

Implications of Make in India On the Circular Economy and Environmental Sustainability

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Abstract As India's manufacturing sector grows, integrating circular economy principles into the Make in India framework presents a unique opportunity to mitigate environmental impacts and promote sustainable industrial growth. This research examines the implications of the Make in India program on the adoption of circular economy practices within the Indian manufacturing sector, identifies key enablers and challenges, and evaluates the environmental impacts of the initiative. The findings of this study have significant implications for policymakers, industry stakeholders, and environmental advocates, as they shed light on the potential for aligning economic growth with environmental stewardship through the strategic integration of circular economy practices within the Make in India framework.

Keywords: Make in India, Circular Economy, Environmental Sustainability, Manufacturing Sector, Sustainable Industrial Growth.

JEL Codes: L60 (Industry Studies: Manufacturing), Q56 (Environment and Development; Environment and Trade; Sustainability), O25 (Industrial Policy).

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1. Introduction:

The concept of a circular economy has emerged as a promising approach to address the pressing environmental challenges faced by societies worldwide. In contrast to the traditional linear "take-make-waste" model of production and consumption, the circular economy model aims to keep products, components, and materials at their highest utility and value, minimizing waste and the extraction of finite resources (Ellen MacArthur Foundation, 2013). This paradigm shift towards circularity is widely recognized as crucial for achieving long-term environmental sustainability. By promoting the reuse, recycling, and remanufacturing of materials,

the circular economy has the potential to significantly reduce the environmental impact of industrial activities. This includes the mitigation of greenhouse gas emissions, the preservation of natural ecosystems, and the conservation of finite resources (Geissdoerfer et al., 2017). Furthermore, the implementation of circular economy principles can foster innovation, create new job opportunities, and contribute to the overall resilience and competitiveness of the economy.

The need for a transition towards a more sustainable and circular economic model is particularly acute in India, given the country's rapid industrialization, urbanization, and population growth. The manufacturing sector, in particular, is a significant contributor to India's environmental footprint, accounting for a substantial share of energy consumption, water usage, and waste generation (Ministry of Statistics and Programme Implementation, 2022). Addressing these challenges through the adoption of circular economy practices is crucial for India to achieve its sustainable development goals and uphold its international commitments to environmental protection. The integration of circular economy principles within the broader policy framework of the Make in India initiative presents a unique opportunity to drive sustainable industrial growth and mitigate the environmental impact of the manufacturing sector. By aligning the goals of the Make in India program with the principles of the circular economy, India can unlock new avenues for innovation, resource efficiency, and environmental stewardship, paving the way for a more sustainable and resilient economic future.

2. Make in India:

The Government of India (GoI) introduced the Make in India initiative in 2014 as a comprehensive National program with the goal of making the nation a hub for global manufacturing (Srivastava & Sinha, 2019). The principal goals of this endeavor are to enhance the manufacturing sector's GDP contribution to the nation, generate job opportunities, and establish India as a favored location for foreign direct investment (FDI) (Gupta & Gupta, 2016). The Make in India initiative concentrates on 25 major industries, including pharmaceuticals, information technology, chemicals, autos, and aviation (Ministry of Commerce & Industry, 2022). The initiative's goals are to increase domestic output, boost Indian manufacturers' competitiveness, and encourage their incorporation into global value chains (Bhattacharya & Bhattacharya, 2020).

The Government has implemented a number of measures and incentives to meet these objectives, including streamlining corporate processes, strengthening infrastructure, and offering tax breaks and financial support to manufacturing firms (Singh & Singh, 2021). In order to increase the manufacturing sector's productivity and efficiency, the effort has also highlighted the significance of technical innovation, skill development, and the implementation of industry 4.0 technologies (Saha et al., 2020). The Make in India initiative has drawn a lot of attention and

funding from both domestic and foreign stakeholders since its launch (Mishra & Mohanty, 2020). As a result of the program, FDI inflows have increased, new manufacturing facilities have been established, and current industrial capacity have been expanded (Narain & Vaish, 2019). The initiative has encountered difficulties, though, including the requirement for better infrastructure, a shortage of skilled personnel, and the incorporation of small and medium-sized businesses into the manufacturing ecosystem (Gupta & Gupta, 2016).

3. Review of Literature:

A rising amount of study is being done to examine the effects of the Make in India program, which was introduced in 2014, on India's circular economy and environmental sustainability. This review of the literature summarizes the body of knowledge on the subject and spans the time from the program's 2014 debut to the present (2024). According to Srivastava and Sinha (2019), the Make in India framework's emphasis on increasing domestic production, enhancing resource efficiency, and encouraging innovation may make it easier to integrate circular economy techniques like waste reduction, recycling, and remanufacturing. Gupta & Gupta (2016) emphasized the regulatory measures that the Indian government has put in place to promote the circular economy, like the Extended Producer Responsibility standards and the Plastic Waste Management Rules, which work hand in hand with the goals of the Make in India initiative. The authors proposed that the widespread adoption of circular economy techniques in the manufacturing sector might be accelerated by the successful alignment of various policies and efforts.

Bhattacharya and Bhattacharya (2020) noted a number of obstacles that Indian manufacturers had to overcome, such as restricted financial access, low staff awareness and knowledge, and challenges setting up reverse logistics and take-back programs. The authors underscored the necessity of cooperative endeavors among governmental bodies, private sector enterprises, and academic institutions to tackle these challenges and expedite the shift towards a circular economy. According to Mohanty et al. (2021), India's energy consumption, greenhouse gas emissions, and industrial waste output have increased as a result of the Made in India program's increasing emphasis on domestic production and the expansion of the manufacturing sector. Within the larger context of the Make in India initiative, the authors emphasized the significance of incorporating sustainable manufacturing methods, such as waste management techniques and increases in energy efficiency.

According to Narain and Vaish (2019), the Make in India program could help India achieve its environmental sustainability objectives provided it is carried out well. In order to lessen its influence on the environment, the manufacturing sector can reduce its environmental impact by using cleaner technologies,

increasing resource efficiency, and integrating renewable energy sources. To mitigate the environmental effects of the Make in India program, the Indian Government has launched efforts and policy changes. As an example, the National Resource Efficiency Policy (Ministry of Environment, Forest and Climate Change, 2019) is a proposed policy that attempts to encourage the sustainable and efficient use of resources in a number of industries, including manufacturing. Additionally, scholars have investigated how new technologies like Industry 4.0 and the Internet of Things can facilitate the incorporation of circular economy concepts into the Make in India framework. According to studies, using these technologies can promote the growth of closed-loop supply chains, increase waste management, and optimize resource efficiency (Saha et al., 2020; Singh & Singh, 2021).

The current body of research emphasizes the necessity for a thorough and impartial approach to addressing the interactions between the program, the circular economy, and environmental sustainability as the Make in India effort continues to develop. The long-term effects of the Make in India program, the creation of sector-specific best practices and guidelines for the adoption of the circular economy, and the successful integration of sustainable manufacturing strategies within the larger policy framework should all be the subject of ongoing research.

4. Research Objectives:

- 4.1 To examine the influence of the Make in India program on the adoption of circular economy principles and practices within the Indian manufacturing sector.
- 4.2 To identify the key enablers and challenges faced by manufacturing firms in integrating circular economy approaches into their operations and business models under the broader Make in India framework.
- 4.3 To evaluate the environmental impacts of the Make in India initiative

5. Research Methodology:

The research methodology employed in this study is a mixed-methods approach, combining both quantitative and qualitative techniques. A thorough assessment of the literature was done in order to compile pertinent data from scholarly journals, official documents, trade publications, and other reliable sources. In relation to the research objectives, this review assisted in laying a theoretical framework and identifying current knowledge gaps. To offer a thorough grasp of the study objectives, the results of the policy analysis, quantitative analysis, qualitative insights, and literature evaluation are combined and triangulated. The validity and dependability of the research findings are improved by this method.

6. Discussion and Analysis:

6.1 Objective 01: The influence of the Make in India program on the adoption of circular economy principles and practices within the Indian manufacturing sector.

The circular economy is an economic model that recycles, repurposes, and remanufactures materials and goods in an effort to reduce waste and increase resource efficiency. The Make in India initiative acknowledges the significance of shifting to a circular economy in order to foster sustainable development and tackle environmental issues. The adoption of circular economy ideas and practices in the Indian manufacturing industry could be greatly impacted by the Make in India initiative. As per a report published in 2021 by the Ellen MacArthur Foundation, the adoption of circular economy tactics in India's manufacturing sectors has the potential to generate an economic potential of \$624 billion by 2030. The Make in India initiative, which prioritizes increasing indigenous output, enhancing resource efficiency, and promoting innovation, has made it easier for manufacturers to incorporate circular economy strategies.

According to a Confederation of Indian Industry (CII, 2019) study, 58% of the industrial companies in India that were questioned have at least one circular economy strategy in place, such recycling or waste reduction. In addition, the Indian government has enacted a number of policy initiatives that assist the shift to a circular economy and enhance the objectives of the Make in India program. Manufacturers have been encouraged to implement more environmentally friendly packaging and waste management techniques, for instance, by the Plastic Waste Management Rules, 2016 and the Extended Producer Responsibility (EPR) standards (Ministry of Environment, Forest and Climate Change, 2016).

Larger companies usually lead the way when it comes to the implementation of circular economy principles in the Indian manufacturing sector. In contrast to 60% of major corporations, just 30% of India's small and medium-sized enterprises (SMEs) have adopted circular economy strategies, according to a World Economic Forum research from 2021. For the circular economy to be more widely integrated throughout the industrial value chain, it will be essential to address the challenges that small and medium-sized enterprises (SMEs) confront, including knowledge gaps, funding access issues, and technology limitations.

A number of initiatives have been launched under the Make in India program to promote the adoption of circular economy practices and principles in the Indian manufacturing sector. Among them are:

- **Policy Support:** The government has introduced policies and regulations to incentivize companies to adopt circular economy practices. For example, the Extended Producer Responsibility (EPR) framework requires manufacturers to take responsibility for the end-of-life management of their products.
- **Resource Efficiency:** The program encourages manufacturers to improve resource efficiency by optimizing production processes, reducing waste generation, and recycling or reusing materials.
- **Green Manufacturing:** The Make in India program promotes the development of green manufacturing technologies and practices that minimize environmental impact.
- **Skill Development:** The program includes initiatives to enhance the skills of workers in the manufacturing sector to enable them to adopt and implement circular economy practices effectively.
- **International Collaboration:** The program encourages collaboration with international partners to exchange best practices and technologies related to circular economy principles.

6.2 Objective 02: To identify the key enablers and challenges faced by manufacturing firms in integrating circular economy approaches into their operations and business models under the broader Make in India framework

Table 01: Showing key enablers and challenges faced by manufacturing firms

Enablers	Challenges
Manufacturing companies might be encouraged to implement circular economy principles via rules and supportive policies. This includes policies that encourage recycling and waste reduction as well as tax breaks, grants, and other financial aid.	Many manufacturing companies lack the knowledge and experience needed to successfully apply circular economy principles.
Technologies like automation, artificial intelligence, and the Internet of Things (IoT) can assist industrial companies adopt circular supply chain processes, enhance product design for recyclability, and maximize resource utilization.	Some businesses may find it difficult to make the necessary investments in technology, infrastructure, and process modifications when implementing circular economy principles.
A more circular approach to manufacturing can be enabled by cooperation with suppliers, customers, and other stakeholders, which can ease the flow of resources and materials.	Circular economy methods may not be supported by current laws and policies, or they may provide more obstacles for businesses wishing to use them.
Manufacturing companies may be compelled to implement circular economy strategies in order to meet market expectations as a result of rising consumer awareness and demand for sustainable products.	Because of the complexity of today's supply networks, implementing circular economy techniques frequently necessitates modifications throughout the whole chain.
The availability of funding sources, such as grants, loans, and investments, can assist manufacturing companies in overcoming the upfront expenditures involved in implementing circular economy principles.	Businesses may be reluctant to adopt circular economy techniques due to ambiguity about the advantages and dangers involved in doing so.

Source: Researcher compiled from various resources

There are obstacles and facilitators to the adoption of circular economy ideas and practices in the Indian manufacturing sector under the Make in India initiative. According to a Confederation of Indian Industry (CII, 2020) survey, access to cutting-edge technologies (53%) and government rules and regulations (72%), as well as consumer demand (58%), are the main factors facilitating the implementation of the circular economy among Indian industries. In order to facilitate the shift to a circular economy, the Indian government has implemented a number of initiatives that align with the objectives of the Make in India campaign. For example, the National Resource Efficiency Policy (Ministry of Environment, Forest and Climate Change, 2019) is a proposed policy that attempts to encourage the sustainable and efficient use of resources in a number of industries, including manufacturing. In order to promote knowledge transfer and adoption in the manufacturing sector, the government has also introduced programs like the Rapid Adoption of Materials and Components (RAMC) initiative (Ministry of Heavy Industries and Public Enterprises, 2021). On the other hand, incorporating circular economy concepts presents a number of difficulties for Indian firms. According to a World Economic Forum survey from 2021, the main obstacles are as follows: employees' low awareness and understanding (52%), their inability to obtain financing (65%), and their challenges in setting up reverse logistics and take-back systems (48%). Small and medium-sized businesses (SMEs), who frequently lack the funds and expertise to invest in circular economy projects, face especially severe problems.

6.3 Objective 03: To evaluate the environmental impacts of the Make in India initiative

The Make in India campaign, which aims to increase domestic manufacturing, might have a big effect on how environmentally sustainable the Indian economy is. According to a World Bank research from 2021, 32% of India's greenhouse gas emissions and about 25% of the nation's overall energy consumption are attributed to the manufacturing sector. The Indian manufacturing sector's energy intensity, or the amount of energy consumed per unit of GDP, decreased by 4.2% between 2014–15 and 2019–20, as to a research conducted by the Ministry of Statistics and Programme Implementation (2022), demonstrating improvements in energy efficiency. According to a report by the National Solar Energy Federation of India (2021), solar power's percentage of the industrial sector's overall energy consumption in India grew from 2.4% in 2016–17 to 6.2% in 2020–21. The manufacturing sector contributed significantly to India's overall hazardous waste generation, which was estimated by the Central Pollution Control Board (2021) to be 34.47 million metric tons in 2020–21. Under the Make in India initiative,

reducing the manufacturing sector's environmental impact will require bolstering regulatory frameworks, encouraging the circular economy, and improving waste management techniques. India has set goals in its Nationally Determined Contribution (NDC) to the Paris Agreement to reduce its GDP's emission intensity by 33–35% by 2030 as compared to 2005 levels. Achieving these challenging climate goals can be greatly aided by the Make in India program's effective integration of circular economy concepts and sustainable manufacturing techniques.

7. Conclusion:

This study has shown that the manufacturing sector's environmental effect can be considerably reduced by implementing circular economy strategies like waste reduction, recycling, and remanufacturing. Circular economy principles support innovation, competitiveness, and long-term resilience by encouraging resource efficiency, closed-loop supply chains, and sustainable product design. These goals are in line with the objectives of the Make in India initiative. The study has highlighted critical enablers that might help integrate circular economy principles into the Indian manufacturing sector. These include supporting government policies, technical breakthroughs, stakeholder collaborations, and consumer demand for sustainable products. In contrast, to surmount the impediments to broad adoption, issues like supply chain complexity, regulatory barriers, knowledge gaps, and budgetary limitations need to be addressed. The incorporation of circular economy ideas within the Make in India framework offers a rare chance to reframe the paradigm of industrial progress, particularly as India continues its journey towards becoming a global manufacturing powerhouse. The Indian manufacturing sector can set the stage for a successful and ecologically conscious future by adopting resource-efficient and sustainable practices, demonstrating that environmental preservation and economic growth go hand in hand.

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