A study on circular economy adoption in Indian MSMEs: exploring the circular economy practices in large industry

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Received 11 Sep 2025; Accepted 1 Oct 2025; Published 4 Nov 2025

DOI: https://doi.org/10.64171/JSRD.4.S1.64-74

Abstract

The existing linear economics system has been unsustainable whereby a lot of waste is produced and the natural resources are not utilized efficiently. To combat that, the Circular Economy (CE) has been presented as a universal option that will be regenerative and restorative, plus sustainable. To the Indian industrial environment and specifically the Micro, Small and Medium Enterprises (MSMEs), circular economy offers a new transformative paradigm in the realization of long term sustainability. To gain better insight in successful strategies and implementation techniques, this study also comprises an analysis of the case of the Reliance Industries, which is one of the largest conglomerates in India and has implemented such strategies related to CE approaches as efficient use of resources and reduction of waste. Findings suggest that Enablers and Barriers to CE adoption are the most frequently mentioned topics in the literature. Though there is a growing interest in adoption of CE practices by MSMEs in India, there are still various challenges which bedevil broad adoption of the practice. These are; low awareness, lack of finances and poor policy and regulation support. Considering both general trends and the micro-level of business operations, this paper will be implemented into the existing discussion on sustainable development and will highlight the crucial place of MSMEs in the shift toward the states of circular economy in India.

Keywords: Circular economy, Sustainability, Adoption, Indian MSMEs, Reliance industry

1. Introduction

The concept of circular economy (CE) being the revolutionary approach to sustainable economic development has become popular, however, in times of the increased awareness regarding environmental issues and restrictions that resources might face. Circular economy focuses heavily on concepts of recycling the resources, minimizing the wastes, along with using particles again to develop a stronger and more defined economic model as opposed to the traditional linear economy model that largely relies on a so-called take-make-dispose structure.

The concept of circular economy is gaining increasingly more interest among businesses and policymakers (Geissdoerfer *et al*. 2017). Borrowing CE techniques provides the developing economies such as India that has large Micro, Small, and Medium Enterprises (MSMEs) industry sector with the opportunity to enhance the effectiveness of their operations, promote long-term sustainability, and mitigate the impact on the environment. Being one of the key industries driving economic growth in India, MSMEs contribute significantly to the industrial output, innovation, and work creation. The following challenges that these businesses experience, like limited information access, technology, and funding, may limit their ability to pursue sustainable practices.

India largest conglomerate Reliance Industries Limited (RIL) has achieved a lot towards adoption of the circular economy concept in each of its business units. RIL also comprise several industries like consumer products, textiles, and manufacturing and is pivotal in shaping the course of the Indian circular economy. In exploring the CE practices in RIL, we can possibly find out a lot concerning how the MSMEs can enhance their competitiveness and how MSMEs can deal with the transition to sustainability. This paper aims at investigating circular economy adoption by Indian MSMEs through the case of circular economy practice at Reliance Industries Limited. By closely examining CE practices, including its waste management, resource efficiency and sustainable product design, we will identify best practice, impediments, and the role of legislative systems in facilitating this transition. It is the wish of this study to uncover more viable information about the circular economy potential and offer viable recommendations to the stakeholders on what can be done to ensure a more robust and sustainable Indian economy.

1.1. Research objectives

- To analyze the current state of the art in the existing research on the Circular Economy adoption in Indian Micro, Small and Medium Enterprises.

- To analyze and document the current circular economy practices implemented by Reliance Industries in its operations.
- To develop strategic recommendations for Reliance Industries and Indian MSMEs on scaling circular economy practices while enhancing sustainability and competitiveness.

Identify the potential areas of research and practice. The systematic literature review is a valuable technique to be used to reach our goal due to the transparency, and traceability. The findings can serve as an effective reference of interested scholars investigating the implementation of circular economy practices.

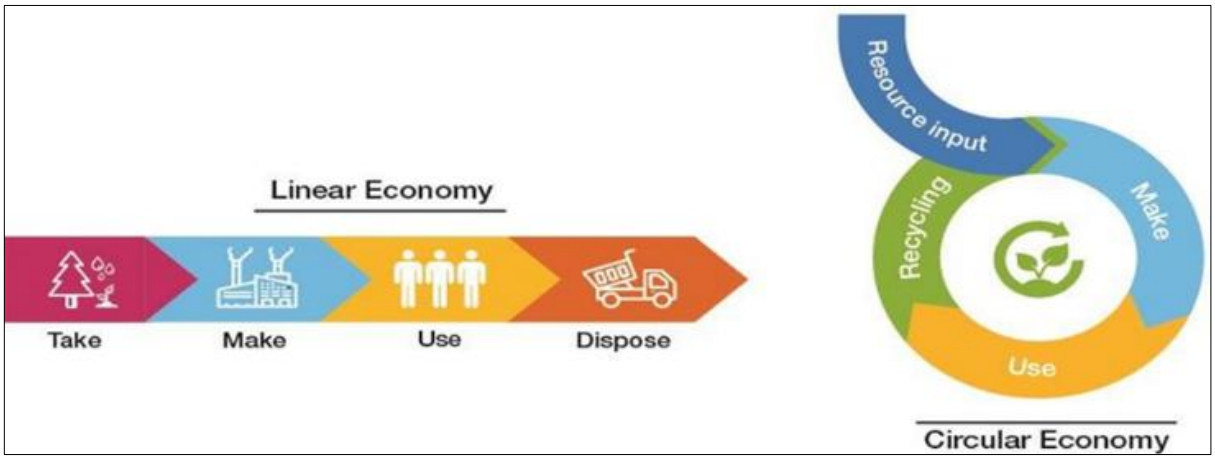
1.2. Background and significance

Circular Economy (CE) is a more sustainable development concept, which tries to make maximum use of resources and minimize waste. It is centered on the closed-loop systems wherein the resources, materials and the products are recycled, remanufactured and reused. The Indian economy largely depends on Micro, Small, and Medium-Sized Enterprises (MSMEs) with abounding challenges such as funding, knowledge gap, shortages of technology accessibility and regulatory roadblocks. This paper examines the CE practice of Reliance Industries that can be of versatile help to the MSMEs in India. The solutions can inform the business activities and make economic growth sustainable to social responsibility and the idea of a green environment.

2. Understanding circular economy

One of the most popular concepts in the field of environmental economics is the circular economy that constitutes a key feature of the Horizon in 2020 program developed by the EU (Sylvie Geissdoerfer & Felicitas Pietrulla, 2017). A circular economy is an industrial system that is designed to be restorative or regenerative and aims at decoupling growth with the use of finite resources. The paradigm of the circular economy is attracting the increasing interest of businesses and policymakers (Geissdoerfer *et al*. 2017). It aims at ensuring that components and products are designed to be reusable, repairable, and durable at desire, and that the production and disposal of products are programmed to recirculate technical and biological nutrients in a faster or more extensive fashion. Finally, it aims to be resource- smart. Through this process, the environmental degradation effect that a product causes in the lifecycle will be minimized (such environmental degradation impact of the chemicals, energy required during marketing of a product, resource consumption during production and waste volumes being recycled or used as a resource). According to studies, the circular economy could address the increasing complications related to resources by 2030, generate employment, stimulate innovation, and produce significant environmental benefits, and this would lead to the net positive impact of EUR 1.8 trillion (Ellen MacArthur Foundation, 2019). These are the basic concepts, which the transition between a linear and a circular manufacturing system is based on. To begin with, in the case of products, products themselves may become temporary sinks. The closed-loop systems are created under which the garbage is sold to another production system and the waste by-product becomes a source of raw material to come back to production system.

In the present-day world, the food system is producing enough food to meet the food needs of everyone on the planet, yet, about the entire third of food is lost during the consumption and supply chain activities (Ellen MacArthur Foundation and Google 2019). A circular economy is an economy in which the outputs of the products and services are shared and commonly traded in a system of lifecycles wherein the waste materials are perceived as resources to the succeeding activities. Regarding product life cycles, compared to the traditional linear ones, the circular economy looks very different and implies that we do not extract materials aimlessly on the face of the Earth, manufacture something out of them to get rid of them as waste at some point.



The model of linear economy and circular economy (Source: Author's Synthesis, 2021)

The volume of the extraction of natural values worldwide has been tripled since the turn of the century (Oberle *et al*. 2019). The circular economy aims to establish a sustainable world by preserving the environment and reversing the destruction by ensuring a sustainable globe as per the concept of corporate social responsibility. The primary goal of the circular economy

is preservation and creation of the goods and materials, which utilize resources and energy to make them. To minimize greenhouse gases, it intends to extend the life cycle of materials and goods concerning energy and resource-efficient in processing technologies. The circular economy also tries to increase the value of services and the duration of goods as well as the infrastructure sustaining them and lower the consumption of non-renewable resources. The concepts of the circular economy rely on three guiding principals, design led (Ellen MacArthur Foundation 2019):

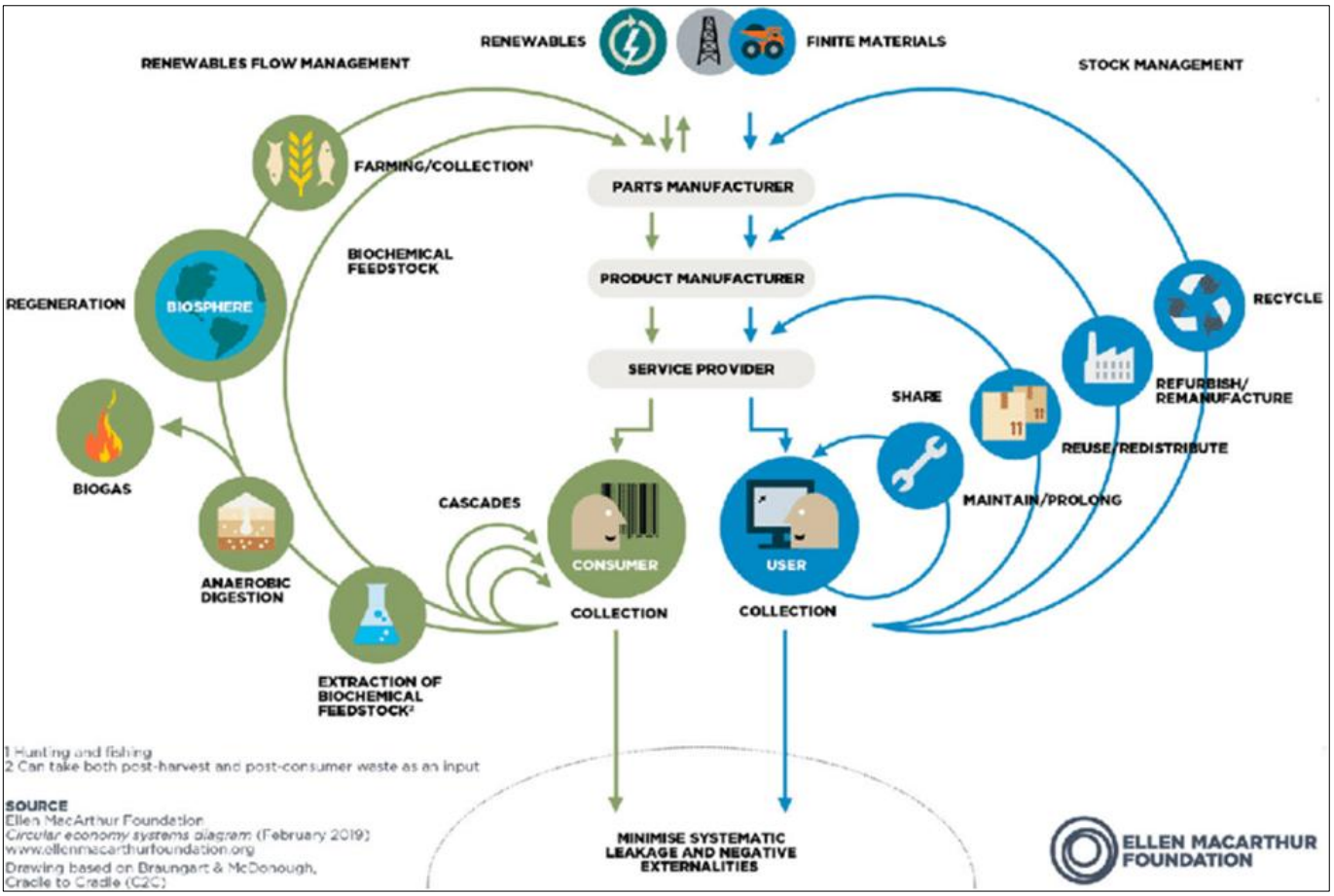
- Eliminate waste and pollution
- Circulate products and materials (at their highest value)
- Regenerate nature

3 R's of Circular Economy:

Reduce - Reduction in the consumption of non- renewable raw materials, resources, and emissions in the process of business as a viewer of a producer. A reduction in the rate of purchase and the longer service of the product as seen by the consumer point of view.

Reuse - Prolonging the life cycle of the products by reintroducing back to the economy after the given usage of these products and either via the existing or new channel.

Recycle - Recycling or reprocessing (shredding/melting) of the end of use materials or section of it to recover pure products that constitute similar or different productions.



Ellen MacArthur Foundation, Circular economy systems diagram (February 2019) www.ellenmacarthurfoundation.org.

The circular economy is gaining interest in the existing environment since the increasing trends such as the rise in energy prices and environment considerations are expected to cause further transformation of the way the global economy is run into a more sustainable and efficient use of resources based model. It is global awareness in the private sector of the necessity to integrate the concepts of the circular economy in the business strategies of companies. Circular economy is worth $1 trillion USD in total and probably will add up to another one trillion USD in future. The circular economy has created a serious paradigm shift in the policy, industry, and the society in the global front by way of good implementation of optimization of resources base value and minimization of waste at the end of a product lifespan.

3. Indian Micro, Small and Medium Enterprises (MSMEs)

Micro, Small and Medium Enterprise are the driving force behind the economic growth of any nation. Indian manufacturing sector comprises all the essential elements of transforming into the global industrial hub, large internal market with ample labour source and government policies such as make in India and skill India. Recent trends show the capacity of India to maintain its strong growth line.

The Indian manufacturing sector in India is dominated in major part by small, medium and micro industries which contribute about 45 percent of the manufacturing output and around 40 percent of the total exports. In addition to the notable contribution, they also develop entrepreneurship and

innovation in the Indian environment, it is essential to understand the role Micro, Small and Medium Enterprises (MSMEs) could play in order to achieve growth in the manufacturing industry.

The enterprises are divided into categories as elaborated under the Micro, Small and Medium Enterprises Development (MSMED) Act, 2006 which is dependent upon the level of investment made in the form of plant and machinery. The following definitions are given to the categories:

- **Micro enterprises:** Those enterprises whose investment in plant and machinery does not go beyond 2.5 million rupees (25 lakhs).
- **Small enterprises:** The enterprises whose investment amounts to over Rs. 2.5 million to a limit of Rs. 50 million (5 crores).
- **Medium business enterprises:** Enterprises whose investment is greater than 50 million India rupees (more than 10 crores) however, these enterprises fall below an investment of 100 million rupees (10 crores).

MSME definition has been revised on 13 May, 2020 through Aatmanirbhar Bharat Abhiyan (ABA) package to ramp up MSME sector and also increase the number of units which come under this definition and was further revised on June 1, 2020. The US innovation uses the turnover factor along with the investment in plant and machinery. Additional separation of service and manufacturing has been eliminated. Another significant provision is also that exports are not to be included in the turnover. The new categorization of the MSMEs took effect on July 1, 2020.

4. Circular economy and Indian MSMEs

The micro, small and medium enterprises (MSMEs) play an essential role in the economy of India since MSMEs are agents of employment generation, innovation in the economy, export and inclusive growth in the economy. The Micro, Small and Medium Enterprises (MSME) are regarded to be the backbone of Indian society developing in terms of economical growth. Indian MSMEs are responsible in generating nearly 30 percent of India GDP. Major products that the Indian MSME sector is exporting include textile, garments, various forms of shoes, rice and castor oil.

Even though the circular economy is very new material in India, already in the last five years the country has received over 1.8B in investments in subsectors. Estimates show that approximately 60 percent of the total deal activity and approximately 80 percent of the deal value concentrate on innovations of energy and sustainable mobility that are mitigation-oriented (Kaalari, 2021).

As predicted by the Ministry of External Affairs of the Government of India, the country will be the third largest economy in the world taking a share of 8.5 in the world GDP by 2030. With this regard, in the instance that the global circular economy might reach 4.5 trillion US dollars as it is projected, the circular economy in India can only approach 1 percent of that market, which is a US 45 billion opportunity in India (Ministry of External Affairs, 2022).

Micro, Small & Medium Enterprises (MSME) segment is among the most important players in shift towards sustainable development in India. Therefore, this segmental development is highly vital. Mechanisms of mentoring and supporting should be put in place to foster culture of innovation and entrepreneurship as well as enhancing understanding and knowledge regarding businesses and policy-makers to build so as to create circular business model and experts on the subject matter. To do this, India will require a profound ecosystem with players that promote and facilitate circular economy projects so that it can survive the financial, skills, market, knowledge and technological barriers.

5. Literature review

Table 1

Title	Objectives	Methodology	Research gaps
Building the circular economy into the SMEs: A behavioral perspective in modeling review (2023)	1. To investigate the factors influencing SMEs' adoption of Circular Economy practices. 2. To assess the attitudes, perceived behavior control, social pressure, and readiness of SME actors towards Circular Economy practices. 3. To analyze the impact of positive attitudes, social pressure, and facilitation on SMEs' commitment to circular economy practices.	1. The research analysed SMEs within Malang region in East Jakat, whereby a sample size of 75 companies was used to conduct the study. 2. Secondary and primary data were taken. 3. The assessment of aspects of the research entailed the measurement of research variables on the Likert Scale, which was on a five-point agreement scale. The collected variables were Attitude, Perceived Behavior Control, Social Pressure, Environmental Commitment and SME Readiness.	1. The researchers concentrated on SMEs within one or another geographic unit, and this can qualify the results of the study to unknown generality as regards SMEs elsewhere or in a different nation. 2. More substantial results could be implemented in a bigger sample size. 3. The role of judgment sampling can allow biasness into the list of respondents.
Practice-based view of antecedents of circular manufacturing and how it affects both the environment	1. To examine the impact of circular manufacturing (CM) practices on environmental and financial performance.	1. This research involves the sequential mixed-methods research design.	1. Take into consideration the environmental and financial performance but not the social sustainability performance.

and financial performance. (2023)	2. To investigate the influence of Industry 4.0 (I4.0) production technologies on the relationship between CM and performance.	2. A survey of 255 Chinese manufacturers and 2 explanatory case studies. 3. The creation of a questionnaire that was conducted on intensive literature study.	2. They did not involve longitudinal data but rather cross sectional information. 3. The China context of a study. Other countries comparative study will be of meaning.
The article is, directly and indirectly, a reflection of other organizations across the manufacturing sector in terms of technological innovations in a circular economy. (2023)	To analyze the contributions of technological innovation toward sustainability in manufacturing organizations with a circular economy (CE) Perspective.	A questionnaire has been developed and conducted, also using the Grey VIKOR method and a sensitivity analysis.	1. One depends on the expertise of the already experienced individuals because the panel of experts can be rotated hence altering the outcomes. 2. Grey VIKOR approach has been employed in conducting analysis in determining the influence of technological innovation to sustainability within the manufacturing industry. This may be a methodological constraint that other MCDM tools, (e.g. TISM, TOPSIS, ANP and DEMATEL) can be used.
ICF: Education: Barriers to adopting circular economy practices in MSMEs: Instrument development, measurement and validation (2022)	1. Determine the dimensions of barriers to the adoption of circular economy practices in MSMEs. 2. Systematically and structurally develop a scale to evaluate barriers to circular economy practices from the perspective of MSMEs in the Indian context.	1. building a multi-item latent measure to evaluate hindrances to integration of circular economy practices in MSMEs. 2. Testing of the sub-constructs and measurement scale using PCA and CFA analysis through the scale validation. 3. The measurement scales should be tested and validated on the basis of exploratory factorial analysis and structural equation modeling by means of the products IBM SPSS 26 and AMOS 26.	1. It also employed cross-sectional data in the study, and hence longitudinal studies that will be conducted in the future will be needed to give the study a much deeper insight into the barriers to the uptake of the circular economy. 2. The generalizability could be increased through repeated use of the study in other areas.
Indian firm sustainability performance exploratory research An exploratory research of sustainability and performance of firms in India.new small and medium size enterprises production (2022)	1. To investigate the drivers of sustainability in Indian manufacturing SMEs. 2. To explore the impact of sustainable environmental and social practices on firm performance. 3. To examine the relationships among internal/external drivers of sustainability, sustainable business practices, environmental and social benefits, and firms' financial and non-financial performance.	1. Identification of SMEs within the distinct manufacturing industry (e.g. food and beverages, textile, engineering, leather, chemicals), in Indian states. 2. Design of a questionnaire to collect data. 3. Conducting a survey of SME owners/managers either by conducting a face to face interview, or using on-line surveys. 4. EFA and SEM were employed.	1. Particular geographic areas in India or limited sample size might have been the limitation of the study. 2. The application of a cross-sectional design means that it is difficult to make causal associations between variables as time progresses. 3. It has been possible that the study has not considered such external influences as the market, change in regulation, or technology development that may have a bearing on the relationship, or it is rather the productivity of sustainability practices and performance within a particular firm.
The question mark is how to make the small and medium enterprises circular economy compliant through minimizing the use of single use plastic (2022)	1. To analyze how personal norms of individuals within SMEs influence their behavior and decision-making regarding the reduction of single-use plastics. 2. To analyze how personal norms of individuals within SMEs influence their behavior and decision-making regarding the reduction of single-use plastics. 3. To analyze the behavioral intentions of employees in SMEs and how these intentions correlate with	1. In the study, the hypotheses were tested and the research questions answered using a quantitative research design in the context of behavioral intentions which refer to the intentions of SMEs to reduce their single-use plastic consumption. 2. The study has made use of an organized survey. 3. The SMEs sample that operated in Indian context gave a total of	1. This study was done within a given geographical setting and only the SMEs in India were studied. This hinders the interpretation of results to other geographical locations or nations. 2. The research can be of no use in bigger organizations or other industries. 3. Although this study obtained information about 305 SMEs, it is possible that the sample is not inclusive of the entire representation of SMEs in India.

	the organizational practices aimed at reducing single-use plastics.	305 responses thus forming a good sample to analyze.	4. Such theoretical approaches as theory of planned behavior or corporate social responsibility were not analyzed, which may bring extra insight into the phenomenon.
Analysis of operational behavioural factors and the idea of circular economy within SMEs: A perspective of an emerging economy (2021)	1. To empirically investigate the operational behavioral factor that contributes to the adoption of circular economy practices in SMEs. 2. To understand the cause-effect relationship between these behavioral factors and build an influential network relationship map. 3. To provide recommendations for the effective adoption of circular economy practices in SMEs.	1. Conducted an extensive literature review to identify operational behavioral factors for adopting circular economy practices in SMEs. 2. Developed a factor structure model using Exploratory Factor Analysis (EFA) to confirm the factors. 3. Developed a questionnaire using a 5-point Likert scale to gather responses from SMEs.	1. The research sampled 162 SMEs, and thus can restrict the extendability of the data to bigger sample of SMEs in emerging economies. 2. The responses taken using convenience and snowball sampling approaches might have certain biases in them inherently possibly much to the validity of the results.
Integration determinants of sustainability, and innovation strategies within the Indian manufacturing firms: Empirical evidence among the MSMEs (2020)	To identify and consolidate the determinant that strengthen the integration of sustainability with innovation for Indian manufacturing MSMEs.	1. Literature review 2. Questionnaire and surveys.	1. Critical factors that only some of them were identified to be strengthening the implementation of sustainability innovated practices in enterprise. 2. The current study has looked into manufacturing only. Other factors may as well be looked into.
Evaluating the drivers of intentions and actions of organization inrelation to a circular economy of plastics (2020)	1. To empirically assess the determinants of intentions and behaviors of organizations towards a circular economy for plastics. 2. To identify the intention-behavior gap in organizations' implementation of best practices for plastic recycling. 3. To investigate the impact of attitudes, subjective norms, and perceived behavioral control on organizations' intentions and behaviors.	1. There were 637 organizations that were studied in Belgium. 2. Usage of the Theory of Planned Behavior (TPB) as the factor of comprehending the determinants of intentions and behaviors. 3. A survey using the questions was used to collect data on the attitude of the organizations, subjective norms, perceived control of behavior, pressures, barriers, and enablers in the regard of the plastic recycling. 4. The associations of the variables were analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM).	1. The research coverage was also narrowed to 637 organizations within Belgium and so this could limit the applicability of the findings to other national situations or other countries. 2. This study had objections in gathering information in an increased amount of organizations.

6. Methodology

This section describes the systematic literature review's method adopted for this paper, listing and discussing all search protocols, inclusion and exclusion criteria, article selection process, as well as the structured key wording and search string used to find relevant research. SLR is a method for creating literature review articles that is integrative or systematic. SLR offers the benefit of an organized review procedure and strives for maximum transparency, reproducibility, and comprehensiveness (Torraco, 2005). The document database utilized to acquire relevant literature is Scopus. We selected titles and abstracts of articles published in English and selected articles with publication, i.e., not older than ten years.

6.1. Search strategy

The primary source of studies for this SLR is journal papers and research articles. Prior to executing the searches, a search plan was established that specified key concepts based on the research questions and inclusion and exclusion criteria. These concepts were then identified to generate search language. An extensive and systematic search for relevant literature was conducted. The search terms used to obtain the relevant literature were “circular economy” AND “small medium enterprise” OR “SME” OR “micro small medium enterprise” OR “MSME”.

6.2. Inclusion and exclusion criteria

Inclusive Criteria

- **Main theme of paper:** This SLR includes papers that are solely associated with the circular economy in MSMEs.
- **Type of papers:** This SLR includes research articles, review articles, perspectives, full papers, and short communication papers.
- **Journal rank:** Cumulative rank of each article and the number of citations for each paper has been defined based on the database.

- **Year of publication:** Only literature that is published after 2015 is considered.
- Full English peer-reviewed conference papers were also included**.**

Exclusion Criteria

- Papers that are unrelated to the theme were excluded.
- Articles in mechanisms such as patents or standards were not included.
- Posters, discussion papers, web pages, editorials, abstracts, or conference slides were excluded from the SLR.

The following figure offers insights into the development and distribution of Circular Economy research by examining publication counts. In the Figure1, the upward publication trend suggests that Circular Economy will attract growing interest from researchers, especially in determining the challenge of balancing financial, environmental and social goals in business activities to maximize value.

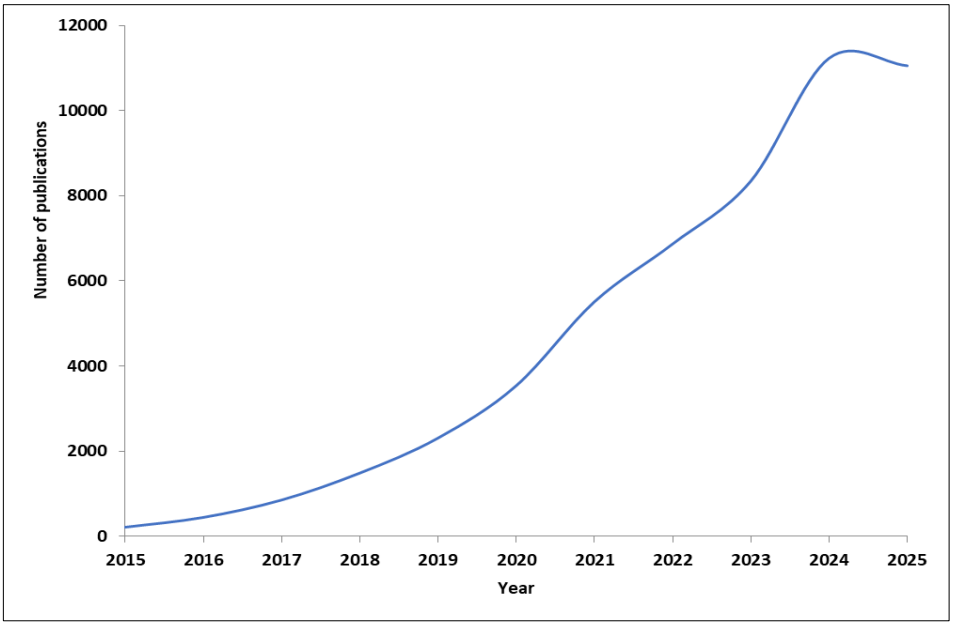


Fig 1: Research articles on "Circular Economy" from 2015 to 2025, as per recent search in Scopus Database

The following figure offers country-wise insights into the development and distribution of Circular Economy research in Small and Medium Enterprise or Micro, Small and Medium Enterprise by examining the publication counts. In Figure 2, it can be seen that Circular Economy concept is attracting interest from researchers in various countries. India has also the growing number of publications on Circular Economy in Small and Medium Enterprise (SMEs) or Micro, Small and Medium Enterprise (MSMEs).

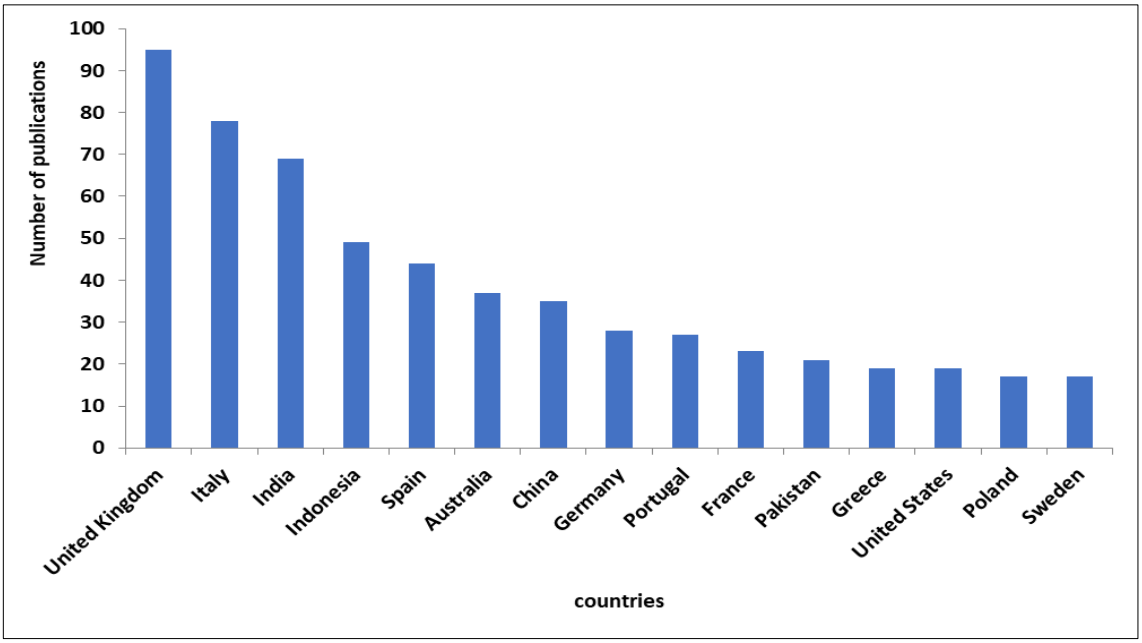


Fig 2: Research articles in countries/territories on "Circular Economy in SMEs or MSMEs" from 2015 to 2025, as per recent search in Scopus Database.

7. Case study of reliance industries

Reliance Industries Limited (RIL), India's largest conglomerate, has made significant strides in implementing the circular economy principles across all its business divisions. The circular economy model emphasizes sustainability, resource efficiency, and waste minimization, aligning with global environmental trends. RIL has invested in infrastructure and technology to recycle plastics, aiming for 100% recyclable or reusable items. The company is also transitioning to using renewable feed stocks in chemical manufacturing, exploring bio-based substitutes and optimizing waste processes. RIL has adopted energy-efficient procedures, integrating renewable energy sources like solar and wind power, improving operational efficiency, and streamlining processes. RIL has programs aimed at managing and reducing trash, focusing on reducing single-use plastics and implementing policies for industrial waste management.

7.1 About Reliance Industries Limited

Reliance Industries Limited (RIL) is the largest company in India, in the private sector, with consolidated revenues of ransom 9,74,864 crore (approximately US118.6 billion), a cash profit of ransom 1,25,951 crore (US15.3 billion), and net profit of ransom 73,670 crore (US9.0 billion) as on the 31 st march 2023, the end of the financial year. The scope of the business operations dealt in by the company has a wide gamut, which covers hydrocarbons exploration and production, petroleum refining and marketing, petrochemicals, advanced materials, renewable energy (such as solar and hydrogen), retail, and digital services.As of 2023, Reliance is the top-ranked Indian privately held business on the Global 500 list of the largest companies of the world ranking 88th on the list. It has also been ranked the highest among Indian corporations at the 45th place in Forbes global 2000 list of the largest companies in the world. Moreover, Reliance has also achieved an honor of being the highest rated Indian Company and the sole Company in the top 100 across the world on Forbes in its list of the World's Best Employers 2023. It is also listed under LinkedIn Top Companies 2023: The 25 Best Places to Grow Your Career in India.

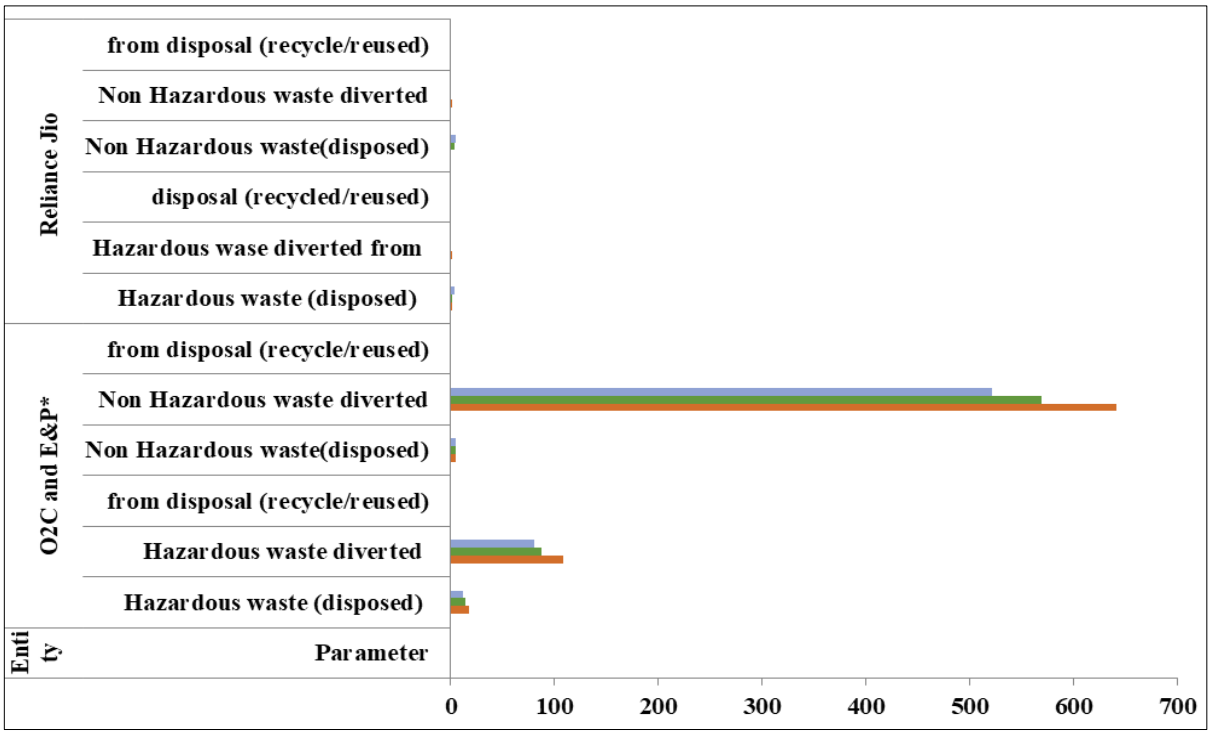
7.2 Waste management and circular economy initiatives

Reliance heavily emphasizes the element of sustainability by maintaining an effective waste management and circular econ practice in many of its business units. The main ones are the recycling of PEt and polyolefins, chemical recycling through pyrolysis oil, reusing of hazardous wastes as alternative fuels/raw materials, and the introduction of zero-waste retail stores.The company is also developing several projects to improve on circularity including the ReRouteTM innovation, sustainable packaging solutions, the RELANTM eco-friendly fabric, the commercialization of the RCAT-HTL technology, and the production of circular polymers. The ISCC Plus certification confirmed its integrated refining and petrochemical plant in Jamnagar where it is able to produce branded circular polymers - CircuRepol (TM) and CircuRelene (TM) - through the chemical recycling process of plastic waste using pyrolysis oil. Reliance also complies with the Extended Producer Responsibility (EPR) Guidelines and Plastic Waste Management Rules implemented in India to make sure that the combination of waste disposal and recycling processes implemented is up to the latest regulatory measures established in the country.

Table 2: Waste generation and management AT reliance in FY 2024-25

Entity	Parameter	Unit	FY 2024-25	FY 2023-24	FY 2022-23
O2C and E&P*	Hazardous waste (disposed)	'000 MT	17.4	14.8	12.32
	Hazardous waste diverted	'000 MT	108.65	87.89	80.68
	From disposal (recycle/reused)				
	Non Hazardous waste(disposed)	'000 MT	4.75	4.8	4.44
	Non Hazardous waste diverted	'000 MT	641	569.27	521.77
	From disposal (recycle/reused)				
Reliance Jio	Hazardous waste (disposed)	'000 MT	0.003	1.93	3.84
	Hazardous waste diverted from	'000 MT	0.54	0	0
	Disposal (recycled/reused)				
	Non Hazardous waste(disposed)	'000 MT	0	3.84	4.47
	Non Hazardous waste diverted	'000 MT	1.36	0	0
	From disposal (recycle/reused)				

Source: Integrated Annual Report 2024-25



Source: Integrated Annual Report 2024-25

8. Results and Discussion

The literature review gave important information about the circular economy (CE) and how it relates to environmental sustainability. The paper has managed to establish some of the main aspects of CE framework and what makes its adoption so necessary especially in the way of environmental safety. Being a new paradigm, the role of the circular economy in realizing a sustainable development and resource efficiency is undermined.

The results also reveal the idea that Micro, Small, and Medium Enterprises (MSMEs) play a tremendous role in economic growth in India. However, adoption of CE practices within the Indian MSMEs is still in nascent state although it has potential. According to the literature, Enablers and Barriers remain the most common mentionable aspects, which suggests their primary role in determining the implementation of CE.

On the whole, the findings indicate that there is increasing awareness about the circular economy but more work should be done to eliminate the structural and systemic issues that MSMEs encounter to spur the mass uptake.

Table 3: Circular Economy Adoption Enablers in Indian MSMEs

Major Categories	Sub-Enablers
Technological Enablers	Adoption of the 3 R's (Reduce, Reuse, Recycle) within organizations Efficient supply chain opportunities Enhanced information management platforms
Financial Enablers	Whole Life Costing Availability of large-scale materials Rising resource prices
Regulatory Enablers	Incentives for CE in manufacturing sectors Regulatory reforms
Policy Enablers	Policy support for skills development and innovation
Cultural Enablers	Strong company environmental culture Client coordination on CE importance Business collaborations to promote CE Environmental awareness among top management
Environmental Enablers	Mitigation of environmental degradation Addressing resource scarcity

Table 4: Circular Economy Adoption Barriers in Indian MSMEs

Major Categories	Sub-Barriers
Production and Operation Related	Lack of advanced manufacturing facilities Lack of R&D facilities Lack of skilled workforce Lack of continuous improvement culture Lack of information technology facilities
Organization Related	Lack of top management support for sustainability Lack of funds Lack of corporate social responsibility Lack of time for transition Lack of initiatives for sustainable manufacturing
Collaboration Related	Lack of supplier integration Lack of integration among stakeholders Lack of customer integration Lack of industrial networks
Government Rules and Regulations	Lack of enforcement for sustainability practices Lack of training and programs organized by governmentdepartments - Lack of financial policies

9. Conclusion and future research direction

The study on the adoption of Circular Economy (CE) practices among Indian Micro, Small, and Medium Enterprises (MSMEs) highlights a significant potential to improve sustainability and operational efficiency. Using Reliance Industries as a case study—one of India's largest conglomerates—this paper illustrates how the transition to CE can lead to multiple benefits, including reduced waste, improved resource utilization, and increased competitive advantage. Reliance serves as a strong example of how large enterprises can successfully implement CE principles and set benchmarks for smaller firms in the MSME sector.

The findings reveal that although a growing number of MSMEs recognize the importance of sustainable practices, several challenges hinder widespread adoption. Key barriers include limited awareness, inadequate financial resources, and restricted access to technology. Nevertheless, initiatives by industry leaders like Reliance can serve as catalysts for transformation by offering platforms for knowledge dissemination, financial assistance, and technological support.

For broader and more inclusive CE adoption, collaboration between large corporations, government bodies, and MSMEs is essential. Such partnerships can help build an ecosystem conducive to circular practices, benefiting enterprises at all levels.

Future research should focus on sector-specific implementation of circular economy principles within the MSME ecosystem, identifying unique barriers and replicable best practices. A deeper investigation into the practical challenges MSMEs face when attempting to adopt CE models will be valuable in framing targeted interventions. This can include real-world applications and solutions tailored to overcome these limitations.

Another promising area for future inquiry is the role of government policy in enabling and accelerating CE adoption in the MSME sector. Research should assess the effectiveness of existing policies and explore the potential of new regulatory frameworks in fostering circularity. Understanding how policy instruments—such as incentives, compliance mechanisms, and capacity-building programs—can support MSMEs will be key to shaping a sustainable and circular industrial future in India.

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