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**MASTER THESIS**

**Adoption of Circular Economy Principles in Indian SMEs:  
Challenges and Opportunities**

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## **STATEMENT OF ORIGINAL AUTHORSHIP**

The candidate declares that the present work is original and has not already been submitted, totally or in part, for the purposes of attaining an academic degree in other Italian or foreign universities. The candidate also declares that all the materials used during the preparation of the thesis have been explicitly indicated in the text and in the section "Bibliography" and that any textual citations can be identified through an explicit reference to the original publication.

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## **LIST OF ABBREVIATIONS**

CE – Circular economy

SME – Small and medium-sized Enterprise

FICCI – Federation of Indian Chambers of Commerce & Industry

GDP – Gross domestic product

MSMED - Micro, Small and Medium Enterprises Development

LE – Linear Economy

EoL – End of life

PaaS – Product-as-a-service

BFR – Brominated flame-retardants

Mt – Metric tonnes (Mt)

PPP – Purchasing power parity

EPR – Extended producer responsibility

Iot – The internet of things

BFR – Brominated flame-retardants

PSS – Product service system

PLI – Production-Linked Incentive

PMMY – Pradhan Mantri Mudra Yojana

MGNREGS – Mahatma Gandhi National Rural Employment Guarantee Scheme

GST – Goods and Services Tax

MMF – Man-made fibre

CFC – Chlorofluorocarbons



## ABSTRACT

The path to becoming integrated into a circular economy (CE) may appear unattainable in a major developing nation like India, where a large portion of the small and medium enterprise (SME) sector is not yet completely organised and frequently receives minimal help through government reform programmes. The foundations for developing a CE in Indian SMEs are described in this study. These foundations are based on a culture that emphasises less waste and more recycling, reusing, repurposing, and product repair. However, a lot of work is carried out informally and in an unorganised manner without a long-term plan or vision in place.

A significant move in the direction of sustainable development is the change from a linear to a circular economy, which places an emphasis on resource efficiency, waste reduction, and material regeneration. This study investigates how India's small and medium-sized businesses (SMEs), which are essential to the country's economy, are implementing the principles of the circular economy. Indian SMEs confront many obstacles in putting circular economy ideas into reality, despite the techniques' enormous potential benefits—such as cost savings, increased competitiveness, and environmental sustainability. These challenges—financial limitations, a lack of technical skills, regulatory obstacles, and inadequate infrastructure—are identified and analysed in this research. The study also looks at how the circular economy is now being adopted in several industries, like textiles, manufacturing, and food processing, using data from industry surveys, government publications, and case studies. It also looks into the main forces behind SMEs' adoption of circular practices and the potential advantages these practices offer in terms of both the environment and the economy. The results emphasise that in order to help with the transition, certain policy measures, funding sources, and information sharing are required. Indian SMEs have a big opportunity to make a big difference in creating a more resilient and sustainable economy by taking advantage of these opportunities and removing these obstacles. In order to encourage a wider adoption of circular economy concepts in India, policymakers, business executives, and SMEs can benefit from the strategic recommendations provided by this study.

Growing manufacturing and economic evolution in India are driving changes in consumption habits that are creating a complex web of interdependencies between the country's resource dependency and economic growth. A move towards a circular economy is indicated by the repurposing of resources to build closed-loop systems for technical and biological needs. This approach extends the useful life of materials and lowers losses from waste and emissions into the atmosphere. Compared to the mostly linear economy, which depends on the extraction, manufacture, consumption, and disposal of materials, this represents a significant shift. Sustainable development is promised when resource use (quantity and intensity) is separated from ecological damage and economic growth. (Ellen MacArthur Foundation. (2013), NITI Aayog. (2021), Rizos, V., et al. 2016)

## 1.0 INTRODUCTION

Adopting the concepts of the circular economy (CE) signifies a paradigm change away from the take-make-dispose nature of the classic linear economic model and towards a regenerative system that maximises resource utilisation and minimises waste. In order to promote sustainable development, circular economy principles place a strong emphasis on closing the loop in product life cycles through increased resource efficiency, reusability, and recycling (Ellen MacArthur Foundation, 2013). The adoption of a circular economy is very important in the Indian setting. India, whose economy is among the fastest expanding in the world, has a lot of problems with waste management, environmental degradation, and resource depletion. With a vast GDP contribution and 111 million jobs created, small and medium-sized businesses are essential to the Indian economy. Small and medium enterprises play a crucial role in India's transition to a circular economy because of their significant economic impact and innovative potential.

Given its benefits for sustainable development, the concept of the circular economy has recently acquired traction and interest among businesses, policymakers, and scholars alike. Walter Stahel's quote, "The products of today are the materials of tomorrow at yesterday's prices," succinctly captures the essence of the CE idea. The research done by Pearce and Turner for "Economics of Natural Resources and the Environment" is considered to be the foundation of the CE idea. A CE is expected to design a sustainable development plan that will enable nations to achieve economic gains while reducing their reliance on natural resources. Since many of these resources are non-renewable and currently depleting quickly, adopting a CE approach or way of thinking enables a change in how these resources are used and managed. That is, CE advances the notion that, as a result of recovering potential resources from their waste, everyone benefits in terms of the economy, society, and environment. (Lieder & Rashid, 2016).

With an emphasis on the final stage, the industry can accomplish CE through five consecutive stages: take, create, distribute, use, and recover. At first, the reduce, reuse, and recycle (3R) of items was the main focus of the CE idea. Subsequently, the industry understood that in order to succeed with 3R, the product needed to be simple to redesign (4th R) in order to conserve resources. As a result, the modern industry moved its emphasis from the 3R to the 4R (Dey et al., 2020), giving the 4R (Mostaghel & Chirumalla, 2021) full attention from the very beginning of a product's design and manufacture to its ultimate recovery. While CE ideas and practices are advantageous to all companies and nations, the strategy employed may differ based on the nation and type of organisation. For example, India has a traditional culture that upholds CE. Consumers in underdeveloped nations have always had a strong desire for repair and reuse choices because of financial constraints associated with the purchase of new products. As a result, there are several tiny repair businesses or home-based repair services that carry out the work on an informal basis.

Due to high population, waste produced in developing countries such as India is significantly high with only a small fraction of these treated formally to be able to capture the full potential. Moreover, despite a long-established culture of CE, remanufactured products and the people working in this industry are still considered inferior by the society (Goyal et al., 2018). To capture around half-a-trillion-dollars' worth of economic value to be generated through CE in India by 2030 (FICCI, 2018), it is important to understand specific challenges that prohibit achievement of the full potential of CE. Some of these challenges are lack of:

- (i) Suitable infrastructure to support 4R (reduce, reuse, recycle and redesign) for large amount of wastes.
- (ii) Education/capabilities among industry to undertake 4R activities in a safe and environmental friendly way.
- (iii) Well-developed reverse logistics for collection, separation of used materials and extraction of raw materials,
- (iv) Large scale government support.
- (v) Acceptance of CE related products from all tiers (upper and middle class) of the society.
- (vi) Initiatives to change mindset of the throwaway society (Di Maio & Rem, 2015).

Although few studies concentrate on emerging economies, environmental policies can assist businesses in moving towards a sustainable future and reaping social, economic, and environmental benefits. Even fewer take into account how SMEs might adopt the idea. The literature on CE adoption in SMEs identifies a number of obstacles. According to scholars such as Garcías-Ayerbe et al. (2019), Fang et al. (2007), Govindan & Hasanagic (2018), Guldmann & Huulgaard (2020), Jackson et al. (2014), Rizos et al. (2015), 2016; Sakr et al. (2011), there are barriers at the macro, meso, and micro levels. Furthermore, there is even less data regarding SMEs' adoption of CE in developing nations like India (Singh et al., 2018). The systems-level perspective emphasises that cultural and behavioural change are operant at this level and that changes are required at a micro-level (e.g., product and processes levels) through managers', leaders', and owners' exercise of personal agentic resources (Malik, 2013, 2017, Malik & Sanders, 2021).

Moreover, inadequate value proposition appraisal is a consequence of managers' risk-averse attitudes towards the implementation of CE. Accordingly, SMEs' adoption of CE is severely hampered by micro-level resistance to change. Comparably, at the meso-level, obstacles to converting business models from linear to CE include a lack of funding and resources, such as industrial parks and CE practice groups (Fang et al., 2007). In order to make such a transition, modern and indigenous corporate organisations must undertake numerous operational and management practice adjustments. The incapacity of big enterprises and policy players to clearly communicate the advantages of the CE method for SMEs is a related problem. Accordingly, cooperation, knowledge sharing, and information dissemination amongst many stakeholders in a SME's value chain are necessary for a successful transition to a CE approach. The fact that this information is frequently proprietary, which hinders its wider distribution and the development of CE business models, exacerbates the issues faced by SMEs (Van Buren et al., 2016).

SMEs also have difficulties due to expenses, barriers related to technical knowledge and skills, and technical expertise. Lastly, on a larger scale, institutional gaps in emerging markets, such as the absence of cohesive platforms for advancing the CE concepts, combined with a lack of government assistance, the expense of legal compliance, and a lack of support for environmental initiatives (Rizos et al., 2016) further discourage the adoption of such innovations. Furthermore, suppliers are typically hesitant to participate in such creative

activities in the absence of close partnerships across all parties in a SME's value chain, which leads to organisational stagnation (Nilakant & Ramnarayan, 2006; Rizos et al., 2016).

The information above points to numerous, intricate, and varied obstacles to SMEs' adoption of CE in the context of emerging markets. These issues call for a deeper investigation of SMEs' change management strategies beyond a linear, CE-focused approach. Thus, by using the theoretical framework of change management and highlighting the significance of leadership (Moktadir et al., 2020; Saini & Agarwal, 2020) in the adoption of CE principles in an emerging market context, like India, this paper adds to the body of literature on the "human side" of CE adoption. A change from a linear to a circular economy represents a major paradigm shift for firms, particularly SMEs and those operating in emerging markets, therefore such an approach is pertinent and contemporary. To be an effective change management programme, CE adoption by SMEs in emerging countries requires an understanding of the obstacles and facilitators.

## **1.1 Thesis outline**

This thesis aims to provide a comprehensive analysis of the opportunities and difficulties related to Indian SMEs' adoption of the circular economy principles. In the first chapter, the circular economy is introduced and its relevance and significance in the Indian context are emphasised, especially for small and medium-sized firms (SMEs). The foundational ideas of the circular economy—such as resource efficiency, waste reduction, and product lifecycle extension—are explained in this chapter along with the reasons they are important for the long-term viability of small and medium-sized enterprises (SMEs) in India.

For sustainable growth, especially for developing nations like India, the shift from a linear to a circular economy is essential. The 'take-make-dispose' concept of the current linear Indian economic system is emphasised, which has resulted in serious environmental problems and resource depletion. The circular economy, on the other hand, provides a regenerative framework that is becoming more widely acknowledged for its ability to promote sustainable growth. The linear economic model and its effects are examined in this chapter, along with the rise and applicability of circular economy concepts in developing countries, the fundamental elements of a circular economy, successful implementation techniques, and the crucial key performance indicators (KPIs) that Small and Medium-sized Enterprises (SMEs) need to track in order to gauge their adoption of circular practices.

In the third chapter, we explore the various obstacles Indian SMEs encounter when implementing the principles of the circular economy. This chapter attempts to provide a thorough knowledge of the challenges impeding SMEs' transition to a circular model by examining financial, technological, regulatory, market-related, supply chain, educational, and cultural barriers. In order to provide useful insights and possible answers, it also offers techniques to overcome these obstacles.

The adoption of circular economy principles presents significant opportunities for economic growth, environmental sustainability, and social development, particularly for a rapidly developing nation like India. Embracing a circular economy can help India address pressing challenges such as resource scarcity, waste management, and pollution while capturing the benefits of increased efficiency, innovation, and resilience. The fourth chapter explores the myriad opportunities that circular economy principles offer to India, including how the country

can harness these benefits for long-term sustainability. It also highlights examples of Indian companies that are leading the way in promoting circular economy practices, demonstrating the tangible advantages of this transformative approach.

The textile industry is a major contributor to global pollution and waste, necessitating a transition towards a circular economy to ensure sustainable development. The sixth chapter explores the current scenario of textile circularity, emphasizing the urgent need for the textile sector to adopt circular economy principles. It outlines strategies for preparing the textiles and apparel sector for this transition and discusses India's specific agenda, such as the developPPP project. The chapter also examines the waste generated in the textile value chain and current recycling practices. By highlighting the steps needed to make circularity a reality and integrating these principles into daily operations, this chapter aims to provide a comprehensive guide for SMEs in India and other emerging economies to embrace circular economy practices in the textile sector.

In the end, the conclusion summarises the key findings from the study and discusses their implications for the adoption of the circular economy by Indian SMEs in the future. It emphasises the necessity of ongoing study and advancement in this field and offers suggestions for more research to expand on the conclusions of this thesis. This rigorous approach ensures a thorough analysis of the subject and offers valuable knowledge about how circular economy techniques may help Indian SMEs grow sustainably and further the country's larger objectives of environmental and economic sustainability.

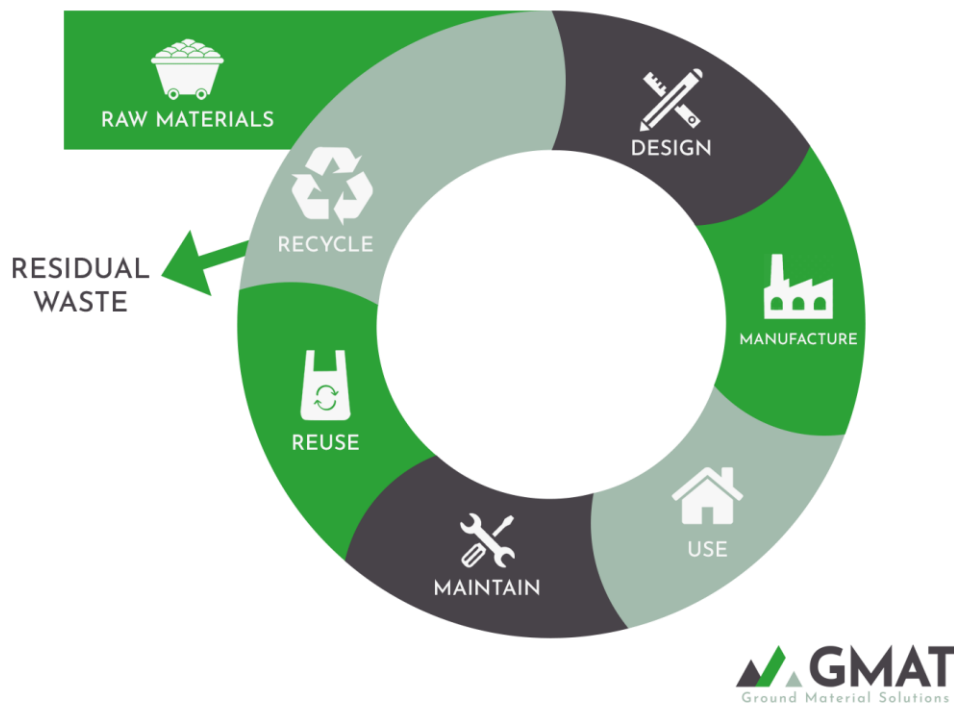
## **1.2 Overview of Circular Economy**

An economic system called the circular economy (CE) aims to do away with waste and continuous resource utilisation. The 'take-make-dispose' linear economy is being replaced by a more sustainable framework that prioritises resource efficiency, reusability, and the regeneration of natural systems. According to the Ellen MacArthur Foundation (2013), the circular economy is predicated on three main ideas: eliminating waste and pollution, reusing resources and products, and rebuilding natural systems.

Products are made with a longer lifespan in mind in a circular economy, with a focus on recyclability, durability, and repairability. This strategy minimises the impact on the environment while reducing the requirement for raw materials. It is recommended that industries implement strategies including recycling, remanufacturing, and refurbishment in order to extend the lifespan of resources. By doing this, the circular economy hopes to promote a more sustainable model of development by severing the link between resource use and economic growth.

A circular economy has several advantages. Economically speaking, it can save companies a lot of money by lowering the cost of materials and trash disposal. Additionally, it can stimulate innovation and open up new economic prospects in sectors like sustainable product design and recycling technology. The circular economy contributes to lessening greenhouse gas emissions, pollution, and the depletion of finite resources. Socially, through encouraging sustainable local economies, it can strengthen community resilience and aid in the creation of jobs in developing green industries (Geissdoerfer et al., 2017).

# THE CIRCULAR ECONOMY



*Figure 1.1 A diagram showcasing the continued cycle of the circular waste model in which materials are reused or recycled back into the economy.*

A number of approaches and concepts have been put out to help with the shift to a circular economy. Among these are the creation of circular business models, including product-as-a-service, in which businesses lease their products to clients while keeping ownership of the items, guaranteeing that they are returned for recycling or refurbishment. Other tactics include encouraging industrial symbiosis, which closes the material flow loop by using the waste or by-products of one industry as the raw materials for another. The circular economy is becoming more and more important, and governments and international organisations are putting laws in place to encourage its adoption. The European Commission (2020) has outlined initiatives to help the transition of Europe to a circular economy, such as encouraging eco-design, setting objectives for recycling rates, and providing support for innovation in circular technologies, as part of its Circular Economy Action Plan.

The circular economy tackles urgent problems like resource shortages, waste management, and environmental degradation and provides a route to sustainable growth for emerging nations like India. Small and medium-sized businesses (SMEs), who make up a sizable share of the Indian economy, have the ability to spearhead this change by implementing creative strategies and regionally relevant solutions. To fully reap the benefits of the circular economy, they must overcome the particular difficulties they encounter, which include limited resources, a lack of technical skills, and poor infrastructure (Singh & Ordoñez, 2016).

### **1.3 Importance of Circular Economy in Indian context**

Due to India's rapid economic expansion, urbanisation, and the ensuing environmental challenges, the implementation of circular economy (CE) principles is crucial. India, whose economy is among the fastest expanding, is confronted with serious problems pertaining to waste management, environmental degradation, and resource depletion. The circular economy encourages waste reduction, the regeneration of natural systems, and the effective use of resources in order to provide a sustainable solution to these urgent issues.

#### ***Resource Efficiency and Sustainability:***

India is rapidly becoming more urbanised and industrialised, which has raised demand for natural resources and put a great deal of strain on the environment. The circular economy encourages the reuse, repair, refurbishing, and recycling of materials and goods, hence promoting resource efficiency. This promotes sustainable economic growth, lessens the impact on the environment, and lessens the dependency on virgin resources (Ellen MacArthur Foundation, 2013).

#### ***Waste Management:***

Waste management is one of India's biggest problems. Every year, the nation produces over 62 million tonnes of municipal solid waste, much of it is improperly managed and ends up as litter or in landfills (Central Pollution Control Board, 2021). By converting trash into useful resources through recycling and industrial symbiosis, the circular economy offers a framework for efficient waste management that lessens the load on landfills and reduces environmental degradation.

#### ***Economic Growth and Job Creation:***

In India, the circular economy has the ability to spur economic expansion and generate new employment possibilities. Remanufacturing, recycling, and product-as-a-service are a few of the new business models that the circular economy can help to grow. According to Chertow and Ehrenfeld (2012), this shift may result in the creation of green jobs in industries like recycling, waste management, and sustainable product design, which would support equitable growth and economic resilience.

#### ***Environmental Protection:***

Pollution of the air and water, degraded soil, and loss of biodiversity are just a few of the serious environmental issues India faces. Through cutting pollution, encouraging resource sustainability, and minimising waste, the circular economy helps to protect the environment. The circular economy aids in reducing environmental harm and protecting natural ecosystems by developing products with longer life cycles and employing environmentally friendly production techniques (Ghisellini, Cialani, & Ulgiati, 2016).

#### ***Support for Regulation and Policy:***

The circular economy is important, and the Indian government has launched a number of regulations and initiatives to encourage its adoption. Waste management, resource efficiency, and sustainable urban development are the goals of programmes like the National Resource

Efficiency Policy, the Smart Cities Mission, and the Swachh Bharat Abhiyan (Clean India Mission). These laws support the adoption of sustainable business practices and provide an atmosphere that is favourable for the application of circular economy principles (NITI Aayog, 2021).

### ***Social Advantages:***

The circular economy also improves community resilience and quality of life, which has a major positive social impact. Circular practices can improve living circumstances and well-being by lowering pollution and preserving resources. Additionally, the circular economy can help reduce poverty and promote social fairness by fostering local economies and job possibilities (Singh & Ordoñez, 2016).

## **1.4 Role of SMEs in Indian economy**

The foundation of the Indian economy, small and medium-sized enterprises (SMEs) are vital to the country's growth, innovation, and job creation. In India, small and medium-sized enterprises (SMEs) account for over 30% of GDP, demonstrating the importance of SMEs to the nation's economy. These businesses are among the biggest employers in the nation, employing more than 110 million people. The industry plays a significant role in the industrial and export environment, accounting for over 40% of India's exports and approximately 45% of the country's manufacturing output. SMEs have an important role in encouraging equitable growth and mitigating regional inequities, which goes beyond economic measurements. SMEs contribute to the decentralisation of economic activity, the promotion of rural entrepreneurship, and the creation of jobs outside of urban areas by developing industries in rural and semi-urban areas. Decentralisation is essential to ensure more balanced regional development and to lessen the gap between urban and rural areas.

SMEs have a critical role in encouraging competition and innovation in the economy. They can be more nimble and sensitive to shifts in consumer demand and technology breakthroughs because of their smaller size. Because of their flexibility, SMEs can launch cutting-edge goods and services, fostering a vibrant and cutthroat marketplace. Additionally, the spirit of entrepreneurship that SMEs exhibit fosters the development of fresh concepts and business plans that have the potential to significantly progress technology and boost productivity.

The expansion and development of SMEs in India has been greatly aided by government policies and efforts. A historic piece of legislation, the Micro, Small, and Medium Enterprises Development (MSMED) Act of 2006, was designed to encourage and facilitate the growth of SMEs. This act offers a thorough framework for resolving the difficulties SMEs have, such as those pertaining to infrastructure, marketing, and loan availability.

The SME sector has benefited greatly from the 2014 launch of the Made in India initiative. The objective of this effort is to encourage domestic and multinational enterprises to produce their products in India, thereby transforming the nation into a worldwide manufacturing hub. By acting as suppliers and service providers to major manufacturing companies, SMEs contribute significantly to this strategy by becoming integrated into global value chains.

One of the biggest obstacles facing SMEs in India is still access to financing. The government has launched a number of initiatives to increase SMEs' access to credit in order to solve this. By offering SMEs financing without collateral, the financing Guarantee Fund Trust for Micro



and Small Enterprises (CGTMSE) lowers the credit risk for lenders and encourages them to lend money to small companies. In a similar vein, the Pradhan Mantri Mudra Yojana (PMMY) seeks to increase small and micro companies' financial inclusion by offering microcredit to them. Another area where SMEs are making great progress is digitalization. Digital technology adoption is assisting SMEs in expanding their customer base, increasing operational efficiency, and reaching new markets. SMEs may use digital tools and platforms by using the infrastructure and support that government initiatives like Digital India are offering.

Furthermore, the COVID-19 epidemic has brought attention to how resilient the SME sector is. Many SMEs have demonstrated amazing adaptability by changing their business models, implementing digital solutions, and venturing into new markets in spite of encountering hitherto unseen obstacles. This tenacity highlights how important SMEs are to maintaining economic growth and stability, especially during difficult times. In conclusion, SMEs are essential to India's economy because they spur innovation, growth, and job creation. Because of the sector's natural dynamism and adaptability as well as the government's encouraging policies, SMEs will continue to be a vital component of India's economic growth.

## **1.5 Objective**

This study's main goals are to assess and examine the function that small and medium-sized enterprises (SMEs) play in the Indian economy. This involves evaluating how SMEs affect GDP, employment creation, industrial production, and exports. The study also intends to investigate how well government policies and support systems—including the MSMED Act, the Made in India drive, and other loan schemes like CGTMSE—work to foster the expansion of SMEs. Additionally, it looks to identify the main obstacles that SMEs must overcome, such as market competitiveness, regulatory barriers, technology adoption, and financing availability.

### **1.5.1 Research Questions**

*To accomplish the objective, this thesis seeks to answer the following research:*

- **RQ:** How effective are the current government policies and initiatives, such as the MSMED Act and Make in India, in supporting SME growth?

## **1.6 Scope**

This thesis delves deeply into the application of circular economy (CE) ideas in small and medium-sized firms (SMEs) in India, emphasising the benefits and problems that come with this shift. The degree to which Indian SMEs are aware of and putting CE techniques into practice, as well as the internal and external factors impacting these adoption decisions, will all be investigated in this study. The study will encompass a number of industries with a high concentration of SMEs, including electronics, manufacturing, and textiles, in order to give a thorough grasp of the dynamics unique to each industry. Using qualitative data from previously published works, case studies, and industry reports, it will also examine the regulatory, economic, and sociocultural contexts that influence the adoption of CE principles. This thesis aims to provide strategic recommendations for policymakers, business leaders, and SMEs by identifying potential enablers such as governmental policies, market incentives, and technological innovations, as well as potential barriers to adoption such as lack of technical knowledge, financial constraints, and inadequate infrastructure. In the end, the study will add

to the larger conversation about resource efficiency and sustainable development in developing nations, highlighting the part played by SMEs in India's shift to a circular economy.

## 2. Theoretical Framework

*The theoretical framework utilised to address the research questions for the master's thesis is covered in this chapter. The chapter will begin with a synopsis of the current economic system in India, or LE, and then go into great detail into the components of CE. In addition, the chapter covers key performance indicators, creating personal SMART objectives and Use of KPIs in SMEs.*

### 2.1 Linear Economy

The existing linear mode of thinking is the source of sustainable development's limits (Merli et al., 2018). The so-called "take-make-dispose" model of resource consumption has been manufactured by industrialization (Ellen MacArthur Foundation, 2013a). Since then, there has been a negligent application of this linear consumption model, leading to a "single-use" lifestyle of things that have exceeded the planet's physical capacity (Esposito et al., 2018). Because labour costs have historically been higher than material costs, society has historically been more inclined to embrace business models that heavily rely on the utilisation of virgin materials (Sariatli, 2017). Comparably, low-cost materials have led to a disregard for material recycling and reuse, which produces a lot of waste. Basically, a corporation can obtain a greater competitive advantage in the past by using more materials and energy (Ellen MacArthur Foundation, 2013a). The linear system's indifference to the product's environmental impact is just one of its many drawbacks. Sustainability is subordinated to profit, and energy used to produce a product is wasted when it is disposed of—typically in landfills.

## THE LINEAR ECONOMY



*Figure 2.1 A diagram that highlights the life cycle of our raw materials until they are final disposed of.*

People may be using natural resources on the earth at a rate that is 50% quicker than their replacement. This indicates that in 2030, the natural resources needed to meet the population's needs will require two entire planets, and by 2050, that number is expected to rise to three planets. The cost of natural resources has skyrocketed since 2000 (Ellen MacArthur Foundation, 2013a). According to Robért (1991), "the majority of environmental issues come from the same systemic fault, linear material processing. The world economy and public health will keep declining until resources are processed in cycles, either by society or by biogeochemical processes" (Robért, 1991, p.1). Businesses are beginning to understand that

the linear system exposes them to risks like rising resource costs and sluggish market demand. In light of this, the only option available to humanity is to change to a more responsible method of using the resources of the planet (Esposito et al., 2018). The "take-make-dispose" linear consumption model is outdated.

## **2.2 Current Economic system in India**

India's present economic structure is a dynamic fusion of capitalism and socialist ideas that has carved out a distinct place for itself in the world economy. India's embrace of socialism, which has its roots in the years following its 1947 independence, was first focused on central planning and government involvement in important industries as a means of promoting industrialization and fair growth. As a result of this strategy, state-run banks, public sector businesses, and resource- and wealth-redistributing regulatory frameworks were established. However, the start of economic reforms that progressively moved the country towards a more liberalised economic paradigm in the 1990s marked a turning point in the country's history.

By removing licencing restrictions, allowing foreign direct investment inflows, and exposing formerly protected industries to competition, the liberalisation process unleashed a wave of revolutionary developments. This change sparked previously unheard-of expansion in sectors like services, telecommunications, and information technology, launching India as a rising economic giant on the international scene. Adoption of policies focused on the market created a growing middle class and consumer market, as well as increased productivity, efficiency, and innovation. However, gaps increased along with the economic boom, with socio-economic progress occurring unevenly across areas and income inequality remaining.

Even with the move towards liberalisation, the government continues to play a big part in setting economic policy and solving socioeconomic issues. Aiming to reduce poverty and offer livelihood security, initiatives like the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and the Goods and Services Tax (GST) also seek to improve fiscal control and streamline taxation. Furthermore, investments in energy, transportation, and urban infrastructure are essential for enhancing competitiveness and connectivity. Infrastructure development continues to be a top priority to enable inclusive development and sustained growth.

The economic landscape of India is complex and fast changing, with notable sectoral diversity, geographical differences, and a continuous shift from conventional to contemporary economic methods. India's economy, which is the third largest in terms of purchasing power parity (PPP) and the fifth largest by nominal GDP, is distinguished by its combination of the industrial, services, and agricultural sectors. Although the LE has dominated the corporate world since the industrial revolution, over the past 10 years, CE has drawn more attention from academics and industry professionals (Velenturf and Purnell, 2021; Nobre and Tavares, 2021). The "take-make-dispose" approach of LE is different from CE in that CE emphasises resource use as efficiently as possible. The idea of circular economy was first introduced in 1976 by Stahel and Reday-Mulvey, who discussed "an economy of loops" and its relationship to prolonging the life of products and the processes that go into them. Following this, there has been a close relationship between CE and other sustainability-related fields and ideals.

In the future, India will need to maintain strong economic growth while maintaining environmental sustainability and equitable development. It will be crucial to address structural barriers like insufficient social infrastructure, regulatory bottlenecks, and bureaucratic

inefficiencies. Furthermore, to fully realise India's economic potential and capitalise on its demographic dividend, inclusive growth methods, innovation, and human capital development are essential. Through strategic and practical handling of these intricacies, India may steer clear of its current state and establish a vibrant, inclusive economy that benefits all of its people

### **2.3 Circular Economy in Emerging Economies**

The adoption of circular economy (CE) ideas can have a substantial impact on the trajectory of sustainable growth of emerging countries at this critical juncture. The "take, make, dispose" approach of the old linear economic model is contrasted with the circular economy, which places more emphasis on resource efficiency, waste reduction, and the restoration of natural systems. Making the shift to a CE offers emerging economies the chance to advance social inclusion, environmental sustainability, and economic prosperity all at once. By utilising CE principles, these economies may lessen their reliance on scarce resources, lessen pollution, and generate new employment opportunities in industries like recycling, remanufacturing, and repair. Adopting CE has financial advantages such as lower costs due to less energy and material use, enhanced competitiveness, and access to new markets driven by environmentally friendly practices.

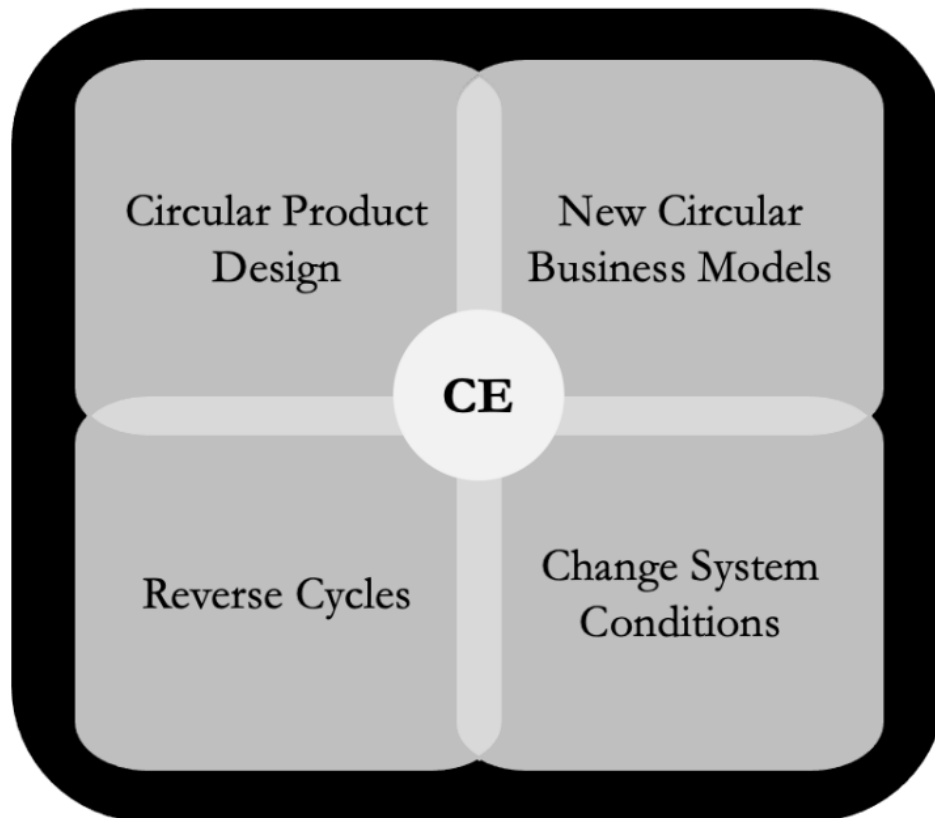
Although the advantages of implementing circular economy principles are evident, rising economies have many obstacles. Significant obstacles are posed by financial restrictions, such as the high upfront costs of CE technology and infrastructure combined with SMEs' restricted access to incentives and funding. The transition is made more difficult by technological limitations, such as a lack of standardised procedures for recycling and material recovery and a deficiency in innovative capabilities. Progress is also hampered by legislative and policy issues, such as contradictory laws and a lack of comprehensive policies promoting CE. Broader acceptance is hindered by aversion to move from old linear business models and limited awareness, which are cultural and behavioural constraints.

In order to address these obstacles and encourage the implementation of circular economy concepts, emerging economies need to put specific measures into place. It is essential to create logical legal and policy frameworks that encourage CE practices. This entails putting extended producer responsibility (EPR) programmes into place and promoting environmentally friendly public procurement. The financial obstacles may be lessened with the aid of financial incentives and support systems like grants, subsidies, low-interest loans, and green financing products like green bonds. Building capacity and educating the public are equally vital; to promote a sustainable culture, awareness campaigns, training courses, and the inclusion of CE concepts in curriculum are all necessary. To encourage the use of CE, technological innovation and cooperation should also be fostered through industry alliances, knowledge transfer, and research and development.

In conclusion, there is a great deal of promise for attaining sustainable development goals if emerging economies embrace the concepts of the circular economy. These economies can realise the economic, environmental, and social advantages of a CE by tackling the technological, financial, regulatory, and cultural obstacles. Realising a circular economy's full potential will require smart policies, teamwork, and creative thinking, which will help emerging economies have a more sustainable and inclusive future.

## 2.4 Pillars of a Circular Economy

Circular Product Design, New Circular Business Models, Reverse Cycles, and Changed System Conditions (see Figure 2.2) are the four main pillars that make up the CE concept, which was first introduced by the Ellen MacArthur Foundation (Saidani et al., 2017; Ellen MacArthur Foundation, 2013a). To successfully make the shift from unsustainable linear to sustainable circularity practices in society, an integrated combination of the four is required (Ellen MacArthur Foundation, 2013a).



*Figure 2.2. A visualization of the four pillars of CE, inspired by Saidani et al. (2017).*

- **Circular Product Design**

The circular product design is the subject of CE's first pillar. The pillar should be seen holistically as it encompasses all aspects related to the product. Slowing, closing, and shrinking resource loops are three widely debated aspects of circular product design (Kwant et al., 2021; Bocken et al., 2016). The slowing dimension pertains to extending the life cycle of a product, closing refers to establishing closed-loop systems to close material and product flows, and narrowing refers to using fewer materials and resources while simultaneously boosting production efficiency (Bocken et al., 2016; Moraga et al., 2019; Dokter et al., 2020; Sucozhañay et al., 2022). Throughout the course of the product's life cycle, the product design is essential (Saidani et al., 2017). Therefore, encouraging the remainder of the supply chain to adopt more circularity practices is one of the most crucial pillars. The supply chain system that surrounds a product is shaped by its design, which includes factors like ease of disassembly

and reassembly, complexity, and the ability to be repaired or upgraded (Moreno et al., 2016; Ortiz-de-Montellano and Meer, 2022; Geissdoerfer et al., 2020).

In her article about incorporating design thinking into a circular design guide, Tantiyaswasdikul (2020) talks about making wise material selections. Asking the proper questions—that is, learning about how materials affect the larger system—will help you make wise material decisions (Tantiyaswasdikul, 2020). Choices can be modified and substituted with less hazardous ones by being aware of the impact that materials have on the environment (Tantiyaswasdikul, 2020; Nußholz, 2017; Mhatre et al., 2021).

- **New Circular business Model**

In order to facilitate a transition towards more inventive approaches to conducting business, it is necessary to replace or revitalise current circular business models (CBMs) (Ellen MacArthur Foundation, 2013b; Lahti et al., 2018; Ortiz-de-Montellano and Meer, 2022). A more comprehensive picture of CE, according to Saidani et al. (2017), can be obtained by combining a top-down objective-driven strategy with a bottom-up data-driven method. Long-term benefits of the transition Nonetheless, there are still difficulties in converting existing BM designs into circular ones while maintaining customer delivery of high-value solutions (Ellen MacArthur Foundation, 2013a). These goods must provide something extra to be seen appealing because they will be up against conventional linearly manufactured goods, which are already effective and affordable. When closed-loop cycles are created, circular products may result in more revenue streams (Moreno et al., 2016). The ability of items to hold their worth even after they have been used, provided they are properly cared for and recycled to make new products, is the source of the economic benefits. This maintains natural capital and resources, resulting in the flow of goods, materials, and components via the biological and technical cycles. For this to be feasible, products need to be made with recycling, refurbishment, and remanufacturing in mind.

Another facet of the New Business Models pillar involves altering the perception of product ownership and aiming for product-service systems (PSS), which are based on services or functions. The product then becomes a service or function with the goal of meeting a certain demand, and the consumer is the user. Examples of approaches to broaden the product offer include performance-based models like renting power tools for a predetermined amount of time or including ancillary services like building kits and tool usage training sessions. Leasing models are another possible component of this kind of business model, which would provide greater product traceability and a higher rate of collection. After-sales services, take-back incentives, and collaboration networks are further considerations for developing new business models. Partnership networks have the potential to facilitate widespread collaboration throughout the value chain, an essential requirement for the successful implementation of significant changes.

Sales of reconditioned, remanufactured, or repaired equipment as well as maintenance services can be profitable. Enhancing the lifespan of a product may also result in more revenue from related services (Moreno et al., 2016). Increased transparency across the whole value chain and end-user approval are key factors influencing the success rate of new BMs (Ellen MacArthur Foundation, 2013b). For instance, a rental programme can require users to adapt their routines in exchange for additional advantages. It is necessary to inform customers about this element, which can necessitate heavy advertising and awareness initiatives. In order for this kind of BM to be successful, the customer must have a significant role in facilitating the change from

business as usual to a CE. To facilitate consumer change, user trust must be established. Companies can produce joint value by facilitating the sharing of underutilised products and resources through model sharing and stakeholder collaboration. Businesses that are able to recognise and comprehend gaps and issues in the market based on past performance and expectations can build collaborative momentum by imagining goals, solutions, and tactics that are in line with one another. This may encourage actor interaction, which leads to the generation and spread of information. Furthermore, firms may not be able to adopt circularity techniques due to internal knowledge gaps, a lack of trained labour, or a lack of managerial competences. Training programmes should be used to improve organisational culture, adaptability, and capability growth (Lewandowski, 2016).

- **Reverse Cycles**

Reverse Cycles emphasises even more how crucial it is to have collection systems that are easy to use, economical, and maintain quality in order for them to function well in real-world situations. Additionally, it's critical that the extraction process maximises the amounts of materials extracted while maintaining quality. Some of the foundational ideas of CE will be compromised by the leaking of various materials and components from items that have reached the end of their life (EoL) in the absence of these collection and treatment systems. Mallick et al. (2022) emphasise that, given the challenges of actually gathering products from millions of individuals, the collection system is one of the most important take-back initiatives.

The efficient and circular logistics of products and their packaging are crucial. Nevertheless, different product categories have different collecting models, thus it's challenging to develop a universally applicable solution. The authors also point out that customer motivation to participate in product returns plays a role in reverse logistics. It is crucial to have the infrastructure and skills required to close material loops. Like the preceding CE pillar of new business models, reverse cycles stress the significance of product traceability over the course of their whole existence. In order to do this, the organisation must have well-thought-out and established take-back procedures. When players with specialised knowledge in various fields (like material recovery, disassembly, and recycling) collaborate and streamline procedures to guarantee proper resource management, the End-of-Life (EoL) stage can become more economical and efficient (Mallick et al., 2023; Ghisellini et al., 2016). This could result in novel approaches to value generation, such as recycling materials at the end of life (EoL) and employing trash as a resource input (Goni et al., 2021; Bocken et al., 2016).

- **Change System Conditions**

System conditions change is the fourth CE pillar. A long-lasting system approach must be established, and changing system circumstances addresses the holistic perspective of CE (Saidani et al., 2017). The area's main focus is on how governments and regulatory bodies can help businesses migrate to more sustainable business practices by offering guidance and support. An ecosystem as a whole must be interconnected for a circular society to prosper. In order for businesses to modify their methods of operation, the environment around them must also adapt and promote circularity in all its forms. By enacting laws supporting sustainable operations, governments can significantly contribute to the development of favourable conditions for circularity practices. Current rules concentrate on reducing the end-of-pipe effects from certain sources, but a more comprehensive strategy that addresses all facets of CE should be considered instead (Desing et al., 2020).



## 2.5 Strategies for a Circular Economy

The resource cycles slowing, shutting, and narrowing loops (see Figure 2.3) are among the most often used CE techniques. The shift from "cradle-to-grave" thinking to "cradle-to-cradle" flows is the cause of these resource cycles. Different configurations of the so-called R-framework could be coupled to each of the three techniques. Reduce, reuse, recover, and recycle are the four framework practices that are most frequently mentioned in literature. Nonetheless, additional R-practices that are emphasised as being even more crucial than the most often utilised ones can be found in more comprehensive frameworks. In the offered 8R-framework, Ortiz-de-Montellano and Meer (2022) highlight redesign as the most ideal behaviour. Other practices that are presented include resale, refurbish & remanufacture, redistribute, and recirculate. Instead, Liang-Ang et al. (2021) emphasise rethink as the most important practice in the article's 9R-framework; refuse, repair, and repurpose are the other practices given. The author claims that rethink focuses on increasing the efficiency of product use by expanding its accessibility to a larger user base through service offerings. As a result, the practice permeates all three strategies since it offers a fresh perspective on manufacturing activities in general as well as commercial processes.

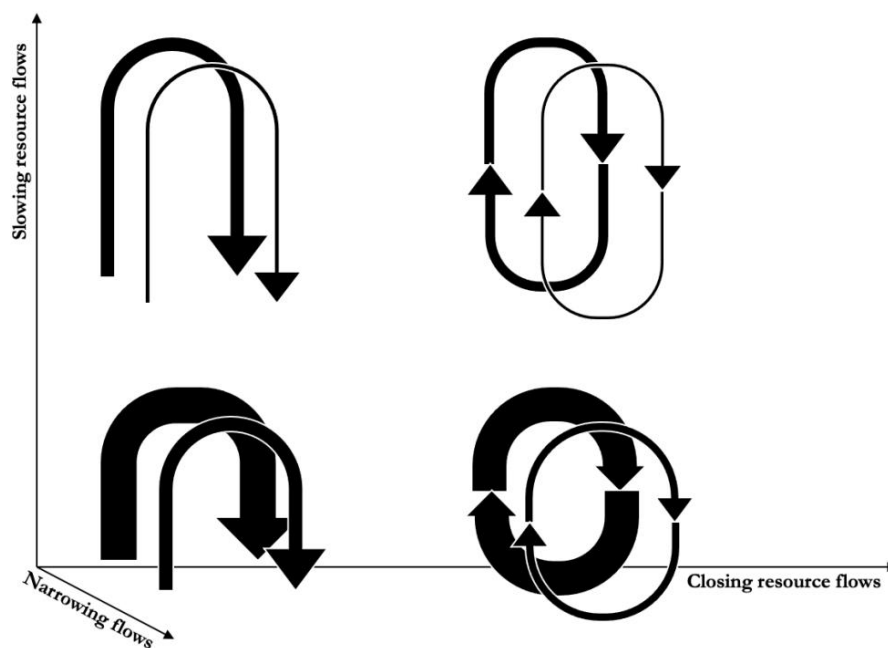


Figure 2.3. A visualization of the three CE strategies slowing, closing, and narrowing, inspired by Bocken et al. (2016).

- **Slowing**

According to published research, slowing resource loops can extend the life of a product. This is because successful value chain transitions frequently credit the design phase as one of the key components. Material value appears to be preserved by rejecting the current "fast fashion" notion and reconsidering how we develop and use items. As Cooper (2005) and Bocken et al. (2016) have noted, prolonging the life of products is a critical factor in slowing resource loops. This can be accomplished by permitting repair, refurbishing, and remanufacturing through

maintenance during the course of a product's life cycle. By using these procedures, fully functional products can be repaired and maintained in use as long as they continue to perform their intended function. This keeps goods from being thrown away when only a few of the parts are broken. Alternatively, products can be upgraded and flawed parts can be changed or fixed, allowing for the complete usage of the items (Moraga et al., 2019; Ávila-Gutiérrez et al., 2019; Aravossis et al., 2019).

As investment energy and resources are completely utilised, this also promotes energy efficiency and resource preservation. To extend the life of products, another method is to collect information on their functionality in order to facilitate remote management and maintenance (Nandi et al., 2021; Kohlbeck et al., 2022). The dispersion of elements and particles throughout production processes poses an additional challenge to the complete restoration and preservation of product material. In order to reduce material loss, this puts pressure on the ongoing supervision of production processes to upgrade and improve the various phases. It also implies that in order to reduce product complexity and streamline production processes, new product designs must be created (Bocken et al., 2016; Moraga et al., 2019). Some factors must be taken into account in order to slow resource flows through product redesign. The end user must be prioritised in addition to facilitating repair, refurbishment, and remanufacturing (Bocken et al., 2016; Geissdoerfer et al., 2020). Because they are in charge of a product's usage phase, user behaviour is frequently acknowledged as one of the primary contributing components to achieving circularity practices. As a result, products must be made to be trustworthy and long-lasting while also fostering user attachment and trust (Moreno et al., 2016; Bocken et al., 2016). Customers are more likely to hang onto things for longer periods of time if their expectations regarding their durability and dependability are satisfied. As a result, resource efficiency and material value are both made possible (Desing et al., 2020).

- **Closing**

Reintroducing goods, components, and materials is known as "closing resource flows," which establishes a closed-loop cycle. Recycling is the most widely utilised technique to achieve this, allowing material preservation when a product is thrown away. To preserve the highest level of resource value, there are, nevertheless, alternative techniques that are preferable. Tantiyaswasdikul (2020) talks on how restoration must take the place of the EoL paradigm. The author suggests that the goal should be to avoid the product from being discarded in the first place, rather than concentrating on how to treat materials and elements after a product has reached its end of life stage. Once more, the product's design assumes a critical role in extending its lifespan and facilitating its subsequent reuse by future consumers. Closing the technical cycle can be achieved by creating products that are simple to disassemble and reassemble (Bocken et al., 2016). In what Triguero et al. (2022) refer to as a regenerative system, this is a crucial stage. Regenerative systems minimise emissions and energy leaks, as well as the amount of virgin resources and created trash they introduce into the system. Additionally, it would result in less virgin resource extraction and energy savings (Ávila-Gutiérrez et al., 2019). Academics highlight the need for collaborative networks in order to completely complete closed loops.

In addition to being covered in academic literature, the closing approach is a fundamental component of the ReSOLVE framework, which was created by the Ellen MacArthur Foundation. According to the Ellen MacArthur Foundation (2015), the framework highlights the significance of regenerating ecosystems, encouraging a sharing economy rather than product ownership, optimising performance and efficiency, looping products and materials into

closed loop cycles, virtualizing functions and services to enable dematerialization, and replacing unsustainable options. Scholars have drawn inspiration for new classifications of CE from the framework, and practitioners have used it to support and direct governments and organisations in developing CE policies (Rosa et al., 2019).

- **Narrowing**

Restricting the flow of resources is the final of the three techniques. Reducing the amount of resources used in the product or its manufacturing process is the strategy's primary goal. Narrowing solemnly concentrates on using fewer resources in regard to a product, in contrast to earlier techniques. This is insufficient to move an organisation to a CE because it is already partially implemented within the LE. However, in order to adjust to demands and situations in the future, it is imperative to take measures such as narrowing resource loops and dematerializing products. The demand for resources and commodities as production inputs rises in tandem with product demand. Reintroducing and reducing materials into production is crucial to managing future conditions as virgin resources become more scarce. Focusing on improving product performance while using fewer resources is therefore very important. Additionally, a virtual shift that largely replaces physical goods with digital services and solutions could be used to achieve dematerialization (Geissdoerfer et al., 2017; Lewandowski, 2016). Geissdoerfer et al. (2017) and Lewandowski (2016) both suggest that rather than emphasising the physical product as the primary feature, the goal should be to give the client the best solutions to meet their needs.

## **2.6 Essential key performance indicators for SMEs**

For small and medium-sized enterprises, key performance indicators, or KPIs, are the means of achieving sustained success. KPIs are a group of measurable metrics that are used by businesses to assess or contrast performance in relation to their operational and strategic objectives. KPIs offer an impenetrable management framework. The findings show that SMEs run the risk of a tragic conclusion in the absence of KPIs. 20% of small firms fail in their first year of operation, and just 30% of these businesses make it to their tenth anniversary. The majority of endings are the result of incompetent management or dysfunctional leadership brought on by imprecise goals that could have been resolved using KPIs.

In other words, key performance indicators serve as an integrated safety net for management, eliminating directional ambiguity and minimising disagreements that ultimately result in turmoil within the organisation. This ultimately lowers morale and diminishes the efficacy of leadership.

### ***Use of KPIs in SMEs***

Small and medium-sized businesses (SMEs) depend on Key Performance Indicators (KPIs) as critical measures to assess their performance and set strategic objectives. KPIs assist SMEs in aligning their operations with sustainable practices, increasing resource efficiency, and minimising environmental impact while using the principles of the circular economy. KPIs help SMEs track their progress towards specific sustainability goals, inform strategic and operational decisions, improve communication with customers, investors, and regulatory bodies, and promote continuous improvement by giving them measurable, clear targets.

Metrics related to finances, operations, customers, and sustainability can be used to group KPIs for SMEs. Revenue growth, cost containment, and return on investment (ROI) from sustainable projects are examples of financial KPIs. Operational KPIs, such as the ratio of input materials to output goods and the decrease in production cycle time, are focused on resource and production efficiency. Customer KPIs provide information on service quality and market positioning by measuring customer satisfaction, retention rates, and market share. Metrics that track and encourage environmental responsibility, such as trash reduction, recycling rates, carbon footprint, and water use efficiency, are examples of sustainability KPIs that are essential for the adoption of the circular economy.

KPI adoption in SMEs has several advantages. By finding inefficiencies and putting solutions into place, they improve operational efficiency and save money by using less resources and generating less waste. By attracting environmentally sensitive customers and assisting in ensuring compliance with environmental legislation, sustainability KPIs can give businesses a competitive edge by preventing penalties and legal problems. Transparent KPI reporting can also draw in investors that support ethical and sustainable business operations. KPIs motivate SMEs to continuously look for methods to improve their operations and sustainability initiatives by establishing a culture of continuous improvement.

KPI implementation in SMEs is not without difficulties, though. Financial and human resources are frequently limited, making it difficult to monitor and evaluate KPIs. Gathering data can be challenging, particularly for small companies without sophisticated IT infrastructure. Additionally, SMEs might not have the knowledge necessary to create and analyse useful KPIs, and they might encounter opposition to the adjustments needed to put KPIs into practice. Furthermore, it might be difficult to incorporate KPI tracking into regular business activities, which calls for reliable systems and procedures.

Many SMEs successfully use KPIs to further their sustainability goals in spite of these obstacles. This helps the business to communicate its sustainability accomplishments to stakeholders and align its production processes with the principles of the circular economy. These real-world KPI applications show how important it is for SMEs to use KPIs to steer them towards more effective and sustainable business operations. According to Maxwell et al. (2015), a lack of SMARTness contributes to the difficulty of achieving environmental targets. Goals should be Timed, Specific, Measurable, Appropriate, Realistic, and Realistic in order to successfully lead a company through its circular transition (Rietbergen and Blok, 2010).

**The SMART framework's components and how they relate to KPIs are broken down as follows:**

- **Specific** : KPIs ought to specify precisely what is being measured. This means that the KPI should focus on a certain performance area and be clear and defined.

*Example – To replace "Improve customer satisfaction," an example of a specific KPI might be "Increase the customer satisfaction score by 10%."*

- **Measurable** : KPIs must to be measurable in order to enable an unbiased evaluation of development or accomplishment. To do this, precise measuring standards must be established.

*Example – “Increase sales revenue by 15%” is an example of a measurable goal because it has a defined end point and a way to track development.*

- **Achievable:** Taking into account the organization's resources and limitations, KPIs should be reasonable and reachable. Achievable goals guarantee that objectives are demanding yet doable.

*Example: If the required plans and tools are available, the goal of "Reduce production costs by 5% in the next quarter" can be accomplished.*

- **Relevant:** KPIs must be relevant to the organization's success and should be in line with larger business goals. This guarantees that the most important regions receive the greatest attention.

*Example: An example of a relevant KPI for a business looking to improve its market presence might be "Expand market share by 3% in the next fiscal year."*

- **Time-bound:** KPIs ought to specify the amount of time that needs to pass before the objective is accomplished. This increases urgency and makes it possible to evaluate and modify strategy in a timely manner.

*Example: For instance, the goal "Increase website traffic by 20% over the next six months" has a specific end date and is therefore time-bound.*

### **KPIs for the circular economy can be categorized into several key areas:**

- **Resource Efficiency KPIs:**

- (i) **Material efficiency:** The ratio of product output to raw material intake is known as material efficiency. "Material productivity (GDP per kg of material used)" is one example.
- (ii) **Energy Effectiveness:** Evaluates energy consumption per unit of production, or energy use per unit of output.

- **Waste management KPIs:**

- (i) **Waste Reduction:** Monitors the decrease in trash production, for example, "Percentage decrease in waste disposed of in landfills."
- (ii) **Recycling Rate** (or "Recycling rate as a percentage of total waste"): Indicates the percentage of waste that is recycled.

- **Product Lifecycle KPIs:**

- (i) **Product Longevity:** Assesses the typical life of products; for example, "Average product lifespan in years"
- (ii) **Repair and Reuse:** Tracks metrics like "Number of products repaired or reused per year" to determine how frequently and successfully products are repaired and reused.

- ***Circular Design KPIs:***
  - (i) ***Design for Disassembly:*** "Percentage of products designed for disassembly" is an example of a design for disassembly that evaluates how easily a product can be disassembled for recycling or reuse.
  - (ii) ***Use of Recycled Materials:*** Indicates the percentage of recycled materials that are employed in new product manufacture, for example. Key
- ***Economic KPIs:***
  - (i) ***Cost Savings from Circular Practices:*** Monitors the money saved by implementing circular projects; an example of this would be "Annual cost savings from material reuse".
  - (ii) ***Income from Circular Products and Services:*** This category includes items like "Revenue from recycled or remanufactured products" that reflect income from circular economy initiatives.
- ***Environmental impact KPIs:***
  - (i) ***Carbon Footprint:*** "Total CO2 emissions per unit of product" is an assessment of the overall greenhouse gas emissions made using carbon footprinting.
  - (ii) ***Water Use:*** Calculates the amount of water used during production, e.g., "Water use per unit of output".

### **3.0 Challenges in Adopting Circular Economy Principles in Indian SMEs**

*This chapter explores the various obstacles Indian SMEs encounter when implementing the principles of the circular economy. This chapter attempts to provide a thorough knowledge of the challenges impeding SMEs' transition to a circular model by examining financial, technological, regulatory, market-related, supply chain, educational, and cultural barriers. In order to provide useful insights and possible answers, it also offers techniques to overcome these obstacles.*

The circular economy (CE) is a novel strategy that reinterprets economic growth by emphasising advantages for the entire community. It means engineering waste out of the system and progressively severing the link between economic activity and the use of limited resources. This model creates social, natural, and economic capital. Adopting CE principles can have a significant positive impact on Indian SMEs (small and medium-sized enterprises) by lowering costs, improving economic sustainability, and reducing environmental impact. Indian SMEs encounter many obstacles while attempting to implement CE principles, even with these possible benefits. In order to fully examine these obstacles, this chapter will analyse many variables, including lack of awareness, technology limits, legislative barriers, cultural and behavioural issues, and insufficient infrastructure.

#### **3.1 Financial Constraints**

One of the biggest obstacles to Indian SMEs adopting CE principles is financial constraints. These businesses frequently have little funding, which makes it challenging for them to invest in the new systems and procedures needed for a circular economy.

##### **3.1.1 High Initial Costs**

Making the switch to a CE model comes with hefty upfront expenses. These expenses include of making infrastructural modifications, undertaking research and development, buying new machinery, and updating current technologies. For instance, a small manufacturing facility might have to spend money on equipment that enables material recycling and reprocessing. Due of their frequently low profit margins, SMEs may find the first investment intimidating. It could be difficult for SMEs to justify these investments if there aren't clear, immediate results.

Moreover, investments in CE procedures may have a protracted payback period. For example, the financial benefits of decreased waste disposal costs and enhanced material recovery may not materialise for several years after the implementation of an advanced waste management system. Adopting such approaches may be discouraged for SMEs by the delayed return on investment, particularly if short-term financial survival is their top concern.

##### **3.1.2 Limited Access to Finance**

For SMEs, another crucial issue is access to financing. Because of the perceived dangers, traditional financial institutions like banks and non-banking financial corporations (NBFCs) frequently hesitate to lend to SMEs. SMEs often have a poor credit history and no collateral, which makes it challenging for them to get loans. The absence of specialised finance products designed to assist CE projects exacerbates this problem even more.

SMEs frequently lack knowledge about or are unable to participate in government programmes and subsidies that support environmentally friendly activities. Even in cases when such programmes are available, SMEs may be discouraged from using them due to the lengthy and bureaucratic application process. Because of this, the SMEs bear all of the financial burden of switching to a CE model, which restricts their capacity to make the required expenditures.

## **3.2 Lack of Awareness and Understanding**

The lack of knowledge and comprehension of the concept and its advantages is a major obstacle to Indian SMEs' adoption of CE principles.

### **3.2.1 Insufficient Information and Training**

Many small and medium-sized enterprises (SMEs) in India lack a thorough understanding of the circular economy and its potential benefits. Lack of access to training programmes and inadequate information distribution are major causes of this knowledge gap. SMEs are unlikely to prioritise or invest in such efforts unless they have a strong understanding of CE principles and practices.

It is essential to provide SMEs with training sessions and seminars that cover the practical applications of CE, such as resource efficiency, waste management, and sustainable product design. These programmes, however, frequently have a narrow scope and audience. In order to provide these instructional tools, industry associations, governmental entities, and non-governmental organisations (NGOs) must take an increasingly active role.

### **3.2.2 Perceived Complexity**

For SMEs, the shift to a circular economy may seem intimidating and complicated. This view stems in part from the complex nature of product end-of-life (CE), which includes modifications to supply chain management, manufacturing procedures, product design, and end-of-life care. These adjustments can be seen by SMEs as disruptive and impractical.

For instance, implementing a closed-loop manufacturing process necessitates a major change in the sourcing, use, and disposal of materials. SMEs might not have the means or know-how to carry out such a change. This apparent complexity can also be exacerbated by the lack of explicit and simple instructions for applying CE practices, which leads SMEs to stick to well-known linear models.

## **3.3 Technological Limitations**

Adopting CE principles frequently calls for SMEs to have access to cutting-edge technology and creative workflows, which can be difficult to get and put into practice.

### **3.3.1 Obsolete Technology**

Many SMEs in India still use antiquated equipment and technologies that are incompatible with CE standards. As was previously mentioned, upgrading to more sustainable and efficient technologies requires a large expenditure that is frequently out of these companies' budgets.



For instance, without significant technological advancements, a textile SME operating antiquated dyeing equipment could find it difficult to switch to water-efficient dyeing techniques.

Reliance on antiquated technology lowers overall competitiveness and impedes the adoption of CE practices. Cutting-edge technology can provide a competitive advantage in the market by increasing resource efficiency, decreasing waste, and improving product quality. Small and medium-sized businesses (SMEs) are disadvantaged in both home and foreign markets if they lack access to such technologies.

### **3.3.2 Limited R&D Capabilities**

For the creation and use of CE strategies, research and development (R&D) is essential. But the majority of SMEs lack the infrastructure and resources necessary to carry out in-depth R&D. They are unable to innovate and implement new procedures that comply with CE guidelines because of this constraint.

For instance, creating biodegradable packaging materials necessitates a large R&D expenditure. It's possible that SMEs lack the resources or knowledge needed to embark on such projects. Although these alliances are frequently restricted, cooperation with larger companies and research institutes might aid in bridging this gap.

## **3.4 Regulatory and Policy Barriers**

Policies and regulatory frameworks are essential to the implementation of CE practices. The current regulatory framework in India presents SMEs with a number of difficulties.

### **3.4.1 Inadequate Policy Support**

Comprehensive laws and rules created especially to encourage CE practices among SMEs are lacking. Current environmental legislation tend to target larger firms, offering insufficient assistance or financial incentives to smaller businesses looking to make the switch to a circular economy. For instance, waste management legislation may place strict obligations on major producers while providing minimal assistance or direction to small and medium-sized enterprises.

Confusion and inconsistent policies among several states can also result from a lack of harmonisation. SMEs with operations in several states could find it difficult to comply with different regulations, which would increase their operational burden. For CE practices to be widely adopted, a more unified and encouraging national policy framework is necessary.

### **3.4.2 Bureaucratic Hurdles**

SMEs may be discouraged from implementing CE practices by India's convoluted and bureaucratic regulatory procedures. It can be expensive and time-consuming to work your way through the regulatory labyrinth to get the permissions and compliance you need. For example, getting environmental permissions for the establishment of waste management facilities or recycling units may need several levels of approval and drawn-out processes.

These red tape obstacles raise the expenses associated with CE projects while also delaying their implementation. SME burdens can be greatly decreased and sustainable practices can be encouraged by streamlining regulatory procedures and offering a single-window clearance system.

### **3.5 Cultural and Behavioral Challenges**

Cultural and behavioural aspects are very important in the Indian SMEs' adoption of CE principles.

#### **3.5.1 Resistance to Change**

Within SMEs, change is frequently met with opposition, especially from management and staff who are used to operating in more traditional methods. Fear of the unknown and a lack of knowledge about the advantages of CE may be the causes of this resistance. Employees accustomed to the same production procedures, for example, could be hesitant to learn and use new techniques that call for more work.

To overcome this reluctance, change management techniques—such as good communication and stakeholder involvement—are essential. Getting management and staff on board with CE practices can be facilitated by showcasing the observable advantages of these practices, such as reduced costs, increased productivity, and improved market reputation.

#### **3.5.2 Short-term Focus**

SMEs frequently prioritise short-term profits above long-term viability. Adopting CE practices can be perceived as having more immediate expenses and effort than long-term advantages, which makes people reluctant to accept these ideas. For instance, even though energy expenditures can be significantly reduced over time, purchasing energy-efficient gear may have higher initial expenses

It is crucial to promote a long-term outlook and emphasise the strategic advantages of CE, such as its resistance to changes in regulations and resource constraint. It can also be beneficial to provide case studies and illustrations of successful CE adoption in order to change the emphasis from immediate to long-term benefits.

### **3.6 Infrastructure and Supply Chain Challenges**

Strong supply chains and infrastructure are necessary for the shift to a circular economy, but these are frequently absent in the context of Indian SMEs.

#### **3.6.1 Inadequate Infrastructure**

Facilities for managing trash, recycling, and logistical networks are examples of infrastructure that is essential to the successful application of CE principles. It is difficult for SMEs to adopt sustainable practices in many Indian locations due to a lack of infrastructure. For instance, SMEs may find it challenging to effectively manage waste if there are no recycling facilities in the area.

It is imperative to allocate resources towards the development of infrastructure, encompassing the creation of recycling hubs and waste management centres. In order to bridge these infrastructure gaps and give SMEs the encouragement they need to implement CE practices, public-private collaborations can be quite helpful.

### **3.6.2 Fragmented Supply Chains**

Many SMEs have disjointed and ineffective supply networks. The establishment of closed-loop supply chains, which reuse and recycle goods and materials, necessitates coordination and cooperation between multiple stakeholders, which can be challenging to accomplish. To establish a sustainable supply chain, for instance, a manufacturing SME might have to work with suppliers, logistics companies, and recycling businesses.

Resource sharing and innovation can be improved by creating cooperative networks and encouraging alliances between SMEs, big businesses, and governmental organisations. These networks can provide SMEs with access to the infrastructure and technology they need to connect into bigger supply chains.

#### **Example 1 : Textile Industry**

Several SMEs make up India's textile industry, which has a difficult time implementing CE practices. Common problems include the high price of sustainable materials, a dearth of technological innovation, and poor infrastructure for waste handling. On the other hand, several progressive SMEs have effectively applied CE principles by utilising government programmes and forming alliances with technology providers.

For example, a technology supplier and a small and medium-sized enterprise in the textile industry worked together to establish a closed-loop water recycling system. With the use of this system, the SME was able to recycle wastewater and drastically cut down on water use, addressing environmental issues and cutting expenses. The SME's initial investment expenses were partially offset by financial assistance from a government programme that promoted sustainable practices in the textile industry.

#### **Example 2 : Electronics Manufacturing**

Technology constraints and the high startup costs associated with recycling process establishment make CE adoption particularly difficult for SMEs in the electronics manufacturing industry. Novel strategies, like extended producer responsibility (EPR) programmes and product-as-a-service models, have demonstrated potential in addressing these issues.

An electronics manufacturing small and medium-sized enterprise (SME) implemented a product-as-a-service model, enabling customers to lease electronic devices rather than buy them entirely. The SME was inspired by this idea to create goods that are easy to disassemble for recycling and have longer lifespans. The SME also took part in an EPR programme, which assigned them the duty of gathering and recycling products that had reached the end of their useful life. Along with cutting waste, these measures gave the SME new sources of income.

## 3.7 Recommendations for Overcoming Challenges

Indian Small and Medium-sized Enterprises (SMEs) have a revolutionary chance to improve sustainability, economic resilience, and competitiveness through the implementation of circular entrepreneurship. The main goals of circular entrepreneurship are waste minimization, material and product reuse, and natural system regeneration. Implementing circular practices presents many obstacles for Indian SMEs, despite the potential benefits. These obstacles include lack of awareness, legal restrictions, cultural resistance, technology limits, and financial constraints. Here we see the outline on the various methods to overcome these challenges faced by the Indian SMEs.

### 3.7.1 Financial Support and Incentives.

#### *Rationale:*

Financial burdens for SMEs looking to implement circular processes might be greatly decreased by government grants and subsidies. These financial incentives can facilitate the transition by reducing the upfront expenditures related to the adoption of new technology and procedures.

#### *Recommendations:*

- **Creation of Green Funds:** The government ought to set up specific green funds that offer grants and subsidies to small and medium-sized enterprises (SMEs) for investments in projects linked to the circular economy. Initiatives including resource-efficient technologies, renewable energy installations, and waste management systems may be supported by these funding.
- Introduce performance-based incentives to recognise and compensate small and medium-sized enterprises (SMEs) for meeting predetermined sustainability goals. For instance, SMEs may be eligible for further funding if they show a notable improvement in recycling rates or a reduction in trash.

### 3.7.2 Low-Interest Loans and Credit Facilities

#### *Rationale:*

For SMEs to invest in the infrastructure and technology needed for circular entrepreneurship, access to affordable finance is essential. Financial hardship can be minimised while providing the necessary capital through low-interest loans and credit facilities.

#### *Recommendations:*

- **Green lending Programmes:** Financial institutions should create green lending programmes with advantageous terms for SMEs in partnership with government organisations. These loans could have longer payback terms, cheaper interest rates, and less collateral requirements for investments in the circular economy.
- **Credit Guarantees:** Put in place credit guarantee programmes to lower banks' perceptions of risk and entice them to lend to SMEs. The government can raise access to financing and reduce possible losses by guaranteeing a portion of the loan.

### 3.7.3 Awareness and Education Programs

#### *Rationale:*

One major obstacle to implementation of the circular economy is a lack of knowledge and comprehension of its ideas. Programmes for comprehensive training and capacity-building can give SMEs the information and abilities they need to adopt sustainable practices.

#### *Recommendations:*

- **Workshops and Seminars:** Schedule frequent workshops and seminars for SME owners, managers, and staff on themes related to the circular economy. These gatherings ought to address useful facets of circular entrepreneurship, such as resource efficiency, waste minimization, and environmentally friendly product design.
- **Online Courses and Webinars:** Provide SMEs flexible learning options by creating online courses and webinars. These digital materials provide easy access to education on the circular economy and have the potential to reach a wider audience.

### 3.7.4 Information Dissemination

#### *Rationale:*

It takes effective information sharing to increase public knowledge of the advantages and realities of adopting a circular economy. To make wise decisions, SMEs require access to accurate and timely information.

#### *Recommendations:*

- **Resource sites:** Establish specialised web sites with extensive data on case studies, legal requirements, support programmes, and circular economy methods. These portals must to be user-friendly and updated often.
- **Industry Publications:** To showcase effective circular economy initiatives and best practices, publish reports, bulletins, and articles on a regular basis in industry magazines and journals. These articles can educate and motivate SMEs about the possible advantages of circular entrepreneurship.

### 3.7.5 Technological Upgradation

#### *Rationale:*

It is essential for SMEs to have access to cutting edge technologies in order to successfully adopt circular economy principles. Upgrading technology can increase sustainability overall, decrease waste, and improve resource efficiency.

#### *Recommendations:*

- **Technology Grants:** Provide funds expressly for the purchase and application of cutting-edge technologies that promote the principles of the circular economy. These grants can be used to pay for the integration of digital solutions, the purchase of new machinery, and upgrading old machinery.

- **Innovation Hubs:** Create technology centres and hubs that provide SMEs with access to cutting-edge resources and technical know-how. These centres can act as testing and development grounds for novel circular economy technologies.

### 3.7.6 Research and Development Support

*Rationale:*

Research and development (R&D) expenditures are necessary to generate creative solutions suited to the requirements of SMEs. The creation of novel materials, procedures, and goods that adhere to the principles of the circular economy can be accelerated by R&D support.

*Recommendations:*

- **R&D Incentives:** Provide SMEs who invest in R&D projects linked to the circular economy with tax breaks and other financial aid. These rewards may persuade companies to commit funds to creating environmentally friendly innovations.
- **Collaborative Research Initiatives:** Encourage cooperation on R&D projects among SMEs, academic institutions, and larger enterprises. These collaborations have the potential to speed up the development of circular economy technologies, lower costs, and promote knowledge transfer.

### 3.7.7 Policy Reforms

*Rationale:*

Encouraging SMEs to adopt the circular economy requires a legislative environment that is favourable. Regulations that are unambiguous and simplified can ease the stress of compliance and foster an environment that supports sustainable behaviours.

*Recommendations:*

- **Simplified legislation:** Streamline and standardise circular economy legislation among various states and industries. SMEs may find it simpler to comply with regulations and experience less uncertainty if clear and consistent standards are followed.
- **One-stop Service Centres:** Create one-stop service centres that offer SMEs complete assistance with adhering to regulations. By assisting with paperwork, approvals, and permits, these centres help lower administrative barriers.

### 3.7.8 Incentive Policies

*Rationale:*

SMEs can be encouraged to use circular economy principles by offering measurable rewards for sustainable behaviour through incentive policies. A transition to more environmentally friendly company models may be aided by these regulations.

*Recommendations:*

- **Tax reductions:** Provide tax reductions to SMEs who contribute to projects promoting the circular economy. A major financial incentive for adoption of environmentally friendly practices might come from lower tax rates.
- **Recognition Initiatives:** Establish initiatives that reward and publicly recognise SMEs for their contributions in sustainability. Public endorsements, certifications, and awards can improve a company's reputation and promote the adoption of circular economy principles more broadly.

### 3.7.9 Collaborative Networks

*Rationale:*

Industry clusters and collaborative networks can help SMEs share information, pool resources, and take coordinated action. The adoption of the circular economy can be aided by the creativity and synergies that these networks can foster.

*Recommendations:*

- **Industry Clusters:** Promote the establishment of circular economy-focused industry clusters. To work together on sustainable initiatives and exchange best practices, these clusters might bring together SMEs, big businesses, academic institutions, and governmental organisations.
- **Business alliances:** Boost alliances for businesses that promote circular economy principles. These organisations can offer a forum for lobbying, networking, and the sharing of knowledge about circular entrepreneurship.

### 3.7.10 Public-Private Partnerships

*Rationale:*

Public-private partnerships (PPPs) have the potential to enhance circular economy practices by capitalising on the advantages of both sectors. The sharing of infrastructure, knowledge, and resources can be facilitated via these collaborations.

*Recommendations:*

- **PPP Initiatives:** Create PPP initiatives that concentrate on projects related to the circular economy, like waste management, infrastructure for recycling, and renewable energy. These programmes can accomplish sustained results by fusing innovation from the commercial sector with public funding.
- Encourage the formation of cooperative ventures between SMEs and bigger companies. Through these partnerships, SMEs may gain access to cutting-edge technologies, capital, and business prospects.

### 3.7.11 Cultural and Behavioural Change

*Rationale:*

Adoption of circular economy practices may be hampered by behavioural and cultural reluctance to change. A more seamless shift to sustainable business models can be facilitated by employing effective change management techniques.

*Recommendations:*

- **Leadership Development:** Create programmes that highlight the benefits and tenets of the circular economy for leaders. A sustainable culture can be promoted and organisational change can be accelerated by educating and empowering leaders in SMEs.
- **Employee Engagement:** Put in place programmes that encourage staff members to embrace circular economy principles. This can include eco-friendly behavior-rewarding incentive plans, sustainability workshops, and training programmes.

### 3.7.12 Long-term Strategic Planning

*Rationale:*

Putting long-term sustainability ahead of short-term advantages is crucial to the implementation of circular economy principles. Strategic planning for the long term can help businesses meet social and environmental goals.

*Recommendations:*

- **Sustainability Objectives:** Include sustainability objectives in SMEs' strategic planning procedures. This may entail establishing quantifiable goals for emissions reduction, resource efficiency, and waste reduction.
- **Balanced Scorecard:** To monitor and control performance in the areas of finances, the environment, and society, use balanced scorecards. This strategy can offer a comprehensive understanding of corporate success and promote ongoing sustainability practice improvement.

### 3.7.13 Waste Management and Recycling Facilities

*Rationale:*

It takes adequate infrastructure to put circular economy principles into operation. Facilities for recycling and waste management are essential parts of a circular economy.

*Recommendations:*

- **Infrastructure Development:** Fund the construction of facilities for recycling and garbage management, especially in areas where such infrastructure is inadequate. PPPs and public funds may be used to assist in the construction of these facilities.
- **Logistics and Supply Chain Integration:** To make the gathering, sifting, and processing of recyclable materials easier, improve supply chain and logistics networks. Reduction of expenses and enhancement of recycling programmes can be achieved through efficient logistics.



### 3.7.13 Digital Infrastructure

*Rationale:*

Circular economy principles can be greatly aided by digital technologies. Sustainable business models can benefit from increased efficiency, transparency, and innovation thanks to digital infrastructure.

*Recommendations:*

- Encourage the use of smart technologies to enhance resource management and traceability, such as blockchain, artificial intelligence (AI), and the Internet of Things (IoT).
- **Digital Platforms:** Create digital platforms that link customers, technology suppliers, and recycling facilities with small and medium-sized enterprises. These platforms have the ability to enable the interchange of goods, data, and services.

### 3.7.14 Case Studies and Best Practices

*Rationale:*

When considering the adoption of circular economy techniques, SMEs can get useful insights and inspiration from case studies and best practices. They illustrate the advantages and difficulties of circular ideas and show how they are applied practically.

*Recommendations:*

- *Recording Case Studies:* Keep track of and share case studies of SMEs that successfully implement the circular economy. The tactics, results, and lessons should all be included in these case studies.
- Create networks that help small and medium-sized enterprises (SMEs) exchange best practices. These networks have the ability to plan forums, webinars, and events where companies may meet and share ideas.

### 3.7.15 Knowledge Transfer and Mentorship Programs

*Rationale:*

Programmes for knowledge transfer and mentoring can hasten the adoption of circular economy principles by giving SMEs access to the advice and assistance of seasoned professionals.

*Recommendations:*

- **Mentorship Initiatives:** Establish mentorship initiatives that match SMEs with mentors who have effectively incorporated circular economy principles. Mentors can offer guidance, encouragement, and support all through the adoption process.
- **Knowledge Transfer Workshops:** Arrange training sessions and workshops with an emphasis on the useful aspects of adopting a circular economy. Topics including business

model innovation, technological implementation, and regulatory compliance may be discussed at these events.

### 3.7.16 Monitoring and Evaluation

#### *Rationale:*

In order to determine whether circular economy projects are effective, monitoring and assessment are necessary. Performance metrics can guide efforts towards continual development and offer insightful feedback.

#### *Recommendations:*

- Create key performance indicators (KPIs) to track how circular economy strategies affect bottom line results, sustainability of the environment, and social impacts. Waste minimization, resource efficiency, and emissions management are a few examples of these indicators.
- **Frequent Audits:** To evaluate adherence to circular economy concepts and pinpoint opportunities for development, conduct routine audits. Consultants from outside the company or within teams may conduct these audits.

### 3.7.17 Reporting and Transparency

#### *Rationale:*

Accountability and transparency are essential for establishing the legitimacy and trustworthiness of circular economy projects. Reporting on a regular basis can show advancement and emphasise the advantages of sustainable practices.

#### *Recommendations:*

- **Sustainability Reports:** Inspire small and medium-sized enterprises to release yearly reports outlining their accomplishments and initiatives related to the circular economy. These reports can improve accountability and transparency.
- **Public Disclosure:** Encourage the release of performance indicators and sustainability statistics to the public. This can involve disseminating information via government portals, business websites, and industry platforms.

## Conclusion

For Indian SMEs, embracing circular entrepreneurship has enormous potential to improve their resilience, competitiveness, and sustainability. Nonetheless, overcoming the obstacles brought forth by this shift calls for concerted efforts and all-encompassing plans. Stakeholders may foster an atmosphere that facilitates the widespread adoption of circular economy principles by putting the advice in this chapter into practice. Indian SMEs can successfully transition to a circular economy and contribute to a more sustainable future through financial support, awareness and education programmes, technological advancements, policy reforms, collaborative networks, cultural change, infrastructure development, case studies, and monitoring and evaluation.

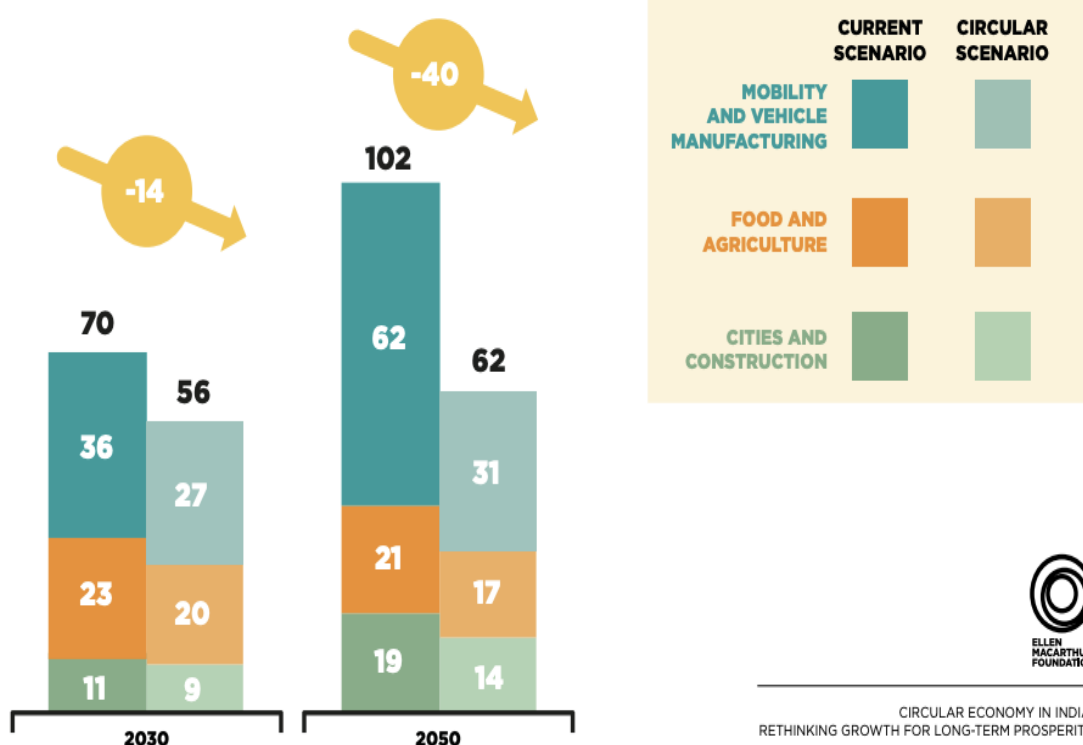
## 4.0 Opportunities in Adopting Circular Economy Principles

With an emphasis on material reuse, recycling, and regeneration, the circular economy (CE) is a paradigm shift away from the conventional linear economic model of "take-make-dispose" and towards a more sustainable framework. Adopting CE principles offers SMEs (small and medium-sized enterprises) in India a revolutionary potential. This chapter explores the several benefits—economic, environmental, social, and strategic—that result from adopting circular economy techniques. This provides a thorough grasp of how SMEs may use the concepts of the circular economy to promote competitiveness and sustainable growth by investigating these potential.

*The research and analysis established seven key insights that make the case for the application of circular economy principles in India.*

- I. Compared to the current growth scenario, India's circular economy may generate an annual value of ₹14 lakh crore (US\$ 218 billion) in 2030 and ₹40 lakh crore (US\$ 624 billion) in 2050 if it follows a different development path. The comparison of costs across the three focal areas leads to this result. According to the calculations, the circular development scenario would result in much reduced costs for the same level of usefulness. By 2030, cost reductions will account for 11% of India's GDP, and by 2050, 30%.

**TOTAL CASH-OUT COSTS IN THREE FOCUS AREAS (₹ LAKH CRORE)**



*Figure 4.1: comparison of cash-out costs in potential development paths*

- II.** Enterprises may enhance their earnings and save material costs by implementing circular economy strategies. Reverse logistics, creative business concepts, and improved product design are the main forces behind value creation. For example, the automobile industry can capture the value of more intensive use of each car by moving from selling cars to offering vehicles as a service. This can produce new revenue streams. Vehicles with innovative designs that reduce maintenance requirements and increase fuel efficiency can add value by boosting utility (measured in total kilometres travelled) and lowering operating expenses. By using design techniques for modular buildings, construction businesses can introduce new ideas into the built environment. Retrieving leftover materials from construction and demolition projects and storing them in cycles could help to realise their worth and eventually lower the total cost of building.

Indian companies may be able to turn a profit in industries other than those our investigation examined. For instance, a prior investigation by the Ellen MacArthur Foundation, based on in-depth product-level modelling, discovered that fast-moving consumer goods companies, at today's consumption levels, have the potential to create up to US\$700 billion in global value annually. The anticipated expansion of the middle class in India means a substantial window of opportunity for Indian enterprises operating in sectors like textiles and electronics where domestic consumption is on the rise. Established companies as well as fresh start-up ventures could benefit from these revenue prospects

- III.** Adopting a circular economy development route has the potential to greatly reduce adverse environmental externalities. For instance, compared to the current development scenario, greenhouse gas (GHG) emissions could be 23% and 44% lower in 2030 and 2050, respectively, assisting India in meeting its commitments under the recently signed Paris Agreement. The combined emissions in the three target areas are used to create this comparison. There would also be a decrease in other negative externalities, such as those brought on by the linear use of virgin materials, water, and synthetic fertilisers. Consumption of virgin materials would be 38% lower in 2050 and 24% lower in 2030 in the three key areas that were examined as compared to the current development path. Compared to the existing development path, the construction industry's water usage would be 19% lower in 2030 and 24% lower in 2050, and its use of synthetic fertiliser and pesticides would be 45% lower in 2030 and 71% lower in 2050 (see Figure 4.2).

**TOTAL CASH-OUT COSTS IN THREE FOCUS AREAS (₹ LAKH CRORE)**

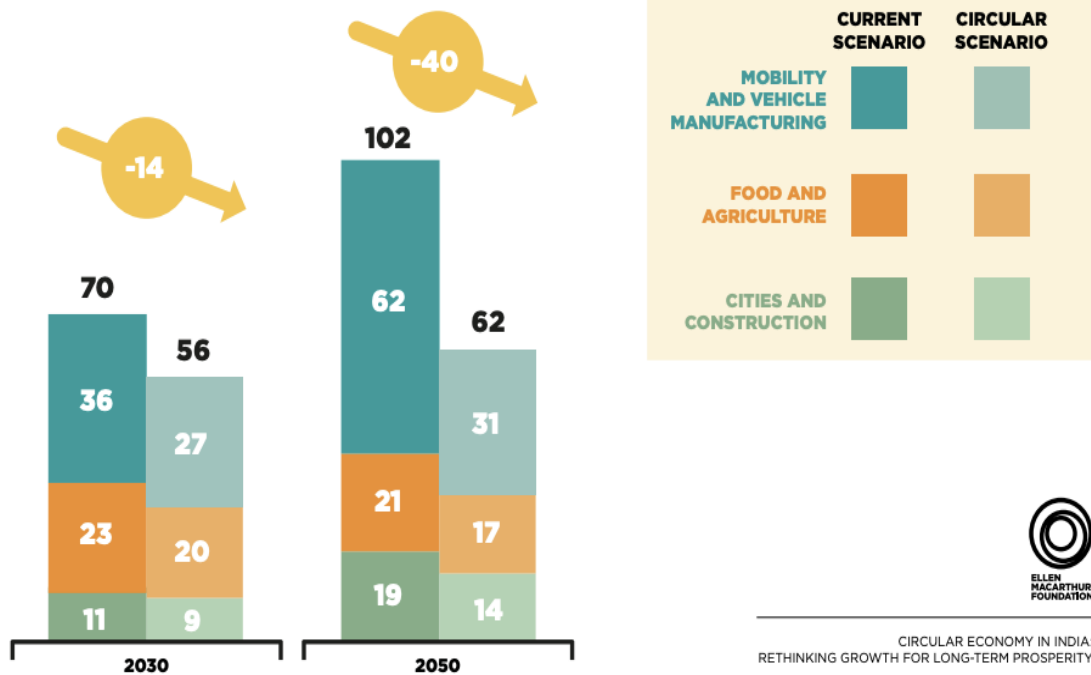


Figure 4.2 : Comparison of cash-out costs in potential development paths

IV. The Indian populace might profit from a circular economy in the form of less expensive goods and services, as well as less traffic and pollution. The analysis revealed that compared to the current course, the circular growth path would significantly reduce the cost of providing the expected services for every resident in each of the three priority areas that were investigated. A portion of this value will be captured by enterprises, but the majority will increase disposable income. Reduced expenses may also facilitate the implementation of the National Food Security Mission and the Pradhan Mantri Awas Yojana (Housing for All) in India.

The analysis also indicated positive effects on pollution, traffic, and health. For instance, compared to the current course, adopting the circular growth path will cut vehicle kilometres travelled on roads by 38% in 2050 and decrease traffic congestion and time spent in traffic. of the circular scenario, there would be an increase of zero-emission cars, which would lessen pollution's detrimental effects on prices and health. Farmers' health should improve if pesticide use is reduced (76% less in 2050 compared to the current trajectory). To quantify the larger systemic impact of applying circular economy concepts in India more precisely, detailed modelling of systemic externalities is required, beyond the purview of this work.

V. India's standing as a centre of innovation and technology might be strengthened by utilising digital technologies to support the circular economy. India is particularly well-positioned to take advantage of these opportunities given its renowned IT sector and the way the circular economy and digital technology interact to generate fertile ground for value creation. The three research priority areas could benefit from digital technologies and the growing ease of connectivity.

Digital supply chains and platforms that facilitate the exchange of knowledge and best practices among small farmers, as well as the maximising of asset utilisation rates, can have a substantial positive impact on the food system. Digital gadgets in the mobility sector can offer smooth door-to-door transport planning, integrating various forms of transport and offering immediate access to mobility when required. Digitally enabled sharing solutions are already being implemented in cities to improve building floor area efficiency. The internet of things (IoT) and the circular economy concepts combine to create a plethora of new opportunities for value creation that can be seized by established companies as well as up-and-coming entrepreneurs. By embracing the concepts of the circular economy, current government programmes like Digital India could help to encourage these potential.

- VI.** India may move straight to a more effective system and avoid becoming stuck in linear models and infrastructure by actively utilising and developing circular economy potential now. In a developing nation such as India, where housing, food, and transportation systems need to be developed, the nation stands to gain a great deal by creating these systems in a circular rather than a linear fashion.

For instance, only over 7.5% of Indians presently own a car, despite the country's growing need for mobility. People's mobility demands could be satisfied more affordably and with fewer negative externalities by designing and constructing a system of transport that allows for safe, practical, and comfortable travel without the need for a car than under the current development scenario. In other contexts, like cities and the building industry, meeting the demand for development with extremely energy-efficient structures and infrastructure, or virtualizing the needs entirely, which benefits the mobility system, could result in long-term resource and energy savings.

- VII.** By adopting a circular economy, high-growth markets like India can gain a competitive edge over developed economies. As previously mentioned, incorporating the concepts of the circular economy into new endeavours from the outset would solidify the course of action and encourage early success. On the other hand, advanced economies would have to completely overhaul their systems in order to achieve the same degree of circularity due to the linear lock-in that already exists. India and other high-growth markets may have a competitive advantage over those economies thanks to this favourable starting place.

For instance, compared to 25% in the UK, 70% of the structures that are anticipated to stand in India by 2030 have not yet been constructed. India's buildings would have more embedded circularity if both economies had implemented circular economy ideas to all new construction up until that point. India may take use of this competitive edge by creating innovative and skilled circular building products that it could export to other nations. In a similar vein, India would incur far smaller overall expenditures (given the size of the economy) to transition to a highly circular system.

## **4.2 Circular economy opportunities for India**

### **4.2.1 Cities and construction:**

Liveable cities with buildings and infrastructure that meet the future needs of India's expanding population.

India is experiencing tremendous urbanisation at a time of constrained resources. To meet the growing demand, an estimated 700–900 million square metres of additional commercial and residential space annually—the equivalent of what is now developed in Chicago—must be constructed.

The application of circular economy concepts to this building project can generate revenue and separate growth from the consumption of virgin, non-renewable materials. Construction expenses can be decreased and trash can be minimised by using modular building techniques using renewable and repurposed resources. During their use phase, buildings can be constructed to contribute to the regenerative urban ecology and be flexible enough to meet changing needs (e.g., by connecting to nutrient cycling systems or generating electricity).

India could apply circular economy principles to the design of the infrastructure required to provide waste, sanitation, and water services at scale, establishing efficient urban nutrient and material cycles, as it invests in long-term infrastructure to enhance citizens' quality of life, for instance through the Smart Cities Mission. The integration of circular mobility solutions with more comprehensive urban planning can lead to improved air quality, less traffic, and a decrease in urban sprawl. Digital solutions that enable flexible building and urban area use can boost utilisation rates and extract more value from the same assets. The housing needs of the urban poor could also be satisfied with increased efficiency and decreased overall development and infrastructure costs without sacrificing quality or safety.

### **4.2.2 Food and agriculture:**

A regenerative, restorative agricultural system that combines modern technology with traditional practices to meet India's growing food demand

The agricultural industry, which employs half of the working people in the nation, is nevertheless critical to the Indian economy and the country's food security. An agricultural system designed to close nutrient loops might provide the industry with a framework for protecting natural capital, enhancing ecological and economic resilience, and providing India's expanding population with a steady supply of fresh, nutritious, and varied food.

India might establish extensive networks of farmers that are dedicated to regenerative methods, integrated, and symbiotic in their activities by utilising the country's current small-farm structure. It is possible to increase yield while drastically reducing the need for resources like water, artificial fertilisers and synthetic fertilisers by combining traditional knowledge from the area with modern technology (like precision farming and digitally enabled asset and knowledge-sharing systems) and working with a wide range of species.

The Indian food system might be even more efficient if food waste was reduced across the supply chain. To more readily match supply and demand, this would necessitate digitalizing food supply networks and optimising production. Food waste and transportation needs can be

decreased by bringing food production and consumption closer together through urban and peri-urban farming. Restoring soil nutrients and producing energy are made possible by composting and anaerobically digesting food waste that has no other useful purpose and post consumption nutrients (those found in human excreta).

### **4.2.3 Mobility and vehicle manufacturing**

A convenient, multimodal transport system enabled by digital technology, for resource-optimised and efficient mobility.

It is anticipated that by 2030, the demand for personal mobility in India would have doubled or tripled. Automobile sales are soaring, and by 2030, the nation—after the United States and China—should rank third globally. The application of circular economy ideas can help create a transportation system that minimises negative externalities like pollution, traffic, and greenhouse gas emissions while meeting the expanding requirements of the Indian population, particularly in urban areas.

With a focus on digital innovation and embracing vehicle-sharing trends, a multimodal, door-to-door on-demand mobility system might offer cost-effective transportation with high vehicle occupancy and utilisation rates. Convenient door-to-door travel can be achieved by utilising mass transit as the spine and combining it with other modes of transportation, such as vehicle as a service, to provide last-mile connection. Innovative technology can assist in organising these trips and expedite and improve safety of travel.

Reducing the demand for virgin, non-renewable resources and energy can be achieved by designing vehicles with reparability, remanufacturing, and recycling in mind, as well as by developing the necessary reverse cycle infrastructure. Constructing automobiles using zero-emission propulsion technology could lessen harmful externalities including pollution, greenhouse gas emissions, and reliance on imported fossil fuels. Since there are currently few cars owned, adoption may happen quickly as ownership increases.

## **4.3 Capturing the benefits**

*This in-depth chapter highlights the economic, environmental, social, and strategic advantages of adopting circular economy principles by Indian SMEs. SMEs may promote sustainable growth and strengthen the foundation of a more robust and sustainable economy by taking advantage of these opportunities. Several parties must take action in order to realise the circular economy prospects outlined in this research. Governments can provide the necessary supportive environments for businesses to embrace circular models, giving them the chance to take the lead in this shift. To bring about structural change, cooperation between these and other actors—such as the unorganised sector, educational institutions, non-profits, and international organizations—will be essential. In the short term, strengthening the foundations required to start the shift might be achieved by establishing such alliances, including additional stakeholders, and doing additional research.*

By exploring these opportunities, we aim to provide a comprehensive understanding of how SMEs can leverage circular economy principles to achieve sustainable growth and competitiveness.



### 4.3.1 Economic Opportunities

Adopting circular economy concepts has numerous financial advantages for SMEs, including increased profitability, lower expenses, and access to new markets. SMEs can realise tremendous economic value by converting to a circular model.

- a) **Cost Savings and Resource Efficiency** : Reductions in costs due to increased resource efficiency are among the most obvious and instant advantages of implementing a circular economy. SMEs may drastically lower operating expenses by optimising the usage of energy and materials. For example, lowering disposal costs and reducing the requirement for raw materials can be achieved by introducing waste reduction and recycling activities. According to a 2013 research by the Ellen MacArthur Foundation, companies that implement CE practices can save a significant amount of money by reducing waste and optimising resource use. These cost savings can have a particularly positive effect on Indian SMEs with narrow profit margins, improving their overall financial stability.
- b) **New Revenue Streams** : The circular economy gives SMEs the chance to develop creative business models, which opens up new revenue sources for them. Examples include take-back programmes that enable businesses to retrieve and refurbish products, and product-as-a-service (PaaS), where users pay for the usage of a product rather than buying it entirely. These strategies improve client loyalty and relationships in addition to producing recurrent revenue. Selling reconditioned items or by-products might be another way for SMEs to investigate prospects in secondary markets. For example, textile SMEs might generate extra revenue by selling fabric scraps to recycling businesses.
- c) **Access to New Markets and Customers** : SMEs can gain access to new markets and client groups by implementing circular economy principles as global consumer trends shift towards sustainability. Businesses and customers who care about the environment are looking for goods and services that share their beliefs. Through showcasing their dedication to sustainability, SMEs may set themselves apart from rivals and draw in an increasing number of environmentally conscientious clientele. This market increase isn't just happening locally; it's also happening internationally, as sustainability regulations tighten. Indian SMEs can increase their export potential by positioning themselves as preferred suppliers in certain markets by implementing CE principles.

### 4.3.2 Environmental Benefits

Adopting a circular economy has significant positive effects on the environment, helping to reduce waste, conserve resources, and lessen negative effects on the environment. In order to solve environmental issues, SMEs can be extremely important by incorporating CE practices.

- a) **Waste Reduction and Management** : Implementing the circular economy's tenets greatly reduces trash production for SMEs. Businesses may reduce the quantity of garbage that ends up in landfills by designing their goods with lifetime, reparability, and recycling in mind. Reducing waste is further aided by efficient waste management techniques including recycling industrial by-products and composting organic garbage. This lessens the load on waste management systems and lowers the environmental impact that enterprises have on the environment. One example of how CE may turn

waste into useful resources is the application of zero-waste manufacturing methods, in which every output is used or repurposed.

- b) Conservation of Natural Resources :** The regenerative and sustainable use of natural resources is emphasised by circular economy techniques. SME dependency on limited resources, like water, fossil fuels, and minerals, can be decreased by implementing resource-efficient technology and procedures. For instance, continuous water reuse made possible by closed-loop manufacturing systems dramatically lowers water consumption. Furthermore, the switch to renewable energy sources reduces greenhouse gas emissions and dependence on fossil fuels, such as wind and solar power. By guaranteeing resource availability, these strategies not only protect natural resources but also improve the long-term viability of SMEs.
- c) Mitigation of Environmental Impact :** By implementing circular economy principles, industrial activities can lessen their negative environmental effects. By encouraging sustainable land use, cutting emissions, and optimising energy use, SMEs may lessen their carbon footprint. One way to mitigate the effects of climate change is by implementing energy-efficient technology and processes, which can reduce greenhouse gas emissions. Reforestation and biodiversity protection are two more sustainable land management techniques that support ecosystem restoration and improve ecological resilience. SMEs can improve the planet's general health and sustainability by lowering pollution and environmental deterioration.

#### 4.3.3 Social Benefits

Adoption of the circular economy has social benefits that go beyond its positive effects on the environment and the economy. These benefits include improved social fairness, job creation, and community development. SMEs can promote beneficial social change by incorporating CE principles.

- a) Job Creation and Skills Development :** Making the shift to a circular economy could lead to new job possibilities and the development of skills. The need for workers with experience in recycling, remanufacturing, and sustainable design is increasing as more SMEs use circular processes. This demand has the potential to boost employment growth in a number of industries, including manufacturing, services, and logistics. Furthermore, the emphasis on sustainability and innovation might encourage workers to acquire new abilities and skills. To fully realise this potential, training programmes and educational activities that give employees the skills they need for the circular economy are crucial.
- b) Community Development :** Community development can be enhanced by circular economy methods, which encourage social entrepreneurs, collaboration, and local sourcing. SMEs that place a high priority on obtaining goods and services locally strengthen local economies and community relationships. Shared manufacturing facilities and resource pooling are two examples of collaborative projects that can save costs and increase community resilience. Social entrepreneurs that prioritise sustainable production, upcycling, and recycling open doors for community empowerment. SME integration can improve the social and economic well-being of their communities by using the ideas of the circular economy.

- c) **Enhanced Social Equity** : By guaranteeing a more equitable distribution of the advantages of sustainable practices, the circular economy advances social fairness. By implementing inclusive business models that offer equitable pay, secure working environments, and opportunity for marginalised groups, SMEs can contribute to the reduction of inequality. For instance, recycling programmes that include unpaid trash labourers might raise their standard of living and help them enter the formal economy. Furthermore, SMEs' reputations can be improved by emphasising sustainability and social responsibility, drawing in investors and customers who share their values. SMEs may help create a society that is more inclusive and just by promoting social equity.

#### 4.3.4 Strategic Opportunities

Adopting the concepts of the circular economy provide SMEs with tactical chances to improve their resilience, inventiveness, and competitiveness. SMEs can establish themselves as industry leaders in sustainability and promote long-term success by adopting CE practices.

- a) **Competitive Advantage** : Adopting the concepts of the circular economy can give SMEs a sizable competitive edge. Companies that show a dedication to sustainability and circular business models are likely to draw partners, investors, and customers who care about the environment. By making a difference, a brand can improve its reputation and win over more loyal customers, which will boost its market share and profitability. Furthermore, sustainable methods are becoming more and more favoured by industry standards and regulatory frameworks. Small and medium-sized enterprises (SMEs) can enhance their competitiveness by proactively implementing circular economy ideas, which can help them stay ahead of regulatory requirements and avoid potential penalties.
- b) **Innovation and Business Model Transformation** : The circular economy promotes creativity and the evolution of conventional company structures. SMEs can create new goods, services, and procedures that address the changing demands of society and consumers by utilising circular principles. For example, companies can look into ways to build products that are easy to repair, modular, and long-lasting. Furthermore, the transition to service-based business models, including leasing and sharing, can lower resource use and generate new revenue streams. Innovation in circular economy strategies can create new markets and propel corporate expansion while promoting resilience and long-term sustainability.
- c) **Resilience and Risk Management** : Through the reduction of reliance on limited resources and the mitigation of supply chain disruption risks, circular economy practices can improve the resilience of small and medium-sized enterprises (SMEs). SMEs may create more robust supply chains by implementing resource-efficient procedures, using recycled and renewable inputs, and diversifying their material sources. Given the global concerns of resource scarcity, climate change, and geopolitical instability, resilience is especially crucial. Additionally, by lowering exposure to erratic commodity prices and regulatory changes, circular economy methods can enhance risk management. SMEs can better manage uncertainty and adjust to shifting market conditions by implementing circular concepts.

## Conclusion

For Indian SMEs, embracing the concepts of the circular economy has enormous potential to improve their resilience, competitiveness, and sustainability. The financial advantages include of reduced expenses, fresh sources of income, and entry into untapped markets. Circular processes help reduce waste, conserve resources, and lessen the negative effects on the environment. The circular economy promotes social justice, community growth, and employment creation. SMEs can gain a competitive edge, stimulate innovation, and build resilience through strategic actions. Indian SMEs can successfully transition to a circular economy and contribute to a more sustainable and prosperous future by putting the advice in this chapter into practice.

## 4.4 Examples of Indian companies promoting Circular Economy

Linear economies have been a feature of the modern industrial world, where you:

- Gather natural resources
- Turn them into products
- Sell them to customers who then discard them after they're done using them and
- Purchase new ones when they become available.

The linear economy greatly increased industrial growth and economic success, but it also endangered biodiversity, harmed our natural ecosystems, and left the environment dirty.

Many consumers in the throw-away culture do not pay much attention to knowing the origins and destinations of products.

Consider the fashion business. Over the past 15 years, manufacturing has doubled, yet the amount of time that apparel is worn before being thrown away has decreased by about 40%.

The same is true for electronic garbage, or "e-waste." According to reports, a record 53.6 million metric tonnes (Mt) of e-waste—discarded devices that require a battery or plug, like computers and mobile phones—were generated globally in 2019, an increase of 9.2 Mt over the previous five years. Many types of electronic equipment contain toxic and hazardous materials like mercury, brominated flame-retardants (BFR), or chlorofluorocarbons (CFCs), which, if not managed properly soundly, offer a serious risk to human health and the environment.

How may this linear technique be modified? The ability to create a circular economy is largely responsible for the solution. In a circular economy, products are reused to the greatest extent feasible before being recycled or upcycled to maximise the value of the resources. Making the transition to a circular economy can be very helpful in lowering global CO<sub>2</sub> emissions and lessening the effects of climate change.

Here are some of the circular economy companies in India transforming waste into valuable products:

- **Binbag Recycling**

Binbag leverages technology to collect and recycle e-waste in formal channels. They operate two plants in Andhra Pradesh and Assam to recycle ACs, computers, laptops, etc.

- Founded in: 2014
- Founded by: Achitra Borgohain
- HQ: Bengaluru, Karnataka

- **Namo eWaste Management**

Name eWaste is into the extraction of metals from e-waste and separating the hazardous content present from the waste. The extracted metals and plastic is sent to respective foundries for molding into different items. For example, the aluminium extracted from refrigerators is moulded into secondary aluminium which is used in the automobile industry.

- Founded in: 2014
- Founded by: Akshay Jain
- HQ: Faridabad, Haryana

- **Attero Recycling**

Attero specializes in end-to-end e-waste recycling and metal extraction and is one of the oldest e-waste circular economy companies in India. The company has a pan-India network connecting stakeholders across the value chain including manufacturers, consumers, waste pickers, and aggregators.

- Founded in: 2008
- Founded by: Rajat Vishnoi
- HQ: Noida, Uttar Pradesh

- **Recykal**

Recykal is an end-to-end waste management company that connects waste generators, processors, recyclers, and brand owners through technology.

- Founded in: 2017
- Founded by: Abhay Deshpande, Vikram Prabakar and Nitin Padmawar
- HQ: Hyderabad, Telangana

- **Saahas**

Saahas was started in 2001 by Wilma Rodrigues to promote waste management practices. Saahas operates two different entities – Saahas and Saahas Zero Waste. Saahas Zero Waste works with bulk waste generators such as businesses, residential complexes, educational institutions, hotels, etc. The discarded waste is further molded into different products like roofing sheets, clipboards, stationary, upcycled textile products, etc.

- Founded in: 2001
- Founded by: Wilma Rodrigues
- HQ: Bangalore, Karnataka

- **Twirl.Store**

Kolkata-based Twirl.store allows people to sell their old clothes which are refurbished and given a new look by the Twirl team. The upcycled clothes can be purchased back by the consumer or can be donated or sold separately.

- Founded in: 2017
- Founded by: Sujata Chatterjee
- HQ: Kolkata, West Bengal

- **Clothes Box Foundation**

Clothes Box Foundation (CBF), is a not-for-profit organization that bestows clothes to less fortunate individuals. Clothes Box Foundation takes clothes discarded by consumers and then the clothes that are in good condition are sorted, segregated, and then dry-cleaned before they are distributed.

- Founded in: 2014
- Founded by: Sajan Veerr Abrol
- HQ: Gurgaon, Haryana

Wrapping up, instead of letting discarded materials choke up ecosystems, these circular economy companies upcycle and transforms waste into something useful. Repurposing e-waste, plastic, metal, or clothes into something which has value. — that defines a circular economy.

## 5.0 Textile Circularity: Present Scenario

India is still in the early phases of developing its textile circularity. The textile industry is becoming more conscious of sustainable practices, but there are still issues that need to be resolved before circularity can be incorporated into the textile value chain. India ranks sixth globally in terms of textile and apparel exports (T & A). In FY20–21, T&A, which includes handicrafts, accounted for 12% of India's overall exports. India makes up 4% of the world market for clothing and textiles.

India produces a wide range of yarns and fibres, including synthetic fibres like polyester, viscose, nylon, and acrylic, as well as natural fibres like cotton, jute, silk, and wool, which is why the country's textile sector is booming.

Decentralised power looms used in knitting and hosiery are the main players in the textile industry. With over 45 million workers, the industry is currently the second largest employer in the nation. It also accounts for about 7% of all industrial output and more than 15% of export revenue. Employment opportunities in handloom, handicrafts, and small-scale power-loom enterprises are generated for millions of individuals living in rural and semi-urban areas.

In an effort to attract foreign direct investment and increase employment, the Indian government has recently launched a number of export promotion policies and measures to give priority to the textile sector and increase its GDP share.

- The Rs. 10,683 crores (US\$ 1.44 billion) Production-Linked Incentive (PLI) scheme, which was established in 2022, will be beneficial to textile manufacturers. Man-made fibre (MMF) clothing, textiles, and eleven categories of technical textiles are promoted by the programme.
- Aiming to construct seven integrated mega textile parks over the course of the next three years, the government has also authorised the Mega Integrated Textile Region and Apparel (MITRA) Park proposal, which is valued at Rs. 4,445 crores (US\$ 594.26 million). Modern infrastructure, shared utilities, and R&D centres will be included to support the nation's textile industry.

Despite several government initiatives, laws, and plans aimed at bolstering the textile industry, the Indian Textile & Apparel sector continues to confront unparalleled obstacles. The industry's high degree of fragmentation (which raises logistics costs), lack of product diversification (apparel, home, and industrial textiles), small client base (MSMEs primarily serving the local market), and inefficient production (caused by the use of outdated technology) in comparison to competitors (China, Bangladesh, Vietnam, etc.) are some of the structural weaknesses that account for this.

Furthermore, MSMEs engaged in non-integrated spinning, knitting, weaving, fabric finishing, and garment manufacturing make up the Indian Textile and Apparel industry. Large-scale integrated mills with cutting-edge machinery and technology, on the other hand, dominate the textile industry in industrialised nations. These mills combine weaving, spinning, and fabric finishing to increase productivity and promote the internal use of process byproducts.

India is a significant global centre for both production and consumption, thus industry reform is necessary to maintain long-term competitiveness.

## 5.1 Need for Textile Sector Transition Towards Circular Economy

All nations in the world now prioritise sustainable manufacturing due to social and environmental consciousness. In recent years, there has been a growing focus on the environmental consequences of both fast rising production volumes and shorter product shelf lives. The amount of clothing produced has risen over the last 15 years, but fewer clothes are worn before being thrown out—a 36% decrease. Synthetic fibres, which are mostly made from crude oil, have been largely blamed for the textile industry's explosive growth. Over the past 20 years, they have increased from accounting for less than 20% of global fibre production in 2018 to 62% of it [Preferred Fibre and Materials Market Report 2018, Textile Exchange]. The textile business uses a lot of resources and harms the environment, with fewer than 1% of fibres used to make recycled garments.



*Figure 5.1 : A typical linear apparel life cycle chain*

An inefficient linear economy is produced by a linear strategy, which raises resource demand, consumption, and waste that needs to be disposed of in an environmentally responsible way. The adoption of a circular economy (CE) is becoming more popular as a means of protecting the environment and keeping goods in their value chain cycles.

A circular economy, as opposed to a linear one, uses resources that can be recycled and recovered at the end of a product's life to build long-lasting, reusable, and repairable goods (EOL). Therefore, in order to combat climate change, preserve finite natural resources, reduce pollution, and avoid supply chain disruptions, governmental and corporate groups on a national and international scale are calling for an increase in circularity. (For example, United Nations, 2022; European Commission, 2018; Ellen MacArthur Foundation, 2017).

There is a growing trend for sustainability in the global fashion industry as the biggest companies in the sector are gradually committing to Net Zero criteria. Given its critical role in the global textile and apparel value chains, such favourable developments on the world stage will have a considerable impact on the Indian textile industry.

Therefore, in order to transition to a more sustainable and circular fashion, all stakeholders (government, industry, and consumers) must coordinate their efforts across all regions, and changes at every stage of the value chain involving players of all sizes and market segments are needed, as illustrated in the illustration below (adapted from the circular fashion ecosystem



A blueprint for the future, Institute of Positive Fashion and modified based on the information obtained during baseline assessment)

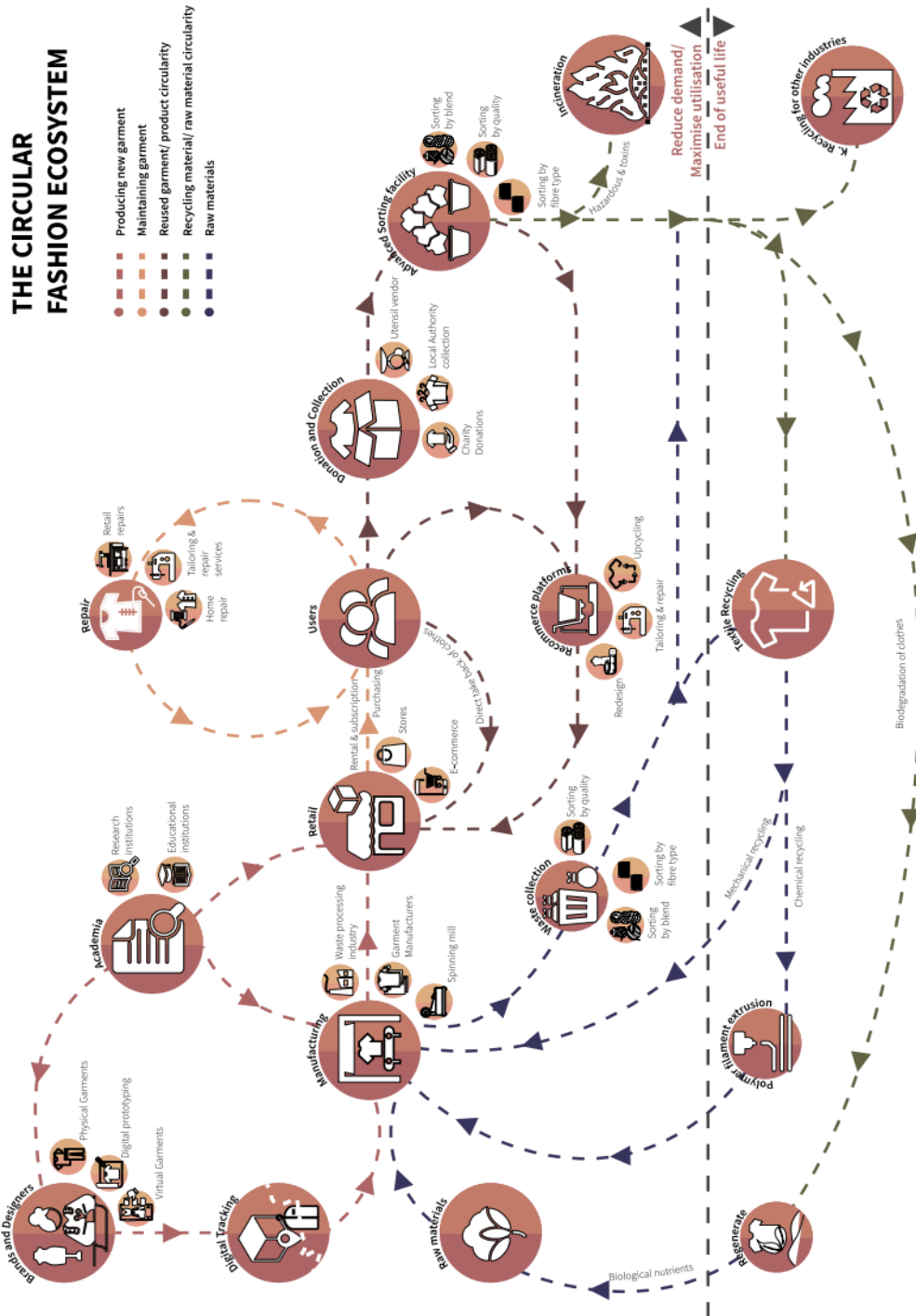


Figure 5.2 : The circular Fashion ecosystem

## 5.2 Preparing the Textiles & Apparel Sector for Circular Economy

The Indian textile and apparel industries have found it difficult to use circular ideas since there are still gaps in communication between recyclers, yarn manufacturers, and designers in the textile and other industries. Moreover, recycling information is frequently still basic and not properly incorporated into strategic company initiatives.

Thus, under the BMZ's public-private partnership programme (DeveloPPP.de), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and Aditya Birla Fashion and Retail Ltd (ABFRL) conceived a joint project "Approaches for Circular Textiles and Apparel Industry in India" with the aim of strengthening the capacities of the Indian Textile & Apparel industry to impart and implement circular approaches. The project's implementation partner is the Centre for Environment Education (CEE).

## 5.3 India Agenda: develoPPP project

The project's objectives are to fortify Circular Economy mechanisms across the textile value chain, establish guidelines for circular business practices, coordinate textile clusters, and establish an ecosystem for the Circular Economy in India's textile and apparel industry. It will help the industry compete with global textile hubs and enable it to meet its SDG targets.

The project's intended development impact is to help the textile and apparel industries become less wasteful and polluting. The project employs the four strategies listed below:

- The adoption and bolstering of circular business practices in the textile and apparel industries and ABFRL in the areas of
  - Reducing use of harmful substances through material innovation,
  - Increasing textile-to-textile recycling
  - Alternatives to plastic packaging and
  - Traceability through the different demonstration projects.
- Guidelines for voluntary circular business are being developed for the Indian textile sector. It is a collection of metrics, key performance indicators (KPIs), and best practices from the industry that direct Indian brands and their supply chains away from the status quo and towards more circular business practices. It serves as a tool for benchmarking. The rules would cover social and environmental issues as well as commercial procedures necessary for a circular textile sector.
- The project will expand upon current benchmarks, norms, and frameworks (such as the Ellen MacArthur Foundation's circular economy framework or the Circle Economy's 7 R's framework) and contextualise them to the Indian textile and apparel sector and geography.
- Developing and bolstering capabilities in areas such as
  - Recycling
  - Employing sustainable materials
  - Utilising renewable resources and inputs in production

- Implementing social and labour standards that are globally relevant in textile supply chains.
- In order to facilitate industry player consultation, knowledge sharing, and cooperation on "what works" around circular Textile & Apparel business practices and the potential for novel products, processes, or business model innovations, it is necessary to strengthen and develop an industry-led platform within the Indian textile, apparel, and fashion sectors.

## **5.4 Waste in Textile Value Chain**

In order to shift the textile industry to a circular economy, it is first necessary to understand how the value chain operates as a linear economy. The creation of waste in the value chain is explained as follows:

### **5.4.1 Decoding Waste**

The value chain for textiles and apparel consists of all the processes involved in creating, producing, distributing, selling, and using textile products (or the services they provide) to generate value. It covers the procurement, extraction, and use of raw materials as well as what happens to the cloth when its useful life has ended. The value chain has been split into six segments according to this view:

- Fibre production/ Raw material Extraction
- Yarn and Fabric production
- Wet Processing
- Garment manufacturing
- Consumption
- End-of-life

Using and processing natural resources like cotton, making synthetic fibres like polyester from crude oil, or combining the two methods can all be used to produce fibre for fabric.

Two major categories can be used to classify textile fibres:

- Natural fibres
- Man-made or manufactured fibres

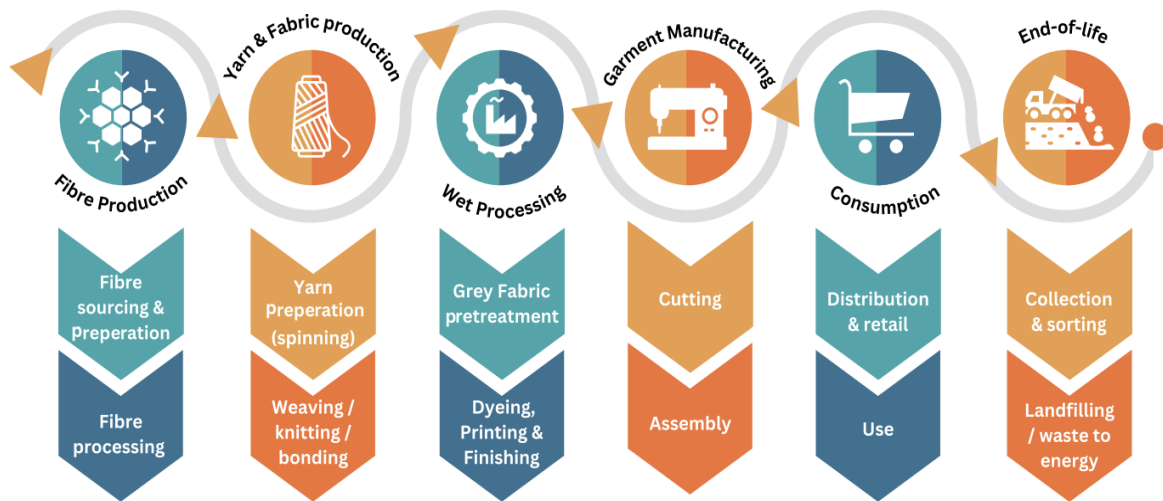


Figure 5.3 : Textile Value chain

India is still in the early phases of developing its textile circularity. The textile industry is becoming more conscious of sustainable practices, but there are still issues that need to be resolved before circularity can be incorporated into the textile value chain.

Two significant obstacles that prevent circularity in the industry from progressing further are a lack of technology and infrastructure. Furthermore, the industry receives little assistance from the government in implementing circularity. Additionally, buyers do not seem to be inclined to purchase sustainable goods.

In India, several firms, including Birla Cellulose, Reliance Industries, PurFI, Kishco, and many more, are working on textile recycling and repurposing in an attempt to address these issues and encourage textile circularity. The likes of "Circular Apparel Innovation Factory (CAIF)," "Textile Exchange," "Fashion for Good," and industry alliances like Su.Re encourage Aditya Birla Fashion and Retail Ltd., Arvind, Welspun, Reliance, Pratibha Syntex, Shahi Exports, and others to set circularity goals and work with internal and external stakeholders to achieve them.

This is a partial and non-exhaustive list of organisations that support circularity, which aids companies in implementing the circular economy.

- The Fashion Innovation and Sustainable Design for Circularity Postgraduate Diploma Programme has been launched by NIFT in association with UNEP.
- With an emphasis on capacity building in natural fibre development and utilisation through design, engineering, and technological innovation, NID founded the "Innovation Centre for Natural Fibre."
- A training programme on "Sustainable Development in Textile Value Chain" was held by SVPITM, Coimbatore.

- IIT Delhi uses its incubator programme to implement sustainable and circular practices.
- A range of educational workforce development programmes, including certificate and diploma programmes on the Fundamentals of Sustainability, Fashion Sustainability, ESG, Circularity, Sustainable Design, Corporate Social Responsibility, and Sustainability Reporting for the Fashion and Textile Industry, have been launched by Sasmira's Institute of Design and Textiles (SIDT) and The Academy for Sustainability (TAS).

## 5.5 Recycling Practices

- It was observed that antiquated technology are being employed for recycling and re-production processes in Panipat, one of India's principal recycling hubs.
- The fibres are torn down and shredded by unravelling, grinding, defibration, and cutting the clothes according to colour and substance. Because the fibres are cut shorter, the sorting process weakens and damages them. Because of its declining quality and functionality, manufacturers are compelled to incorporate virgin, premium fibres.
- In the business, open-ended recycled yarns with a Ne count of 0s to 30s are common, although ring-spun recycled yarns are produced by a small number of recyclers.
- For recycled textiles, entry into the formal sector is currently possible through GRS certification. The current technology barrier allows for a 30% substitution of recycled fibres for natural fibres. The quality of recycled fibres is further reduced by impurities in the input material.
- Fibre qualities decline due to mechanical recycling limits, however knitted (solid coloured, 100% cotton) materials have a higher recycling value than woven materials.
- Depending on how coarse the yarn is, it is recycled and utilised to make items like oil-absorbent mats, bath mats, industry wipes, insulating materials, and industrial cleaning cloths.
- Recycled yarn is now being used sparingly in denim and knit fabrics.
- Pre-consumer cotton waste can now be chemically recycled by Birla Cellulose to produce GRS-certified liva reviva, a recycled viscose fibre.

## 5.6 Making Circularity a Reality: The Way Forward

Numerous procedures within the Textile & Apparel value chain support the circular economy in one way or another. However, there are still major obstacles in the way of formalising, scaling up, and putting these innovative circular ideas into practice.

### 5.6.1 Scaling circularity: Understanding Challenges

Six groups have been established to represent the difficulties that were found during the assessment. In order to achieve circularity in the textile and apparel business, these six categories also serve as action areas.

- **Waste Management**

Investment in sustainable technologies is lukewarm among industries. The utilisation of diverse methodologies and technologies to meet evolving client demands necessitates intricate production process monitoring. As a result, there is an overuse of raw materials and increased waste production. For pre- and post-consumer waste, there are no uniform rules or recommendations for the collection of textile waste. For instance, in order for materials to be recyclable, they must not be contaminated or dirty. Due to the absence of regional recycling hubs, the intricate and widespread presence of the textile industry throughout India makes it challenging to track the origin of materials, resulting in an intricate and costly logistical system. The lack of national standards or criteria for standardised sorting makes it challenging to develop automated technology for sorting worn clothing, which might make a substantial and cost-effective contribution to large-scale recycling systems. However, increasing the amount of post-consumer trash recycled is limited by the labour- and money-intensive nature of manual sorting.

Small and medium-sized businesses (SMEs) find it costly to adopt circular practices since they cannot afford to invest in cutting-edge equipment and procedures. The recycling of polyester and other synthetic fibres is still in its infancy, and these materials are not biodegradable. Occasionally, the label of a garment does not provide a clear breakdown of the fibres' exact composition, and other times, it is unavailable after use. This limits the post-consumer clothing industry's capacity to trace and recycle its products.

- **Building a Robust Infrastructure**

The textile industry faces several challenges in its efforts to recycle and reuse materials. These include inadequate infrastructure to support the implementation of sustainable and circular production techniques and practices, the use of outdated technology, and the difficulty of separating different types of fibres. Additionally, the industry lacks adequate waste management infrastructure for waste collection and processing systems. Consumer demand for circular items is not high enough. As a result, the brand's efforts to promote these products are difficult. Many companies have said that finding circular practices that are simple to implement is essential. It takes a lot of experiments at every point in the value chain to properly introduce a circular product. Such notions cannot be implemented on a bigger scale by the supply chain ecology that exists today. Sophisticated textile recycling plants need a large installation space and sophisticated technology. Because of the expensive initial investment, there are therefore very few companies in the market.

- **Educating & Creating Awareness for Value Chain Stakeholders**

Recycling throughout the garment's lifecycle and End-of-Life disposal consequences are not included in the present design requirements. Many MSMEs lack the technical know-how and proficiency necessary to implement circular processes effectively. They might not fully understand the advantages of these techniques or how to apply them in a way that is both economical and efficient. Suppliers find it difficult to work with buyers and provide support in

order to accomplish their long-term circularity objectives. They struggle to strike a balance between circular behaviours and economic production.

- **Getting support from the Government**

Only a small portion of sustainability is supported by current legislation, and circularity is not yet covered. There are no comprehensive rules, if any, for resource management and waste reduction. There are no financial incentives, in the form of tax breaks, subsidies, or other types of support, associated with the adoption of circularity practices. Comprehensive standards to help the textile industry reduce the use of hazardous chemicals are lacking.

- **Investing in Research and Development**

The textile industry is a conventional, conservative sector of the economy that finds it difficult to adopt new methods and technologies. Few major companies make R&D investments to create sustainable alternative materials. The Textile & Apparel business faces difficulties in locating circular packaging options because to a lack of research and development by package producers; also, sustainable textile dyestuffs, chemicals, and auxiliaries are scarce and costly. Little research and development is being done to increase industry acceptance of these compounds at a reasonable cost.

- **Generating Consumer Awareness**

The environmental effects of the clothes industry are not well known to consumers, and they do not value circularity highly when making purchases. Some customers believe recycled products are inferior and won't pay more for circular products. Because there are no appropriate ways to dispose of non-useable textile items, they wind up as municipal waste in landfills rather than being recycled.

## **5.7 Making Textile Circularity a Way of Life**

The circularity domain has a serious awareness and knowledge gap. Nonetheless, a lot of industries have already been using some aspects of circular practices—sometimes without even realising it. Repurposing, upcycling, and recycling textile waste to create fibre are a few of the techniques used. But because the industry does not connect it to circularity, there are gaps in the value chain's implementation of circularity. In order for the industries to identify and close the gaps and finish the circular cycle, it is necessary that they are made aware of the sequential phases that make up the circular textile value chain.

The results of this assessment speak about the shortcomings in the industry's application of circularity methodologies. Therefore, it is highly desirable that training and capacity building of the stakeholders within entire value chain is carried out in order to illustrate the planned circular economy strategy in India's Textile & Apparel sector. In addition, the management must be aware of and open to the financial as well as ecological advantages of circularity. In addition, it has been noted that many circularity initiatives may not be financially feasible, particularly for the textile MSME sector. Although financial support and incentive programmes are anticipated, new and creative approaches to circularity adoption are also required.

In this regard, a challenge to creativity has been developed, inviting startups and innovators to present their latest ideas and methods that can help industry implement circularity initiatives.

ABFRL value chain will test and adopt a few chosen technologies, and case studies from the successful results will be shared with India's industry. In parallel, a training and capacity building effort will be conducted to raise national knowledge of and acceptance of circular techniques. This would go after supply chain vendors in addition to upper and intermediate management. It is also intended to create a pool of trainers in order to sustain the information distribution inside the industry clusters. This project-sponsored activity will keep producing knowledge for a long time to come. The project's experience and lessons learned will eventually be turned into a circularity manifesto that will act as a manual for introducing and expanding circular economy strategies throughout India's textile and apparel value chain.

## **5.8 Applying circular economy principles by SMEs in other emerging economies**

The world's general economic and environmental trajectory in the ensuing decades will be largely influenced by developing economies, owing to their substantial rates of economic growth and swift societal transformation. Therefore, the degree to which circular economy concepts are adopted in these nations will determine their applicability on a worldwide scale. The report's conclusions include information that is pertinent to both India and other developing nations. These observations may help with the examination of potential circular economy opportunities in certain markets. However, any attempt to analyse circular economy opportunities in other regions would necessitate creating strategies specific to their particular social, political, economic, and environmental context.

Emerging markets are seeing a lot of circular activities, most of which are small-scale and concentrate on the end of value chains. Reusing materials and products, recovering biological nutrients, using a lot of cars and infrastructure, and using conventional, regenerative farming techniques are some of these activities. Recognising that economic growth has mostly followed a linear route up to this point is crucial. The quest for economies of scale is expected to drive emerging markets even more in that direction by promoting the adoption of models that are popular in more developed markets. This course would quickly erode the current circular economy. To make those operations a key component of their value creation plans and to start new initiatives that may become mainstream, emerging markets should professionalise and scale those activities.

Emerging markets may adopt a circular economy quickly because they haven't had time to establish or organise many processes. It is difficult to move mature economies from a linear economic model to a circular economy since they have numerous processes and infrastructure in place. Cities designed for automobile traffic, infrastructure for incineration, and company expansion predicated on higher sales volume and related overcapacity (cars, appliances, etc.) are only a few examples (261). Developing economies could gain a long-term economic edge by avoiding linear lock-ins by embracing a circular economy development route now.

In emerging nations, digital enablement would be crucial to seizing circular economy potential. Large-scale data management and exchange are made possible by digital tools. Benefits from this include improved comprehension of material flows, assistance in making difficult decisions, like selecting materials or optimising business models, and platforms for exchanging knowledge and information. Digital solutions are beneficial in any market, but because of their low marginal costs, they are particularly significant in emerging countries. As a result, solutions could be widely embraced and allow for low-investment, effective decentralised models.



An important part of the economy in emerging nations is the informal sector. A significant amount of economic activity is unreported and informal. This promotes the ingenuity and entrepreneurship needed to put the concepts of the circular economy into reality, but it also creates information gaps and complicates the application of standards. Using the labour force more efficiently would probably be possible with more decentralised models of the shift to a circular economy, where small companies and entrepreneurs play important roles. But more research is needed on the topic of how to include informal workers in the shift to a circular economy.

In order for circular economy ideas to be successfully implemented in emerging markets, it will be necessary to change the way the increasing middle class feels about itself. Numerous interviews and conversations that went into this paper made clear that the belief that linear consumption patterns, like owning a product or having access to air conditioning, indicate affluence would be a barrier to the adoption of a circular economy model in emerging nations. Understanding and tackling this issue will be necessary for circular economy initiatives to be successful. Long-term success will also depend on proving that circular economic models are not just more desired for individuals but also more effective for society as a whole. This would therefore necessitate efficient operations (such as practical and economical business models) and communications (such as informational and promotional campaigns).

## **6.0 Limitations and Future Research**

Every research study has its limitations, and it's important to recognise these constraints in order to fully comprehend the context and implications of the findings. The constraints that this study on the implementation of Circular Economy (CE) principles in Indian Small and Medium-sized Enterprises (SMEs) faced are covered in this chapter. It also suggests possible directions for further investigation that could expand on the results of this analysis and go deeper into the nuances of CE adoption in the Indian SME market.

### **6.0.1 Sample Size and Representation**

The sample size is one of the study's main drawbacks. The sample size might not accurately reflect all Indian SMEs, despite efforts to include a wide variety of SMEs from various industries and geographical areas. This restriction may limit how broadly the results may be applied. To solve this problem, future research could include a more representative and sizable sample to capture a greater range of viewpoints and experiences.

### **6.0.2 Access to Data**

Obtaining trustworthy and thorough data was another difficulty. A large number of SMEs can be unwilling to divulge sensitive company information or fail to keep thorough records of their environmental procedures. This restriction has an impact on the analysis's depth and its capacity to produce firm conclusions. In order to increase data access, future research might concentrate on developing trust with SMEs and utilising techniques to guarantee data confidentiality.

### **6.0.3 Response Bias**

Survey-based research is inherently susceptible to response bias. Particularly when it comes to sustainability and environmental policies, participants could give answers that are more socially acceptable than those that accurately reflect their views or experiences. This bias may distort the outcomes and compromise the reliability of the conclusions. In future studies, this constraint might be lessened by utilising mixed approaches and triangulating data from several sources.

### **6.0.4 Temporal Scope**

An overview of the present level of CE adoption across Indian SMEs is given by the report. But the shift to a circular economy is a continuous process that changes with time. The dynamic nature of CE practices and the ever-changing regulatory and commercial settings may not be well reflected in the findings. A more thorough understanding of the development of these behaviours may be obtained through longitudinal studies that monitor the acceptance of CE over time.

### **6.0.5 Regional and Sectoral Differences**

India is a multifaceted nation with notable regional and industry disparities. Though it might not have fully taken into account all the differences in legislative frameworks, economic situations, and cultural views across various areas and sectors, this study made an effort to

reflect this diversity. Subsequent investigations may carry out more targeted analyses on particular areas or industries to identify distinct obstacles and prospects.

## **6.1 Future Research Directions**

A number of topics for further investigation are proposed in light of the study's limitations and results. These topics can fill in some of the gaps this research has identified and contribute to a deeper knowledge of CE adoption in Indian SMEs.

### **6.1.1 Longitudinal Studies**

Longitudinal research can yield important information about the changes in CE uptake over time. Researchers can observe the long-term effects of CE practices on social outcomes, environmental sustainability, and commercial performance by following SMEs over a period of time. This method can also be used to determine the elements that lead to successful and long-lasting CE adoption.

### **6.1.2 Sector-Specific Analysis**

Adopting CE principles presents different opportunities and problems for different sectors. Subsequent investigations may concentrate on sector-specific evaluations to delve deeper into these variations. Extensive research on the textile, electronics, and manufacturing industries, for instance, may provide customised strategies and solutions that solve industry-specific obstacles and take advantage of special opportunities.

### **6.1.3 Policy Impact Assessment**

Assessing the efficacy of current governmental regulations and incentives is crucial in comprehending its influence on the adoption of CE by small and medium-sized enterprises. Future studies could evaluate how various policies affect the behaviour of SMEs, point out holes in the existing regulatory framework, and offer recommendations for improved policies based on solid data. The promotion of CE practices by state-level policy may also be the subject of this study.

### **6.1.4 Consumer Behaviour and Market Demand**

Promoting the adoption of circular economy (CE) requires an understanding of consumer behaviour and market demand for circular goods and services. Subsequent research endeavours may delve into consumer attitudes, inclinations, and financial readiness towards eco-friendly merchandise. This study can assist SMEs in matching market demand with their product offerings and creating successful marketing plans to draw in environmentally concerned customers.

### **6.1.5 Technological Innovations and Digitalization**

Digital solutions and emerging technologies are essential for encouraging the use of CE. Subsequent investigations may examine the effects of cutting-edge technologies on waste management, supply chain transparency, and resource efficiency, including blockchain, artificial intelligence, and the Internet of Things (IoT). Examining how these technologies are

being adopted and integrated by SMEs may shed light on the kind of technological developments that are required to enable a circular economy.

#### **6.1.6 Collaborative Models and Partnerships**

To overcome the obstacles associated with CE adoption, cooperation and collaborations are essential. Subsequent investigations may explore efficacious models of collaboration, including industry clusters, public-private partnerships, and cross-sectoral alliances. Replicating successful tactics can be made easier for other SMEs and stakeholders by identifying best practices and lessons learnt from these collaborations.

## Conclusions

While sustainable techniques are generally acknowledged in theory, they are relatively uncommon in actual product development and manufacture. It takes new modes of thinking and tools for decision-making to incorporate environmental factors over a product's whole life cycle. A comprehensive policy framework is necessary to support small and medium-sized businesses' (SMEs) adoption of green manufacturing. Financial incentives, such as tax breaks, are important motivators for SMEs to invest in environmentally friendly technologies. Government subsidies also lessen the financial burden associated with deploying cutting-edge technology like blockchain, AI, and the Internet of Things. Grants for the study and development of green technologies encourage creativity and increase the viability of sustainability. Encouraging industrial partnerships and cooperative platforms facilitates the sharing of knowledge, and expedited processes for environmental compliance make compliance easier.

Additional incentives for SMEs are created by public procurement laws that support green suppliers. Transitioning to green manufacturing is made easy and long-lasting by capacity-building programmes, awareness campaigns, and long-term support efforts. This all-encompassing strategy promotes a greener industrial landscape by bringing Indian SMEs into compliance with international sustainability standards. In a country like India, a detailed examination of the green manufacturing process and related metrics is still required. New techniques and government-approved assessment standards are necessary to advance the process and make it more comprehensible. Determining the technique's efficacy is currently the key issue. Considering how eager Indian SMEs are to adopt green manufacturing, the government ought to seriously consider developing a framework for measurement.

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Thank you so much for your time

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