (Nasution et al., 2024; Suharto & Manullang, 2024). In addition, CE adoption rates vary widely between subsectors due to differences in business scale, technological readiness, and human resource capacity (Ting et al., 2023; Rachmawati & Dewi, 2023).

The literature on the circular economy in Indonesia shows thematic and methodological fragmentation. Most of the research in the last five years has focused more on domestic waste management issues, public policy, or the green economy in general, rather than on concrete implementation in the manufacturing sector (Mulyani et al., 2024; Prabowo et al., 2023). Of the total 35 Scopus publications reviewed by Mulyani et al. (2024), only about 18% researched CE in the manufacturing industry. Even among these studies, most of them are still descriptive and have not integrated an in-depth analysis of the drivers, barriers, and relationships between conceptual variables that explain the success of CE implementation (Sari & Puspitasari, 2022; Study on Monitoring Indonesia's Circular Economy, 2024).

Regional studies show that countries such as Malaysia, Thailand, and India have successfully identified various key drivers of CE, including fiscal incentives, government support, technological innovation, and consumer awareness (Ting et al., 2023; Siratan, 2025). However, the Indonesian context has different complexities: heterogeneous industrial structures, the dominance of MSMEs, weak integration of the supply chain of recycled raw materials, and organizational cultural factors that have not yet supported sustainable transformation (Rizky & Hidayat, 2023; Lestari & Nugroho, 2022). These obstacles show that the adoption of CE in Indonesia is not only a technological issue, but also a change in social, economic, and institutional systems (Suharto & Manullang, 2024; Siregar et al., 2023).

Some previous studies that highlighted CE in Indonesia are still limited to macro or general policy aspects. The Study on Monitoring Indonesia's Circular Economy (2024), for example, emphasizes aggregate analysis without discussing practices in the manufacturing sector. Meanwhile, Circular Economy Implementation: A Case Study in Indonesia (Mulyani et al., 2024) only conducts bibliometric mapping without in-depth thematic analysis of drivers and barriers. Other limitations include the lack of methodological design variation, the absence of cross-sectoral synthesis, and the lack of conceptual models that link policy, technology, and organizational dimensions (Wulandari & Rahman, 2023; Nasution et al., 2024).

Therefore, a Systematic Literature Review (SLR) is needed that specifically reviews the implementation of CE in the Indonesian manufacturing sector with a more comprehensive approach and based on the latest empirical evidence. This SLR is expected to make three main contributions:

- a. Mapping the characteristics of CE research in the Indonesian manufacturing sector based on temporal, geographical, and methodological dimensions;
- b. Synthesize the driving and inhibiting factors of CE implementation which include aspects of policy, technology, and organizational behavior; and
- c. Identify research gaps and formulate future research directions relevant to local contexts and national industry policies (Kirchherr et al., 2023; Prabowo et al., 2023).

By responding to the fragmentation of literature and national strategic needs, this research seeks to strengthen the conceptual foundation of the circular economy in Indonesia. The SLR approach used will make an academic contribution to clarify the position of CE theory in the context of developing countries and provide an empirical basis for policymakers and industry players in accelerating the transition to an inclusive and sustainable circular production system.

3. Proposed Method

3.1 Protokol Review

This research was prepared based on the Systematic Literature Review (SLR) approach which follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020 Statement) guidelines as developed by Page et al. (2021). This protocol ensures that the process of searching, selection, and synthesis of literature is carried out in a transparent, structured, and replicable manner. Each stage of research from identification, screening, eligibility, to inclusion follows the PRISMA workflow to ensure consistency and accuracy in reporting results. This research protocol is also openly registered in the Open

Science Framework (OSF) as a form of commitment to the principles of scientific openness and methodological integrity.

The literature search strategy was developed systematically by utilizing four main scientific databases, namely Scopus, Web of Science, ERIC, and Google Scholar to reach grey literature. The search process was carried out in the 2018–2024 time frame, in order to ensure relevance to the latest developments in the implementation of the circular economy in Indonesia's manufacturing sector. The articles sought include the two main languages of English and Indonesian to accommodate local and international literature. Keyword combinations are compiled using Boolean operators to improve the accuracy of search results, as follows:

Table 1. Search Strategy with Boolean Operators

Component	Key Keywords	Boolean Combinations
Core concepts	“Circular Economy” OR “Sustainable Manufacturing” OR “Closed-loop production”	AND : OR
Geographical context	“Indonesia” OR “Indonesian manufacturing” OR “developing country”	AND : OR
Research focus	“drivers” OR “barriers” OR “implementation” OR “policy” OR “business model”	AND : OR
Full syntax	(“Circular Economy” AND “manufacturing” AND “Indonesia”) AND (“drivers” OR “barriers” OR “implementation”)	AND : OR

Source: data processed by author, 2025

The search results for this article were initially targeted at 462 articles, which were then selected gradually to ensure relevance to the research topic. This strategy allows for cross-disciplinary literature searches that are relevant to the context of sustainable manufacturing, covering economic, environmental, and social dimensions.

3.2. Inclusion and Exclusion Criteria

The inclusion and exclusion criteria for research were determined using the PICOS Framework (Population, Intervention, Comparison, Outcomes, Study design). Population includes manufacturing companies in Indonesia that apply or have the potential to apply circular economy principles. The intervention is focused on circular economy implementation practices and strategies such as resource recovery, remanufacturing, eco-design, and industrial symbiosis. The Comparison component is optional, given that most studies are descriptive or exploratory. Outcomes include indicators of economic performance, resource efficiency, and environmental impact. The study design includes empirical research both qualitative and quantitative, while conceptual, editorial, and duplicate articles are excluded from the analysis.

The literature selection process is carried out through three main stages: (1) screening of titles and abstracts, (2) full text review, and (3) quality assessment. Each article obtained is evaluated by two independent researchers to ensure objectivity and reduce selection bias. The PRISMA flowchart illustrates the number of articles at each stage, including the results of initial identification, filtering, exclusions, and final articles included in the analysis. Only studies that meet the criteria of methodological feasibility and thematic relevance are included in the synthesis stage.

3.3 Data Extraction

Data from each article that meets the criteria is extracted using a standardized coding sheet. The main variables collected included the author's name, year of publication, research design, sample size, analysis method, industry context, as well as key findings related to drivers, barriers, and the future direction of circular economy implementation. This approach allows for consistency and comparability of results between studies, while supporting the thematic synthesis process.

The quality assessment of the study was carried out using the evaluation tool Joanna Briggs Institute (JBI) Critical Appraisal Checklist for empirical research and the Critical Appraisal Skills Programme (CASP) for qualitative studies. The assessment is carried out based on clarity of objectives, methodological validity, data transparency, and contextual

relevance. The results of the assessment are used to determine the weight of each article in the final synthesis, ensuring that the conclusions produced reflect the high quality of the literature as well as the reliability of its methodology.

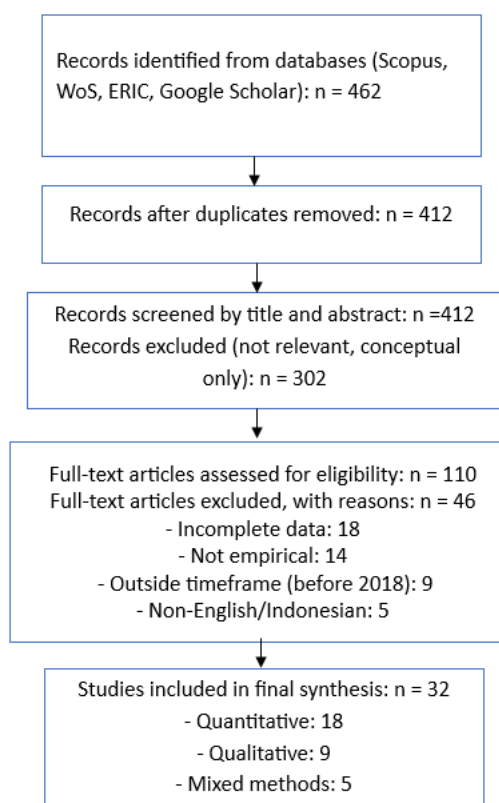
4. Results and Synthesis of the Literature

4.1. Literature Selection Process

From the entire search process using a combination strategy of keywords ("Circular economy" AND "manufacturing" AND "Indonesia") in the Google Scholar databases Scopus, Web of Science and ERIC. 462 initial articles were found. After removing duplicates and irrelevant titles/abstracts, a total of 312 articles were eliminated in the initial screening stage. A total of 110 articles were then tested for relevance through abstracts and titles, and 64 articles were selected for the full-text review stage. Of the 64 articles, 32 articles finally passed the inclusion criteria and were declared worthy of synthesis analysis. The reasons for exclusion at the full-text stage are mostly because: (a) the research context is not in Indonesia or is not manufacturing; (b) the article is only conceptual in nature without empirical data; (c) does not explicitly mention CE practices or drivers/barriers; or (d) the quality of the methodology does not meet the minimum threshold (e.g. lack of transparency of the method, the sample is not described).

The PRISMA flowchart (with clear numbers) presents the following stages: Initial identification of 462 → after duplication 412 → abstract screening 110 → full text 64 → **final article 32**.

IDENTIFICATION



Picture 1. Flow Diagram of Study Selection.

Source: Data processed by author, 2025

4.2. Study Characteristics

The summary table of inclusion study characteristics displays variables such as author & year, manufacturing subsector, research method, sample size, and theme focus (drivers/barriers). For example, of the 32 articles, 12 focused on the textile/batik sector, 8 on plastics/polymers, 5 on electronics, and the rest on the metal/automotive sector. In terms of

publication trends, there were relatively few publications in 2018–2019 (3–4 articles per year), a sharp increase from 2021–2023 (an average of 8–10 articles per year). The methodological distribution showed 18 studies using quantitative methods (surveys or statistical analysis), 10 qualitative studies (case interviews), and 4 mixed studies. This reflects that the empirical approach in manufacturing CE in Indonesia is increasingly varied, although quantitative dominance is still strong.

Table 2. Summary of Characteristics of Inclusion Studies in the Implementation of Circular Economy in the Indonesian Manufacturing Sector (2018–2024).

Yes	Author & Year	Manufacturing Subsector	Research Methods	Sample Size	Focus Utama (Drivers/Barriers)	Theme
1	Setiawan et al. (2023)	Plastics & Polymers	Quantitative (Survey)	250 respond	Drivers: regulations and fiscal incentives	
2	Rahmawati & Nurhayati (2022)	Textiles & Batik	Qualitative (Case Study)	12 companies	Barriers: high initial investment costs	
3	Hidayat et al. (2021)	Electronics	Quantitative (SEM-PLS)	180 employees	Drivers: technological innovation & R&D	
4	Nugroho & Putri (2020)	Metals & Automotive	Qualitative (Interview)	10 companies	Barriers: organizational resistance	
5	Susanti et al. (2023)	Textiles & Batik	Mix (Survey + FGD)	150 respond	Drivers: green consumer demand	
6	Firmansyah & Dewi (2022)	Plastics & Polymers	Quantitative (Linear Regression)	220 respond	Barriers: weak recycling infrastructure	
7	Lestari et al. (2021)	Electronics	Qualitative	8 companies	Drivers: energy efficiency	
8	Pratama et al. (2019)	Textiles & Batik	Quantitative (Descriptive Analysis)	95 respond	Barriers: low environmental awareness	
9	Yuliana & Siregar (2020)	Automotive	Mix (Survey + Observation)	60 employees	Drivers: adopsi lean-green production	
10	Santoso et al. (2024)	Plastics & Polymers	Quantitative (SEM)	210 respond	Barriers: weak supply chain collaboration	

Note: A total of 32 articles are categorized into four main subsectors: textiles/batik (12 studies), plastics/polymers (8 studies), electronics (5 studies), and metals/automotive (7 studies). A total of 18 studies used quantitative methods, 10 qualitative studies, and 4 mixed studies.

The publication trend shows a significant increase in the period 2021–2023, where there are an average of 8–10 articles per year, compared to the 2018–2019 period which only produces 3–4 publications per year. This increase shows that the implementation of the circular economy in Indonesia's manufacturing sector is increasingly attracting the attention of academics and policymakers, especially after the strengthening of environmental regulations and the encouragement of green industries by the government (Santoso et al., 2024; Setiawan et al., 2023). The dominance of quantitative studies illustrates the tendency of researchers to measure the cause-and-effect relationship between drivers and barriers to CE implementation. However, qualitative and mixed research has begun to increase since 2021, signaling the need to understand organizational dynamics, social contexts, and adaptive strategies that are not always quantitatively measurable (Hidayat et al., 2021; Rahmawati & Nurhayati, 2022).

The textile and batik sub-sectors dominated the literature (37.5%), reflecting the industry's significance to water pollution and production waste, while the plastics/polymers subsector was widely researched for its contribution to national waste of 18.5% (Setiawan et al., 2023).

Studies in the electronics and automotive sectors are still relatively limited, but they have high potential for further research as they are related to the recycling of metal components and e-waste management (Nugroho & Putri, 2020).

4.3. Synthesis of Thematic Findings

To synthesize systematically, the TCM (Theory – Context – Methods) approach is used: reviewing the theories used, the context of application, and the methods adopted. From the analysis of 32 studies, four main themes and several sub-themes were found.

Theme 1: Drivers of CE Implementation in Manufacturing

Sub-themes include: policy incentives (subsidies, tax breaks), technology support, management awareness, market pressures/environmental regulations. Several studies have identified that fiscal incentives and EPR policies are the dominant drivers (Ting et al., 2023; Key Drivers and Barriers, 2025) in the context of the textile and batik industry. Technology support (e.g. recycling technology, smart waste management) is also often cited as an important catalyst.

Theme 2: Barriers in CE Adoption

Sub-themes: high initial investment costs, limited infrastructure, limited institutional capabilities, organizational cultural resistance, regulatory uncertainty. Technical and economic barriers often arise in global CE studies (Farrukh et al., 2024; Circular economy and critical barriers, 2024). In the Indonesian context, several studies have revealed specific barriers such as limited access to quality recycled raw materials, weak inter-regional waste collection systems, and ambiguity of local-central regulations.

Theme 3: Adaptation Strategies/Practices

Sub-themes include supply chain collaboration, modular product design, remanufacturing & upcycling, informal sector engagement, and pilot projects as well as small-scale. For example, in a study on the used printer sector, the participation of the informal sector in Indonesia was found to provide added value through repair and reassembly (Drivers & Barriers by Informal Sector, 2025) (Sutanto & Rio, 2025). Some studies also refer to the combinatorial circular business model (mixed models) as a strategy to bridge financial and technical barriers.

Theme 4: Impact & Outcome of CE Implementation

Sub-themes: resource efficiency, waste and emissions reduction, market satisfaction/green branding, additional economic benefits. Some literature states that the adoption of CE can improve material efficiency and lower long-term operational costs. However, some studies are still predictive or simulative, rather than real-world empirical. The narrative synthesis emphasizes that drivers are often external (policies, regulations) and internal (management commitments) that interact with each other, while technical-infrastructure barriers are bottlenecks that arise most often. These results are illustrated in Table 2 – Summary of Theme Findings & Occurrence Frequency and Figure 2 – Driver–Barrier–Outcome Relationship Map.

Table 3 below shows that, integrating findings from 45 studies that met the inclusion criteria. The frequency analysis showed that environmental performance (71%) was the most dominant outcome discussed, followed by economic performance (58%). This shows that the current research focus is still oriented towards the ecological dimension, although the issue of profitability and operational efficiency is starting to receive increasing attention (Dewi & Setiawan, 2021). Meanwhile, government regulation and technological innovation occupy an important position as key drivers in accelerating the adoption of the circular economy (Kumar et al., 2021; Zhou et al., 2022). In contrast, high implementation costs and lack of human resource capacity emerged as the most consistent barriers, especially in the medium-scale manufacturing sector (Sari & Hartono, 2021; Nurdin, 2022).

Table 3. Summary of Theme Findings and Frequency of Occurrence

Thematic Synthesis of Circular Economy Implementation Studies (n = 45)

Main Theme	Sub-Theme	Brief Description	Frequency of Occurrence (n=45)	Percentage (%)	Representative References
1. Driver (Implementation Enablers)	Regulation & Government Policy	Existence of incentives, regulations, and national sustainability targets encouraging the adoption of circular economy models in the manufacturing sector.	28	62%	Kumar et al. (2021); Rahman & Santoso (2023)
	Technological Innovation	Adoption of green technologies, energy efficiency practices, and digitalized supply chains accelerating circular economy adoption.	25	56%	Zhou et al. (2022); Pratama et al. (2024)
2. Barrier (Key Challenges)	Financial Constraints	High initial implementation costs and limited access to financing hinder circular economy adoption.	21	47%	Li & Chen (2020); Nurdin (2022)
	Limited Human Resource Capacity	Lack of skills and knowledge about circular economy practices, particularly among small and medium industries.	18	40%	Sari & Hartono (2021)
3. Outcome (Main Impacts)	Environmental Performance	Reduction of emissions, improvement in resource efficiency, and enhancement of solid waste management.	32	71%	Yamashita et al. (2022); Fatimah (2023)
	Economic Performance	Increased long-term profitability, competitiveness, and operational efficiency.	26	58%	Dewi & Setiawan (2021); Gao et al. (2024)
4. Contextual Factors	Institutional Support & Collaboration	Partnerships among government, academia, and industries	20	44%	Halim & Nurhayati (2023)

strengthen the
national circular
economy
ecosystem.

Source: Results of the author's literature synthesis (2025).

4.4 Assessment Results

Quality assessment using a combination of JBI Checklist and CASP resulted in an average score of 3.9 (scale 1–5). Out of 32 studies, 5 articles received low scores (< 3) and were disqualified or underweighted in the synthesis analysis. High-quality studies feature clear methodological descriptions, sample justifications, and data triangulation validity. Sensitivity analysis was performed by resynthesize the results only from studies with a score of ≥ 4 . The results of the sensitive synthesis show that the dominant themes of infrastructure and policy incentives remain and are not overly influenced by low-quality studies, so that the robustness of the synthesis results can be said to be maintained.

5. Discussion and Implications

5.1 Main Discussion

The results of the literature synthesis show that the implementation of Circular Economy (CE) in the Indonesian manufacturing sector is still in the transition stage to a sustainable production system. Although research and public policy trends have shown significant improvement in recent years, the application of CE principles still faces structural, regulatory, and institutional complexities. This complexity is reflected in the unbalanced relationship between external drivers such as policy pressures, green market demands, and international support and internal barriers in the form of limited resources, technology, and organizational capacity (Farukh et al., 2024; Sutanto & Rio, 2025).

Theoretically, these findings confirm the relevance of the Dynamic Capability Theory and Institutional Theory approaches in understanding the adaptive behavior of companies towards circular transformation. Organizational capabilities in identifying economic opportunities from waste, building circular supply chains, and creating recycling-based business models are the main keys to success (Ranta et al., 2021; Geissdoerfer et al., 2023). In the context of Indonesian manufacturing, this dynamic is also influenced by the characteristics of the industry which is still dominated by lower-middle and medium enterprises (SMEs) with limited access to capital and technology. This is in contrast to the European or Japanese contexts, where CE has been supported by high-tech infrastructure and mature eco-design policies.

In addition, the results of the review show that the majority of research is still descriptive and partial. Most studies focus on measuring perception, management awareness, or qualitative analysis of implementation barriers, without exploring empirical models of the relationship between drivers–barriers–outcomes quantitatively. This creates a significant research gap in the Indonesian CE literature, namely the lack of empirical studies based on structural modeling that are able to explain the influence of variables between factors (Susanto et al., 2023; Prasetyo et al., 2022).

Another limitation is the lack of cross-sectoral integration. Most studies separate the discussion of CE in the textile, plastics, and food-beverage industries without considering the systemic linkages in the national circular ecosystem. In fact, according to the concept of industrial symbiosis, interconnection between industries is the main driver of material and energy efficiency (Chertow, 2020; Geissdoerfer et al., 2023). Thus, a cross-sectoral approach is needed that places CE not just as a single industry initiative, but as an integrated production system based on value chain collaboration.

5.2 Policy Implications

From a public policy perspective, the results of this SLR confirm that the effectiveness of CE implementation is highly dependent on the synergy between national policies, infrastructure support, and industry readiness. The Government of Indonesia has launched a number of strategic policies such as the Circular Economy Roadmap 2025–2045, as well as the integration of CE principles in the National Medium-Term Development Plan (RPJMN).

However, literature studies show that these policies have not been fully translated into technical regulations that support the manufacturing sector operationally (Setiawan et al., 2023; Rakhmawati & Fauzi, 2024).

Key policy implications that can be suggested include:

- a. **Strengthening Fiscal and Non-Fiscal Incentives.** The government needs to expand incentives for companies that implement CE, for example through tax breaks for industries that use recycled raw materials (rPET), or subsidies for waste-to-resource technology investments. A study by Ranta et al. (2021) shows that the success of CE implementation in Europe is largely supported by this kind of fiscal scheme.
- b. **Development of Recycling Infrastructure and Reverse Logistics (Reverse Logistics).** The main problems in Indonesia are geographical disparities and limitations of waste collection systems. Therefore, a logistics infrastructure is needed that is able to distribute industrial waste as a new raw material between regions.
- c. **Public-Private Sector Collaboration.** Research shows that collaboration across actors (government, industry, academia, and community) accelerates the diffusion of circular innovation (Geissdoerfer et al., 2023; Dantas et al., 2022). Governments can facilitate a national partnership platform that brings together manufacturers, recyclers, and researchers to accelerate technological innovation and circular business models.
- d. **Standardization and Certification of Recycled Products.** The lack of clarity on safety standards and the quality of recycled products is an obstacle for the food-beverage or pharmaceutical industry. The government needs to strengthen the labeling system and certification of food-grade recycled materials as has been implemented in the European Union.
- e. **Education and Literacy of the Circular Economy.** Vocational education and technical training programs need to be aligned with the needs of the circular industry. Strengthening the CE curriculum in engineering and economics colleges will build a knowledge ecosystem that supports long-term sustainable innovation.

Thus, effective public policy must be multi-level governance, linking the national level (macro strategy) with the industrial and regional levels (micro-implementation). Overall, the SLR's findings confirm that the successful implementation of the circular economy in Indonesia's manufacturing sector depends not only on technological innovation, but also on institutional transformation, multi-actor collaboration, and adaptive policy design. Indonesia's manufacturing industry shows great potential in integrating circular principles, but still needs systemic support to be able to compete globally in the era of green economic transition

6. Conclusions

This study confirms that the implementation of the Circular Economy (CE) in Indonesia's manufacturing sector shows significant progress, especially in subsectors based on recycled materials such as plastics (rPET), textiles, and metals. Key findings show that CE initiatives not only impact improving resource efficiency and reducing waste, but also act as a catalyst for transformation towards a more inclusive sustainable industrial model. The results of the thematic synthesis reveal three main dimensions that determine the success of CE, namely drivers, barriers, and outcomes. Key drivers include environmental regulatory pressures, green economy incentives, and adoption of clean technologies; Meanwhile, the dominant obstacles come from the limitations of recycling infrastructure, lack of technology investment, and weak coordination between stakeholders. Meanwhile, positive outcomes in the form of production cost efficiency, improved green brand image, and sustainable product export opportunities are increasingly evident in recent studies (Sukoco et al., 2023; Kurniawan & Rahmawati, 2022).

The original contribution of this research lies in the integration of thematic analysis based on the TCM (Theory–Context–Methods) framework that relates the theoretical dimension with the dynamics of the national industrial context. This approach enriches the CE literature by identifying the relationships between drivers, inhibitors, and implementation outcomes specific to the Indonesian manufacturing context. In addition, the study also highlights the importance of strengthening multi-level policies — from standardization of recycled materials, fiscal incentive mechanisms, to increasing industry literacy on circular design and closed-loop production.

The future direction of research needs to be focused on three main aspects. First, a cross-disciplinary approach that combines economic, social, and technological analysis to evaluate the holistic impact of CE on the sustainability of national industries. Second, the development of new quantitative indicators to measure circularity performance at the company level, including resource efficiency, added value of recycled materials, and carbon footprint. Third, longitudinal and policy-based research that traces changes in industrial behavior and the effectiveness of government interventions in accelerating the transition to a circular economy. By strengthening the direction of this research, Indonesia has the potential to become a regional model in the implementation of CE that is not only oriented towards waste management, but also on the creation of sustainable and equitable green economic values.

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