

**TO WHAT EXTENT DO CIRCULAR ECONOMY PRINCIPLES
APPLY IN RURAL PLANNING IN INDIA?**

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Declaration of Individual Authorship

I affirm that this dissertation contains no unacknowledged work or ideas from any publication or written work by another student or any other person.

Statement of Ethics Review Approval

This dissertation involved human participants. A Form E1 for each group of participants, showing ethics review approval, has been attached to this dissertation as an appendix.

Abstract

This dissertation provides an in-depth examination of the applicability of circular economy principles within the realm of rural planning in India. The circular economy, characterized by its focus on waste minimization, resource efficiency, and the creation of closed-loop systems, has gained prominence as a sustainable economic model. However, its adaptation to rural settings poses unique challenges and opportunities, shaped by the distinctive socio-economic and environmental contexts prevalent in India's rural areas.

The primary objective of this study is to analyse the extent to which circular economy principles are integrated into rural planning practices in India. By exploring the potential benefits and challenges associated with the adoption of circular economy principles, it seeks to provide valuable insights into rural development strategies. These insights are particularly pertinent in the Indian context, where rural areas constitute a significant portion of the population and play a crucial role in the nation's economic and environmental landscape.

To achieve this objective, the study incorporates inductive approaches and methodologies. It commences with a comprehensive literature review then analysing two case studies in the same setting against the set fame work. These regions are further compared to draw conclusion based on the current scenarios and policies, giving insights to reality and identifying the niche which could be worked on. This foundational phase sets the stage for understanding the core concepts, potential advantages, and key challenges associated with the circular economy model.

In conclusion, this dissertation aspires to contribute significantly to the body of knowledge surrounding circular economy practices in rural planning, with a specific focus on the Indian context. Its findings aim to serve as a valuable resource for policymakers, planners, researchers, and stakeholders involved in rural development efforts. Ultimately, the study endeavours to build on the guidance and insights that foster sustainable rural development practices in India, aligning with the principles of the circular economy.

Key words- *circular economy principles, rural planning, closed-loop systems, rural development strategies*

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Chapter 1 Introduction

1.1. Significance of this research

India has a significant rural population, with more than 66% of its people residing in the villages and relying on agriculture and natural resources for their livelihoods (Census of India, 2011). The sustainable management of resources such as water, soil, forests, and waste is crucial for the long-term well-being of these communities. However, rural areas in India are facing serious challenges related to resource depletion and waste management (Government of India, Ministry of Rural Development, 2020). These issues pose threats to the ecological sustainability of rural livelihoods. Issues such as groundwater overexploitation, soil degradation, deforestation, and unregulated waste dumping are exerting immense pressure on natural capital in rural India.

For example, unsustainable irrigation extraction has led to declining water tables in 54% of groundwater wells, jeopardizing water security for farmers (Shah, 2009).

Additionally, approximately 30% of soils have been degraded due to chemical overuse and erosion, resulting in reduced agricultural productivity (Kumar, 2013). Primary forest loss, limits the availability of essential resources like fodder, fuelwood, and non-timber forest products that rural communities rely on. Moreover, a significant portion of rural solid waste ends up in open dumpsites, causing contamination, and unchecked effluent discharge from industries further damages rural water bodies and ecosystems.

Such unsustainable resource utilization and unregulated pollution are putting immense strain on natural systems, which are vital for rural economies and livelihoods in India. Therefore, there is an urgent need to transition towards sustainable models of rural development, and the principles of a circular economy hold potential for providing innovative solutions.

Strategies inspired by circular economy, such as closed-loop production, regenerative agriculture, and waste reduction through re-use and recycling, could help rural communities distinguish economic activity from resource depletion and foster greener local economies. However, translating circular economy theory into practice faces various context-specific barriers in rural India (Gupta & Singh, 2018).

This underlines the importance of conducting research to explore the adaptability and application of circular economy principles in rural planning within the Indian context (Khan & Sharma, 2020). This exploration aims to critically analyse the opportunities and limitations of implementing circular economy principles in rural planning, using two case studies set in rural Karnataka. By examining and comparing the two locations using a standardized framework, these case studies will provide insights into how circular economy principles and policies are implemented within the same jurisdictions. This analysis also helps to recognize the existing scenarios and determine the extent to which circular economy practices are adopted (Sharma & Singh, 2020).

1.1.1. Why is it so important to deal with resource and waste?

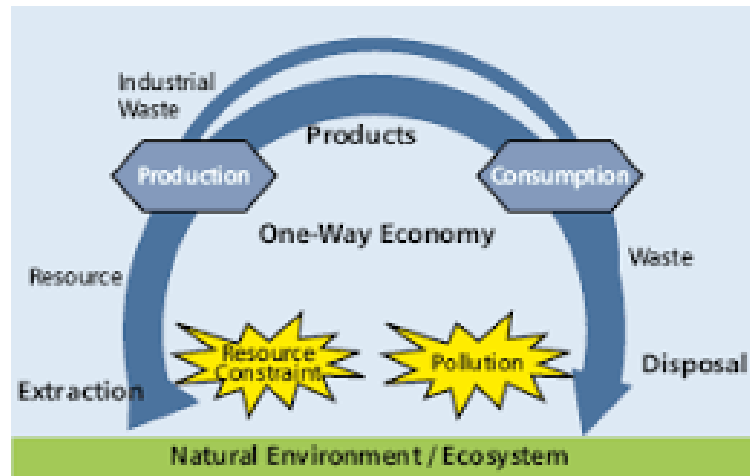


Figure 1: Image showing the relationship of the products with the ecosystem.

Circular economy principles can be applied to a considerable extent in rural planning in India. The concept of a circular economy emphasizes reducing waste, maximizing resource efficiency, and promoting sustainable practices across all stages of the product lifecycle. Although rural areas may face unique challenges, such as limited infrastructure and resources, circular economy principles offer viable solutions that can benefit both the environment and the rural communities (Verma & Yadav, 2019).

Firstly, applying circular economy principles in rural planning allows for the efficient use of limited resources. Rural areas heavily rely on natural resources for agriculture, water, and energy. By adopting sustainable practices like organic farming, efficient water management, and renewable energy sources, rural communities can ensure the longevity and productivity of their resources. This not only safeguards the environment but also supports the livelihoods of the people living in rural areas.

Secondly, addressing resources and waste is crucial for environmental conservation. Rural areas often face the risk of environmental degradation due to improper waste management practices. Open dumping, burning of waste, and contamination of water bodies can have severe consequences for both the ecosystem and human health. Implementing circular economy principles in rural planning can help mitigate these risks by promoting waste reduction, recycling, and proper waste disposal methods. This approach contributes to maintaining a clean and healthy environment for rural communities.

Lastly, dealing with resources and waste in rural areas is essential for sustainable development. The circular economy approach presents economic opportunities for rural communities. By encouraging recycling, reusing materials, and developing local enterprises and industries, rural areas can create employment and income-generating activities. Waste management projects, such as waste-to-energy initiatives and recycling facilities, not only contribute to waste reduction but also promote economic growth and self-sufficiency in rural areas.

1.1.2. What are the problems faced by Rural India?

The depletion and degradation of essential natural resources pose significant challenges to rural India. One major issue is the unregulated extraction of groundwater for irrigation. Across rural India, groundwater is being overexploited without proper oversight and metering, leading to a situation where withdrawal exceeds recharge rates in many areas. This unsustainable practice jeopardizes water security and the agricultural sector, which is the backbone of rural economies (Mishra & Patel, 2017).

The health of soil is another major concern. Excessive use of chemical fertilizers and pesticides is causing soil degradation through salinization, contamination, and reduced organic matter. Unsustainable land management practices also contribute to soil erosion,

resulting in an alarming decline in soil fertility. Approximately 30% of India's soils are estimated to be degraded, directly impacting the productivity and sustainability of rural farming livelihoods (Mishra & Patel, 2017).

Loss of forests is a persistent problem in rural regions. Over the years, India has witnessed an 18% reduction in primary forests, mainly in rural areas. This loss of forest cover has a direct impact on the availability of essential resources such as fodder, fuelwood, and non-timber forest products that rural communities rely on (Das & Banerjee, 2019).

Moreover, continued deforestation leads to biodiversity loss and environmental degradation. Uncontrolled dumping of household, agricultural, and industrial waste is a significant challenge in rural India. More than 90% of rural solid waste is disposed of in open dumpsites or water bodies, rather than managed landfills. Additionally, effluent discharge from industries like textiles and leather into rural waterways often goes unchecked, resulting in severe contamination. Such unregulated waste disposal practices have detrimental effects on rural environments and public health (Das & Banerjee, 2019).

1.1.3 What do the circular economy principles have to offer as a way of addressing the issues faced?

To address the issue of groundwater depletion, the circular economy promotes resource conservation and closed-loop systems that recycle and reuse water multiple times. Implementing circular water management strategies like rainwater harvesting, wastewater recycling, and efficient irrigation can replenish aquifers and reduce the demand for groundwater extraction in rural areas (Kumar & Gupta, 2021).

In terms of soil degradation, the circular economy encourages the adoption of regenerative agriculture techniques that rebuild soil health through the use of organic inputs, conservation tillage, crop rotation, and agroforestry. These regenerative practices can revive soil fertility and promote sustainable agricultural productivity in rural areas (Kumar & Gupta, 2021).

The challenge of deforestation, circular principles promote the cascading use of re-sources, such as utilizing forest residues for energy production, to reduce dependence on fuelwood and mitigate over-harvesting. Additionally, integrating agroforestry models that sustainably incorporate trees into farming systems can help meet the demand for forest products (Kumar & Gupta, 2021).

To address rural waste management, the circular economy emphasizes the valorisation and recycling of waste materials through decentralized systems tailored for rural areas. By diverting waste from open dumping sites and transforming it into valuable resources for local enterprises, these practices contribute to more effective waste management in rural communities (Sharma & Singh, 2020).

In summary, the circular economy offers comprehensive and systematic solutions that align with the key sustainability objectives for rural India. By adopting circular models, rural areas have the potential to revitalize natural resources, improve resource efficiency, promote value addition, and strengthen local economies. However, it is important to conduct context-specific research to identify effective pathways for implementing circular principles in order to achieve sustainable rural development in India (Kumar & Gupta, 2021; Sharma & Singh, 2020).

1.2. Research questions

1.2.1 To what extent are the principles of waste minimization, resource efficiency and industrial symbiosis incorporated into planning in rural India?

Waste minimization aims to reduce the amount of waste generated by rethinking product design, manufacturing processes, and consumer use. In rural India, efforts have focused on reducing agricultural crop residues and organic wastes, as these make up a large portion of total waste in rural areas. Techniques such as vermicomposting crop residues on-site have been encouraged, which avoids burning fields and produces organic fertilizer for future crops. Training programs for farmers have also promoted utilizing waste from one crop as productive inputs for another, such as using straw as animal feed or bedding. There are also initiatives to minimize post-harvest loss of perishable foods by improving storage and transportation from farms to markets. More progress is still needed in minimizing waste in packaging and processing of goods produced in rural areas (Mishra & Patel, 2017).

Resource efficiency entails maximizing productivity while minimizing resource use. In rural development planning, the focus has been on sustainable agricultural practices that increase crop yield while using water, fertilizers, and pesticides more efficiently. Drip

irrigation, rainwater harvesting, and targeted fertilizer application are techniques that have been subsidized. However, adoption rates are low due to high upfront costs and lack of technical knowledge among farmers. Crop diversification, intercropping, and crop rotation are other resource efficient practices that have been encouraged. Beyond agriculture, resource efficiency measures in rural businesses like eco-friendly brick kilns are limited. Overall, more incentives and accessible financing mechanisms are needed to drive the uptake of resource efficient technologies in rural production (Patil & Joshi, 2018).

Industrial symbiosis involves connecting industries such that one facility's wastes or by-products become inputs for another. In rural areas, agro-industrial parks have attempted to develop symbiosis among farm, food processing, and ancillary enterprises located in a concentrated cluster. For example, rice mills use rice husks as fuel for electricity generation or inputs for bricks. However, widespread planned symbiosis has been constrained by the small, dispersed nature of rural production units. Establishing symbiotic exchanges between large urban factories and nearby rural suppliers has had some success but requires coordination. Wider application of industrial symbiosis in rural planning is limited by infrastructure challenges like lack of all-weather roads connecting production centres.

Overall, India's focus on waste and resource efficiency in rural development planning is positive. But progress has been gradual and largely driven by small-scale pilot projects or one-off industries rather than systematic policy. Waste minimization, recycling, and industrial symbiosis at scale will require larger system-wide changes. These include investing in R&D for low-waste technologies, providing access to finance and markets for waste-derived products, offering tax incentives, and building local capacity. Integrating these principles into mainstream rural planning in India still remains a substantial challenge requiring persistent, multi-sectoral efforts. But the potential benefits for long-term resource sustainability and village-level circular economies are significant (Mishra & Patel, 2017; Patil & Joshi, 2018).

1.2.2 Is there a need for greater use of circular economy principles?

Supporting the livelihoods and development needs of rural communities in an ecologically sustainable manner requires rethinking conventional linear economic models of 'take-make-dispose'. Applying principles of the circular economy has emerged as a potential solution. Circular systems employ resource-efficient closed-loop production, reuse and recycling to minimize waste and environmental impact. Although circular economy efforts have expanded in India's urban centres, there remains an urgent need to transition rural economies towards circularity.

The linear practices prevalent across agricultural and allied rural industries generate massive volumes of biomass, plastic, packaging and industrial wastes. Over 90% of plastics used in rural areas end up discarded in the environment. Crop waste burning emits pollutants and reduces soil fertility. Much of the municipal solid waste stream also originates from the countryside. Transitioning to circular approaches in production, distribution and consumption systems could significantly improve resource efficiency and sustainability (Kumar & Gupta, 2021).

Specific strategies like industrial symbiosis, where one facility's waste becomes another's input, can be applied across agro-processing industries in rural clusters. For example, rice mills can provide husk ash to cement plants as a substitute for silica or spent wash from distilleries can be used as liquid fertilizer. Circular business models that promote renting farm equipment or refurbishing old machinery also reduce the need for new materials and waste. Principles of eco-design, green chemistry and bio-mimicry can minimize waste generation in the first place. Scaling decentralized renewable energy systems to power rural industries using agricultural residues as feedstock offers circular synergies (Kumar & Gupta, 2021).

Moving from consumption to utilization, practices like home composting of organic kitchen scraps can supplement farm-level circularity. Strengthening rural recycling sys-

tems through decentralized micro enterprises and collection centres is essential for managing dry waste streams. Transitioning from low-value linear consumption like packaged snacks to regenerative circular economies shall require raising awareness and providing viable alternatives (Zareen & Ramesh, 2021).

Policy tools like tax incentives for waste exchange, subsidies to scale circular innovations and strong Extended Producer Responsibility regulations are important enablers. Integrating circular economy modules into agricultural and vocational education can build critical capacities. Developing circular economy transitions, roadmaps for rural districts can align efforts of local authorities, industries and communities. Digital technologies like waste exchange platforms and circular supply chain mapping offer promising solutions (Gupta & Singh, 2018).

A major challenge is the high upfront investment required to adopt new circular processes, materials or business models. Innovative financing mechanisms to bridge access and affordability gaps for small rural producers are vital. Partnerships between rural enterprises and urban circular economy leaders can accelerate technology transfer and systemic change.

To summarise, embracing circular economy approaches across agricultural production, rural industry, distribution systems and community practices can usher sustainability, resilience and self-reliance. But this requires multi-stakeholder collaboration and coherence between policies, investments and incentives at national, state and local levels. If done right, the circular economy offers a real opportunity to balance prosperity and ecology across rural India (Kumar & Gupta, 2021; Zareen & Ramesh, 2021; Gupta & Singh, 2018).

1.3. Scope of research

As a spatial planner, embracing circular economic thinking in rural development planning is critical for sustainably managing resources, eliminating waste and regenerating natural environments across these extensive regions (Pandey, 2019; Raghunandan, 2019). In this study, I critically examine the current status, diverse opportunities and key challenges associated with integrating principles of circularity into India's rural spaces and economies.

Present adoption of circular systems remains limited and fragmented in India's countryside (Kumar, 2017). Small scale initiatives like on-farm composting of crop residues, informal plastic recycling cooperatives, and decentralized renewable energy micro-grids have emerged in some villages. However, these are localized experiments rather than widespread systemic transitions (Raghunandan, 2019). Linear "take-make-dispose" models still dominate material and energy flows across rural production and consumption systems. Massive volumes of agricultural, municipal and industrial waste amounting to millions of tonnes annually are discarded unsustainably through practices like open burning of agricultural residues after harvesting (Pandey, 2019).

As a spatial planner, I see diverse prospects for mainstreaming circularity principles across rural land uses, infrastructure networks, policies, capacities and partnerships. At the land use planning level, zones can be earmarked in spatial plans for establishing decentralized solid and liquid waste management micro-enterprises. This avoids long-distance transport of waste to central facilities. Site optimization models can identify locations to establish eco-industrial symbiosis clusters, integrating diverse agricultural, processing and ancillary industries in a localized circular resource sharing network. Space for community composting centres, recycling stations for specific dry waste streams like plastic or e-waste, and strategically located biomass collection depots must be delineated based on availability and efficient logistics (Pandey and Agrawal, 2017).

Infrastructure plans should focus on providing key physical enablers for scaling up rural circular systems. All-weather rural road connectivity, integrated storage and market yard facilities, and cold storage chains are essential to support circular bio-economy supply chains and enable reverse material flows back to production units (Sing, 2000). Renewable energy powered decentralized micro-grids ensuring reliable, eco-friendly electricity access across villages can meet the energy needs of circular enterprises (Pandey, 2019). Waste collection points equipped with segregation and sorting facilities and linked via feeder routes to processing hubs minimize transport costs while allowing circularity (Raghunandan, 2019). Water reuse networks and efficient irrigation systems reduce freshwater demands.

Beyond physical planning, policy tools like fiscal incentives for village councils to integrate circular economy into their development plans, subsidized financing mechanisms for small producers to adopt circular innovations, and strong Extended Producer Responsibility regulations are vital to propagate circular practices. Awareness drives, circular economy training programs and demonstration projects for planners, architects, rural industries and village councils, and integration of circular economy modules into school curriculums from a young age can enable much needed capacities (Raghunandan, 2019).

Partnerships present opportunities to accelerate the transition to circular village economies. Linking rural enterprises in symbiotic exchanges with larger urban circular hubs can enable technology transfer, skill development and access to investible capital. Engaging agricultural and consumer goods producers early on to integrate eco-design and establish waste take-back channels is key to Extended Producer Responsibility implementation. Academic and civil society collaborations can provide research insights and help collect spatial data on material and energy flows to inform planning.

However, translating circular economy principles rooted in urban industrial ecosystems to rural village contexts also poses unique spatial planning challenges (Pandey and

Agrawal, 2017). The small, scattered and informal nature of rural production units reduces economies of scale in adopting new technological or organizational processes (Kumar, 2017). Agricultural producers and rural micro-enterprises often lack access to adequate financing, skill sets and basic infrastructural support to feasibly make the transition to emerging circular innovations. Existing dominant sociocultural attitudes and entrenched linear habits resist departing from established wasteful systems. As a planner, I need to be cognizant that these barriers rooted in geography, economics and culture may slow or constrain transitions even where clear circular potential exists.

On the land use planning front, zones can be earmarked in spatial plans for decentralized solid and liquid waste management micro-enterprises, avoiding long-distance transport to central facilities (Pandey and Agrawal, 2017). Site optimization models can identify locations for establishing eco-industrial symbiosis clusters, integrating diverse industries and farms in a circular resource sharing network. Space for community composting centres, recycling stations and biomass depots must be planned based on availability and efficient logistics (Raghunandan, 2019).

Infrastructure plans should enable circular systems. All-weather rural road connectivity, integrated storage and market yard facilities support circular bio-economy supply chains (Singh, 2000). Renewable energy mini-grids ensure reliable, eco-friendly power for enterprises. Decentralized waste collection points and sorting facilities linked to processing hubs minimize transport costs. Water reuse networks and efficient irrigation reduce freshwater demands (Raghunandan, 2019).

Policy tools like incentives for village councils, subsidized financing for producers, and strong Extended Producer Responsibility regulations are essential to propagate circular practices. Awareness drives, circular training programs for planners, architects, councils, and integration of circular economy in school curriculums can enable capacities (Patel & Verma, 2019). Partnerships present opportunities to accelerate circularity. Linking rural enterprises with urban hubs enables technology transfer and skill development. Engaging producers on eco-design and waste take-back channels is

key. Academic collaborations provide research insights and support circular economy data collection (Singh & Sharma, 2021).

The scope of research on the application of circular economy principles in rural planning in India is expansive and multifaceted. It encompasses a holistic examination of how circularity can transform rural landscapes, promote sustainability, and improve the quality of life for rural communities. By addressing waste minimization, resource efficiency, socio-economic implications, environmental benefits, challenges, and policy frameworks, this research seeks to provide a comprehensive roadmap for the integration of circular economy principles into rural planning (Tiwari & Kumar, 2018).

Ultimately, the research endeavours to contribute to India's sustainable development goals, bridging the urban-rural divide, and fostering inclusive growth that leaves no community behind. It recognizes the imperative of developing innovative and contextually relevant solutions that empower rural India to thrive in a circular and sustainable manner. The insights gained from this research hold the potential to shape policies, inspire grassroots initiatives, and drive positive change in rural planning practices across the nation.

1.4. Summary

To summarise, this research focuses on the significance, issues, and potential of applying circular economy principles in rural planning in India. It highlights major problems faced by rural India like groundwater depletion, soil degradation, deforestation, and unregulated waste dumping that threaten ecological sustainability. Circular economy strategies like closed-loop production, regenerative agriculture, waste recycling etc. can address these challenges and foster greener rural economies. However, translating circular economy theory into localized implementation faces barriers. Hence, research examining adaptability of circular principles in Indian rural

contexts is important. Case studies can provide insights into current scenarios and extent of adoption of circular practices.

Lastly the study examines incorporation of waste minimization, resource efficiency and industrial symbiosis specifically in rural planning. Efforts like on-farm composting of crop residue and training on waste as productive inputs indicate initial progress in waste minimization. However, large-scale adoption faces challenges like financing and capacity. Similarly, resource efficiency techniques have limited uptake due to high costs and knowledge gaps. Industrial symbiosis is constrained by lack of infrastructure and scale. Overall, the study emphasizes need for further research, investments, incentives, capacities and multi-stakeholder efforts to integrate circular economy principles into mainstream rural planning in India. It highlights the potential for circularity to enable sustainable rural development but notes that systematic transition requires persistent efforts to address existing barriers.

Chapter 2 Research Methods

2.1. Research strategy

A robust research strategy is crucial for conducting high-quality, impactful research and should be clearly articulated in academic dissertations (Sreejesh, 2014). The research strategy sets out the plan and procedures for undertaking the study in a way that ensures the research objectives can be met in a valid, reliable manner within constraints of time and resources (Kumar, 2019). It provides a framework for making cohesive decisions on all key aspects of the research process, including the theoretical lens, research design, data sources, sample selection, instruments for data collection, analytical techniques, ethical dimensions, budgeting, and timelines (Creswell, 2014).

Articulating a detailed research strategy is important for several reasons. Firstly, it requires reviewing literature to identify knowledge gaps and situate one's own research within existing scholarship, which strengthens context relevance (Bryman, 2015). Secondly, underpinning philosophical assumptions that shape approach must be clarified, as this determines appropriate designs, tools and analytical methods (Crotty, 1998). Thirdly, establishing methodological rigor by carefully aligning strategy with objectives demonstrates credibility and trustworthiness (Kumar, 2019). Fourthly, the strategy enables anticipating potential limitations proactively and building in necessary validity measures through triangulation, respondent validation, audit trails etc. (Sreejesh, 2014). Finally, an explicit strategy aids transparency, consistency and efficiency during research execution.

This research employs an inductive approach using descriptive case studies to empirically investigate the integration of circular economy principles within rural planning in India. An inductive approach is suitable when the research aims to generate new concepts, hypotheses, and theoretical propositions by starting from granular observations of a phenomenon within its real-world context, rather than testing predefined hypotheses deductively (Bryman, 2015). It involves first exploring the specifics of a topic through

flexible research design before identifying broader patterns and generalizations (Creswell, 2014). This aligns well with the objectives, as the research seeks to discover how and why circular economy principles manifest in complex rural governance contexts.

The use of case studies as strategy stems from the need to holistically examine contemporary dynamics in depth within bounded real-world systems, especially when the boundaries between phenomenon and context are not clear (Yin, 2018). Case studies centered on defined geographical settings like villages aid tracing operational linkages between circular economy concepts and ground realities of rural planning (Easton, 2010). Cases provide real-life opportunities to gather multi-dimensional data using methods like interviews, focus groups, observations and document analysis to develop contextualized, experience-based insights on sustainability-planning linkages from the perspective of diverse stakeholders (Bartlett & Vavrus, 2017). This constructivist, grounded approach facilitates building integrated theoretical propositions on transitioning rural planning towards circular economy in an inductive manner.

Reliance on cases and qualitative data enables flexible exploratory research driven by field-based patterns (Hyde, 2000). While statistical generalizability is limited, in-depth insights help analytically generalize theoretical frameworks on embedding emerging sustainability paradigms into rural planning. Detailed accounts with local nuances enhance applicability to other contexts (Creswell & Poth, 2017). Overall, an inductive case study methodology aligns well with investigating how aspirational concepts like circular economy translate into the particularities of rural planning practice.

Starting with predefined theories or narrow research questions could limit the scope for emergent insights on the forms and mechanisms through which circular economy principles interact with rooted structures, dominant practices and varied stakeholders in rural planning. An inductive approach keeps the enquiry more open-ended and driven by patterns arising from granular observations, allowing fuller accommodation of contextual factors (Mukherjee & Mukherjee, 2012).

Case studies support the emphasis on exploratory, contextualized knowledge generation by enabling holistic investigation of contemporary dynamics within bounded real-world systems (Yin, 2014). The village selected as an instrumental case provides a naturally defined setting to trace whether circular economy concepts manifest in its planning processes and outcomes, and if so how, why and in what ways. Within this real-life context, multiple sources of qualitative data will help reveal diverse insider perspectives, institutional mechanisms at work, points of conflict, etc. that shape integration of sustainability principles into rural planning (Zainal, 2007).

A comparative case study strategy examining more than one village across contexts will also allow identifying common patterns and themes on operationalizing circular economy in different rural settings as well as teasing out contextual variations (Bartlett & Vavrus, 2017). But the focus remains on in-depth understanding of complex interactions between concepts and contexts, rather than statistical generalization. The insights drawn can inform theoretical propositions and analytical frameworks on transitioning rural planning to sustainability paradigms like circular economy.

2.2. Data Collection and Analysis

Researching the integration of circular economy into rural planning solely through secondary desk-based methods without primary interviews can have several limitations. According to Yin (2014), interviews are one of the most important sources of data collection for case study research as they provide insightful explanations and personal views that shed light on contemporary real-world events. Interviews allow asking probing questions to elicit detailed information beyond what is available through documents or observation. Excluding interviews from the research design can thus pose constraints for a study aimed at understanding dynamics within rural planning systems.

Firstly, only relying on documents may present an incomplete or biased perspective as official records reflect priorities of influential actors like governments but exclude dissenting voices (Ravitch & Carl, 2021). Interviews enable canvassing diverse viewpoints from multiple stakeholders like panchayat leaders, farmers, women's collectives, youth groups, NGOs and marginalized communities. Their varied grassroots experiences and observations might uncover aspects and challenges of rural planning processes that formal documents do not reveal. Interviews support capturing subjective, experiential insights into how circular economy principles interact with local cultural beliefs, knowledge systems, power hierarchies, resource constraints etc. which shape their application in rural contexts.

Secondly, documents provide retrospective data that might not reflect current rural realities. As Marcus (1994) notes, documentary analysis has limitations for studying contemporary cases as records relate to past events. Interviews can garner latest empirical information on present waste management practices, resource utilization patterns, industrial symbiosis opportunities, barriers faced etc. to assess the extent of circular economy adoption based on current village-level ground situation. They provide a real-time snapshot which documents, or old studies would lack.

Thirdly, relying solely on secondary data precludes probing into specifically relevant aspects for the research questions under study, unlike responsive interviews tailored to the subject (Yin, 2014). Asking context-specific questions around circular economy awareness, ownership of sustainability initiatives, feasibility perceptions etc. is only possible through interviews, to directly understand applicability of concepts within rural settings. Lack of interview data can thus impede gathering targeted information to address research objectives.

Fourthly, inferences from thematic or content analysis of documents may provide indirect indicators but cannot substitute the insights from directly interacting with implementers and targeted beneficiaries of rural planning through interviews (Ravitch & Carl, 2021). 'Face value' assumptions from documentary evidence without human input

can limit deeper comprehension of on-ground change processes and circular economy translation pathways. Finally, the ability to ask follow-up questions is restricted in documentary analysis unlike semi-structured interviews which permits probing for clarifications and rich data (Owen, 2014).

Listed below are some examples of documentary data that could be collected and analyzed for an inductive case study approach examining circular economy in rural planning in India without interviews:

- *Census data*
- *Agricultural statistics*
- *Village development plans*
- *Panchayat budgets/expenditures*
- *Government schemes/policies*
- *Technical/Research reports*
- *Satellite imagery*
- *News reports/RTI applications*
- *Content analysis software*

Reviewing documentary evidence in the form of government reports, census and survey data, budget statements, development plans, policy documents etc. have served as an important secondary data collection method for this research. Documents provide a useful realistic backdrop on the rural planning context being studied. Statistical data from census reports, household surveys, agriculture census etc. offer quantitative insights into demographic attributes, socioeconomic indicators, livelihood patterns, infrastructure access levels and human development outcomes in the selected villages. This helps objectively profile the development status and needs, providing a reality check of the current situation.

Analysis of panchayat budget statements and development plans over past years highlights planning priorities articulated by local governments, shedding light on their

mandates, resource allocation patterns and development philosophy. Comparing these documents with primary data reveals gaps between planning style and actual implementation on the ground. Reviewing higher level plans and policies framed by district, state and national governments shows the formal development vision embraced in rural areas. This aids in contextualizing the governance environment in which grassroots planning operates.

A key strength of documentary evidence is providing longitudinal insight into how socioeconomic attributes, planning priorities and resource allocations have evolved in the study context over time (Owen, 2014). For instance, analysing census data across decades depicts changing demographics, land use patterns, occupational profiles, amenities access etc. Tracing panchayat budget allocations and infrastructure investments chronologically reveals shifts in rural planning focus with changes in political leadership and policies. Repeated household surveys highlight fluctuating poverty levels and development indicators. This historical perspective on rural planning obtained from documents complements the snapshot of contemporary dynamics captured through primary field data.

Documents also offer a window into the official representation of rural planning processes, governance systems, development schemes, resource availability etc. which may diverge from on-ground realities (Ravitch & Carl, 2021). Comparing documents articulating formal roles and responsibilities of different government bodies with qualitative insights into their functioning, can uncover discrepancies between policy mandates and practices. Triangulating public statements on rural infrastructure status or scheme outcomes with primary observational data can reveal potential gaps in implementation and monitoring. Thus, documents provide an official counter narrative to balance grounded community perspectives.

2.3. Why Case Studies

This research employed descriptive case studies as a key methodological strategy because they enable holistic investigation of complex contemporary dynamics within real-world contexts. Case studies are well-suited for exploring whether and how circular economy principles manifest in the particularities of rural planning within defined geographical settings (Yin, 2014). Selecting specific villages as instrumental cases facilitates tracing operational linkages between sustainability concepts and on-ground realities of rural governance.

The case study method supports gathering multi-dimensional data on factors shaping integration of circular economy into rural planning such as institutional processes, stakeholder relationships, power dynamics, historical contexts etc. (Zainal, 2007). Within real villages as bounded cases, interviews, focus groups, observations and documents can be utilized to develop detailed, empirical insights on planning from diverse community perspectives. Case studies allow inductively to building grounded theoretical propositions on transitioning towards sustainability paradigms based on synthesized learnings from contexts rather than relying on abstract hypotheses.

Multiple cases across different rural settings are examined to support comparison and analytical generalization. The cases are carefully selected to provide diversity in size, demographic attributes, resource profiles, livelihood patterns, socioeconomic characteristics, development challenges and exposure to circular economy interventions (Bartlett & Vavrus, 2017). Comparing findings across these varied contexts highlights common themes and patterns in operationalizing circular economy in rural planning. But insights into case-specific conditions, constraints and workable solutions are also generated.

The intensive qualitative approach facilitates unpacking contextual degrees and causal factors shaping circular economy integration in each unique setting. This helps critically assess applicability of solutions across diverse rural realities. Though statistical

generalization is limited due to small samples, in-depth analysis of multiple heterogeneous cases strengthens theoretical insights on transitioning rural planning to sustainability in different circumstances.

Within each case, triangulation across sources and perspectives enhances depth and validity of findings. Data is gathered through methods like interviews, focus groups and document analysis to develop rounded, empirical insights on that particular village's planning system. This overcomes limitations intrinsic in single data types like respondent bias in interviews or exclusion of marginalized voices (Yin 2014). Divergent stakeholder accounts and complementary datasets enable cross-verification and integrated analysis. Thick descriptions retain village-specific gradations while allowing analytical generalizations for theory development.

Thus, case studies support holistic, contextualized investigation of a complex issue to inform applied theoretical understanding, rather than pursuing predictive theory testing. In-depth insights from particular rural settings can illuminate possibilities and challenges of integrating sustainability principles like circular economy into grassroots planning. Case studies offer a pragmatic, grounded approach suited for an exploratory research purpose focused on complex interactions between concepts and contexts.

2.4. Summary

To summarize, qualitative case study approach adopted for the research on circular economy principles in rural planning in India. It highlights that an open-ended, exploratory strategy using real-world case studies can provide contextual insights into whether and how circular economy manifests in complex rural governance systems. Selecting villages as instrumental cases allows holistically examining planning from diverse perspectives. Comparative cases across different rural settings will identify common themes and variations in applying circular economy.

The section emphasizes qualitative case studies enable unpacking interactions between sustainability concepts like circular economy and grounded rural planning realities. In-depth investigation within bounded village contexts generates empirical findings on opportunities and constraints in translating principles into practice. Cases are carefully chosen to provide diversity across rural conditions and development contexts. Though statistical generalization is limited due to small samples, cross-case analysis strengthens theoretical insights on transitioning rural planning to sustainability paradigms. Thick descriptions retain village-specific factors while allowing wider learnings. Overall, inductive case studies can provide contextualized, pragmatic understanding of integrating circular economy into grassroots rural planning.

Chapter 3 Literature Review

3.1. Introduction

This literature review looks into how circular economy has gained importance in India. It further elaborates on the set of research framework that has been created to analyse the case studies on. This will give insights on the current scenarios and help recognise the policies in play. This research methodology will help build on the existing documentation and also identify the niches to look into.

The concept of circular economy has gained growing traction in recent years, with its principles of reducing, reusing, and recycling resources finding increasing relevance (Geissdoerfer, 2017). However, the discourse has centred more on urban contexts. Application in rural planning contexts remains limited but holds immense potential, given that nearly 66% of India's population resides in rural areas (Census of India, 2011). Recent studies have started examining opportunities and challenges for circular transitions in rural India. These highlight enormous potential benefits in areas like waste management, food systems, crafts, and decentralized renewables (Kishna, 2017). However, translating principles to on-ground implementation faces barriers like lack of finance, policy gaps, infrastructure limitations, lack of capacities, and socio-cultural factors (Kiran, 2018).

Waste minimization is a key circular economy priority with huge relevance for rural India, given the largely ineffective current waste management systems. Studies highlight opportunities around decentralised composting, anaerobic digestion, waste segregation, integrating the informal sector and recycling ecosystems to reduce waste while enabling resource recovery (Pappu, 2007). However, challenges exist around habits of open dumping, lack of waste collection mechanisms, and limited incentives or

capacities for segregation and treatment. Resource efficiency techniques like organic farming, water conservation, eco-design of crafts, shared services etc. can optimise rural resource usage. But knowledge, financing, quality standards, and marketing linkages remain barriers.

Industrial symbiosis has emerged as an important aspect of circular systems, where wastes from one industry are utilized as inputs by other industries (Singh & Ordoñez, 2016). In rural contexts, studies have examined the potential for agro-industrial synergies where crop residues or forestry by-products can provide renewable feedstock for power generation and other enterprises (Khandelwal & Yadav, 2021). This can minimize waste while promoting rural industries. However, infrastructure limitations around renewable energy projects, storage and transportation facilities, and lack of financing have hindered symbiotic linkages (Surendra, 2014).

Review of literature highlights that circular economy holds promise for sustainable rural development but faces contextual challenges in India (Kumar, 2020). Research has focused more on conceptual potential and less on policies, incentives, stakeholder capacities, cultural dimensions, indicators and metrics to drive adoption. Scalability of pilot initiatives across value chains remains limited. Experts have called for decentralizing policies, building local capacities, providing financing mechanisms and demonstrating circular benefits through studies to facilitate the transition. Integration into local planning processes is also crucial but lacking (Wallbaum, 2018).

In summary, principles of waste minimization, resource efficiency and industrial symbiosis are highly relevant for enabling localized circular systems in rural India (Cordella, 2020). This holds benefits across income generation, job creation, environmental protection and more resilient rural economies. However, for circularity to be mainstreamed, systems-level changes are required spanning policies, cultural shifts, infrastructure, market linkages, capacities, financing and inter-departmental convergence. More empirical studies can help build an evidence base. Overall, literature

review reveals promising scope but also complex challenges in translating circular economy from theory to practice in rural contexts in India.

3.2.Circular Economy Principles



Figure 2: Circular economy principles

Circular economy (CE) principles are a set of guidelines and strategies that aim in transforming production and consumption cycles from the current linear ‘take-make-waste’ model to circular closed-loop systems. Core CE principles include designing out waste, keeping materials and products in use, regenerating natural systems, leveraging renewable energy, and transitioning to service/performance models rather than selling products (Ellen MacArthur Foundation, 2017).

CE seeks to decouple economic activity from the consumption of finite resources and build long-term resilience by retaining the utility and value of materials, components and products in the economy (Geissdoerfer, 2017). It necessitates system-wide changes

in business models, technologies, infrastructure, governance mechanisms and consumer behavior. While CE has gained policy traction globally, translating principles into practice, particularly in the informal, agrarian economies of the developing world involves adaption to local contexts.

In India, CE advocates emphasize resource conservation, optimization of utility, converting ‘waste to wealth’, and sustainable community development as relevant framings in the global South context (Agrawal, 2021). The Indian government has recently begun promoting CE to tackle issues like plastic waste, electronic waste, and air pollution. Policies include extended producer responsibility mandates, establishment of recycling clusters, and incentives for eco-industrial parks to foster industrial symbiosis (MoEFCC, 2022).

However, CE policy is largely focused on urban-industrial waste flows. In agrarian rural India, which lacks formal recycling infrastructure, decentralized biomass-based circular models aligned with village scale are gaining traction (Padmanabhan, 2017). These aim to harness agricultural residues and organic waste for energy generation, composting, artisanal products etc. Other interventions pursue farm-based rainwater harvesting, organic farming transition, eco-tourism and infrastructure development using local materials like bamboo.

These principles of a circular economy include:

Design out waste and pollution:

Products and systems should be designed in a way that minimizes waste and pollution throughout their entire life cycle. This involves using renewable materials, designing for durability and reparability, and reducing the use of harmful substances (Geissdoerfer, 2017).

Keep products and materials in use:

The goal is to maximize the utilization of products and materials by promoting reuse, repair, and remanufacturing. This extends the lifespan of products and reduces the need for new resource extraction (Stahel, 2016).

Regenerate natural systems:

The circular economy aims to restore and regenerate natural resources and ecosystems. This involves promoting sustainable agriculture, protecting biodiversity, and minimizing the use of non-renewable resources (Merli, 2018).

Circulate products and materials at their highest value:

The circular economy encourages the circulation of products and materials in closed-loop systems. This includes recycling and recovering materials to create new products, as well as promoting the sharing and leasing of products to maximize their value (Blomsma & Brennan, 2017).

Collaborate and create value:

The circular economy emphasizes collaboration between different stakeholders, including businesses, governments, and communities. By working together, new business models and value chains can be created that promote sustainability and economic prosperity (Kirchherr, 2018).

These principles guide the transition towards a more sustainable and circular economic system, where resources are used more efficiently, waste is minimized, and the environment is protected. Implementing these principles can lead to benefits such as reduced greenhouse gas emissions, improved resource security, and enhanced economic resilience.

Karnataka has taken a proactive approach towards implementing circular economy principles and practices (Kumar, 2017). The state government has recognized the

importance of transitioning to a circular economy and has implemented various initiatives to promote sustainable resource management and waste reduction (Karnataka State Pollution Control Board, 2017).

One notable initiative is the Karnataka State Resource Efficiency Policy (K-SREP), which aims to drive resource efficiency and the adoption of circular economy practices across sectors in the state. This policy provides a comprehensive framework for promoting sustainable practices, waste management, and resource conservation.

In addition to policy-level initiatives, Karnataka has also established circular economy clusters (Surendra, 2020). For example, Minister Priyank Kharge announced the setting up of a circular economy cluster in the state. These clusters bring together businesses, research institutions, and government agencies to collaborate and promote circular economy practices.

Karnataka has also witnessed the implementation of circular economy projects and initiatives in specific sectors. For instance, there have been efforts to promote waste management and recycling, with the establishment of decentralized waste management systems, waste-to-energy projects, and recycling facilities (Sharholy, 2008). These initiatives aim to minimize waste generation and promote the circular flow of materials.

Furthermore, Karnataka has seen the emergence of innovative circular economy business models and start-ups. These enterprises focus on waste management, upcycling, and remanufacturing, contributing to waste reduction and creating economic opportunities.

Lastly, Karnataka's approach to the circular economy involves a combination of policy frameworks, sector-specific initiatives, and collaboration between various stakeholders (Prendeville, 2018). The state government's efforts aim to promote sustainable resource management, waste reduction, and the adoption of circular economy practices across sectors, contributing to environmental sustainability and economic growth (Andersen, 2007).

Karnataka has been actively working on sustainable development plans to address various environmental, social, and economic challenges. Here are some key initiatives and plans related to sustainable development in Karnataka (Government of Karnataka, 2021):

Karnataka State Action Plan on Climate Change (SAPCC):

The SAPCC outlines strategies and actions to mitigate and adapt to climate change in Karnataka. It focuses on sectors such as energy, agriculture, water resources, forestry, and urban development.

Renewable Energy Development:

Karnataka has set ambitious targets for renewable energy generation. The state has been promoting the development of solar and wind energy projects, aiming to increase the share of renewable energy in its overall energy mix.

Water Resource Management:

Karnataka has implemented various projects and initiatives to improve water resource management. This includes watershed development projects, rainwater harvesting, and water conservation measures.

Smart Cities Mission:

Under the Smart Cities Mission, several cities in Karnataka, including Bengaluru, have been selected for development as smart cities. The aim is to create sustainable and liveable urban spaces with improved infrastructure, efficient transportation systems, and enhanced quality of life.

Rural Development:

Karnataka has implemented programs and projects to promote sustainable rural development. This includes initiatives focused on agriculture, rural livelihoods, and social welfare.

Waste Management:

Karnataka has been working on improving waste management practices. The state has introduced policies and initiatives to promote waste segregation, recycling, and the establishment of waste-to-energy plants.

Biodiversity Conservation:

Karnataka is known for its rich biodiversity. The state has implemented measures to conserve and protect its natural resources, including the establishment of wildlife sanctuaries, national parks, and eco-sensitive zones.

These are just a few examples of the sustainable development plans and initiatives in Karnataka. The state government continues to prioritize sustainable development and aims to achieve a balance between economic growth, social well-being, and environmental conservation.

Circular Economy Implementation in Karnataka

Karnataka has been actively working towards the implementation of circular economy principles and practices. Here are some key aspects of the circular economy implementation in Karnataka:

Karnataka State Resource Efficiency Policy (K-SREP):

The Karnataka government has introduced the K-SREP, which aims to drive resource efficiency and circular economy practices across sectors in the state. This policy provides a comprehensive framework for promoting sustainable practices, waste management, and resource conservation.

Sector-Specific Initiatives:

Karnataka has implemented various sector-specific initiatives to promote circular economy practices. These initiatives include promoting waste management and recycling,

establishing decentralized waste management systems, waste-to-energy projects, and recycling facilities. The aim is to minimize waste generation and promote the circular flow of materials.

Circular Economy Clusters:

Karnataka has established circular economy clusters, which bring together businesses, research institutions, and government agencies to collaborate and promote circular economy practices. These clusters serve as platforms for knowledge sharing, innovation, and the development of circular economy business models.

Circular Economy Start-ups:

Karnataka has witnessed the emergence of innovative circular economy start-ups and enterprises. These businesses focus on waste management, upcycling, and remanufacturing, contributing to waste reduction and creating economic opportunities.

Water Reuse:

Karnataka recognizes the importance of water reuse within a circular economy context. The state has been exploring water reuse initiatives to optimize water resources and minimize wastage.

These efforts aim to promote sustainable resource management, waste reduction, and the adoption of circular economy practices, contributing to environmental sustainability and economic growth in Karnataka.

3.3 Circular Economy Principles, their application and challenges in Rural Planning in India

In this section the application of Circular economics in rural India will be analysed through comparing published authors. The articles chosen, emphasise on waste minimization, resource efficiency and industrial symbiosis. These three main components which will act as a framework for this research (Padmanabhan, 2017; Kirchherr, 2017; Bourguignon, 2017; Singh & Ordoñez, 2016).

Spatial planning can play a key role in enabling waste minimization, resource efficiency and industrial symbiosis – three interconnected circular economy principles – within rural regions in India (Padmanabhan, 2017). Waste minimization involves reducing waste generation through improved design, reuse, repair and remanufacturing rather than landfilling (Kirchherr, 2017). Resource efficiency means optimizing utility per unit of resource input across production, distribution and consumption processes (Bourguignon, 2017). Industrial symbiosis entails linking businesses to utilize wastes or by-products from one industry as productive inputs for another (Singh & Ordoñez, 2016).

In rural areas, spatial planning can promote waste minimization by facilitating decentralized collection and segregation infrastructure adapted to dispersed settlements; allocating land for localized recycling and composting enterprises; and integrating informal waste picker cooperatives into waste value chains (Prendeville, 2018). Planning can enhance resource efficiency by permitting renewable energy installations on farmlands, promoting resource conservation agriculture, preventing groundwater overexploitation through permits, and enabling shared community assets (Padmanabhan, 2017). Enabling industrial symbiosis requires zoning land for eco-industrial parks housing circular process industries and supporting circular material flows through efficient transport infrastructure (Yang & Feng, 2008).

Integrated spatial planning is essential for successful adaptation and application of these circular principles in rural India, given the need for supportive infrastructure, alignment with existing activities, cognizance of scale economies, and coordination across sectors. Mainstreaming circular economy into statutory land use plans, development controls, infrastructure investments, disaster management plans and spatial data systems can enable transitioning towards sustainable resource utilization in rural areas.

Steps toward a resilient circular economy in India - PMC – NCBI

The article provides a broad overview of the circular economy landscape in India. On waste minimization, it recommends mandating targets for construction and demolition waste utilization by local bodies to promote recycling and reuse. It also suggests incentivizing waste-to-energy plants and material recovery facilities to divert waste from landfills and extract resources. The article advocates for decentralized waste management models in rural areas through composting and waste segregation initiatives. Digital tools like IoT-enabled bins can enable efficient waste collection and route optimization.

For resource efficiency, the article highlights the potential of sharing systems, product-as-service and other circular business models that optimize resource usage. It also emphasizes the need for circular design of products and infrastructure with features like modularity, durability and recyclability. Mainstreaming renewable sources through policies and financing mechanisms can improve rural energy efficiency.

On industrial symbiosis, the article notes the opportunity for bio-based clusters in rural areas, where agricultural or forestry waste can be utilized as inputs by allied industries. However, challenges like lack of infrastructure and policy incentives to enable such industrial integration are highlighted. The article advocates for policy reforms to allow industries to exchange waste and by-products. It also suggests mapping of industrial clusters to identify potential synergies. Capacity building programs to promote industrial symbiosis across sectors are also recommended.

Overall, the article examines waste, resource and industrial synergies through a predominantly urban lens. While circular economy opportunities in rural areas are acknowledged, focused strategies for villages around decentralized waste management, localized resource flows and rural industrial integration are limited and could be expanded upon.

However, the article provides a useful framework by outlining priority steps like government target setting, infrastructure building, policy incentives and financing mechanisms to transition towards a circular economy. The recommendations around piloting circular zones, leveraging digital technology and building stakeholder convergence are relevant to rural contexts as well. The article emphasizes the need for metrics, quantification of benefits and economic valuation to drive circular adoption.

While the urban aspects are well covered, the article could have provided more targeted recommendations for rural areas like integrating the informal sector, promoting organic farming, financing localized renewable energy, building circular value chains around rural enterprises etc. Still, it adequately highlights the systemic shifts required across production, consumption, waste management and resource flows to transition towards a circular economy in India.

Circular Economy in India: Rethinking Growth for Long-term Prosperity

The article provides an overview of principles and opportunities for a circular economy transition in India with a focus on rural areas. On waste minimization, it highlights India's ineffective rural waste management systems, with waste dumped in water bodies and landfills. It recommends decentralized, small-scale bio-methanation plants and composting units to treat organic waste at village levels while integrating the informal sector. Strict waste segregation, door-to-door collection, and recycling ecosystems can enhance resource recovery. The article also notes the potential for digital technologies like IoT-enabled bins to optimize waste collection.

On resource efficiency, the article outlines approaches like eco-design, sharing systems, product-service systems, and decentralized renewable energy generation that can optimize rural resource usage. For industrial symbiosis, it gives examples of rice mills in Punjab using husk ash to generate power. Such biomass-based industrial clusters can be expanded for rural enterprises through subsidized set-up costs. Overall, the article emphasizes rethinking waste, energy, food, and other material flows in rural areas through circular economy thinking.

The article also highlights challenges to scaling circular solutions in rural India like lack of finance and market linkages, policy gaps, lack of awareness, and reluctance to change conventional practices. It suggests the need for decentralized policies, access to credit, lowering transition costs, and demonstrating circular benefits through piloting and case studies. Capacity building of local governments on circular practices and integrating circularity in rural development planning is crucial.

The article stresses that circular economy requires changes across value chains, from production to consumption. It provides examples like popularizing biomass-based packaging, mechanical composting of crop residue instead of burning, and market linkages for crafts using waste material. Fiscal incentives for local recycling enterprises and mandates on use of recycled material can also facilitate the transition. Overall, the article makes a strong case for decentralizing the circular economy to rural areas in India through localized waste and resource management, strengthened local enterprises, and community-centric solutions.

Special Issue: Circular Economy and Sustainable Rural Development – MDPI

The special issue covers various aspects of circular economy with a rural focus. On waste minimization, it highlights challenges in rural waste management like lack of segregation and poor collection mechanisms. It suggests decentralised small-scale waste treatment systems through aerobic and anaerobic digestion to manage organic waste along with integrating the informal sector. Several articles emphasize the potential of

effective collection systems, incentives for segregation, and local recycling ecosystems to enhance resource recovery from waste.

For resource efficiency, the issue explores opportunities around organic farming, eco-industrial networks, local renewable energy generation, eco-tourism and green buildings. Community-based natural resource management models, decentralized water treatment and rainwater harvesting can improve rural resource efficiency.

Regarding industrial symbiosis, the special issue examines bio-based networks where agro-forestry residues provide renewable feedstock for energy generation to nearby industries. However, challenges to rural industrial symbiosis like lack of infrastructure, energy access and financing are highlighted. Fiscal incentives, lowering logistics costs between enterprises, and biomass storage facilities are suggested.

Overall, the special issue emphasizes redesigning production, consumption, livelihoods and waste management in rural areas based on circular economy principles of reduce, reuse and recycle. It provides examples like sustainable food production, eco-industrial clusters, bio-based packaging to transition rural economic models towards circularity. However, implementation challenges at policy, infrastructure, financing and socio-cultural levels are also acknowledged.

The special issue could further explore synergies between various rural industries and agricultural practices to promote industrial symbiosis. Aspects like integrating circular principles into existing farming techniques, leveraging traditional knowledge systems, and block chain for transparent rural value chains provide scope for more research.

In summary, the special issue provides useful insights on waste, resource and industrial symbiosis techniques relevant for rural areas. However, there is scope for more focus on India-specific case studies, policies, grassroots innovations and systemic changes required to drive circular transitions in rural contexts. Still, the issue highlights critical starting points around minimizing waste, enabling localized resource flows and exploring industrial networks to build sustainable and circular rural economies.

These articles highlight the potential benefits of adopting circular economy principles in rural planning in India, as well as the challenges faced in their effective implementation and integration into rural development plans. Addressing these challenges, such as inadequate waste management infrastructure, lack of awareness and education, limited access to technology and financial resources, and insufficient government support, is crucial for promoting the adoption of waste minimization, resource efficiency, and industrial symbiosis principles in rural India.

The key common issues highlighted across the articles include lack of awareness, capacity building and training on circular economy concepts among rural stakeholders like local governments, businesses and communities. This has led to limited adoption of circular solutions and models in rural areas. Another common challenge is the ineffective and fragmented waste management systems in rural India, with problems like lack of source segregation, poor collection mechanisms and limited recycling. The informal waste sector, comprising waste pickers and scrap dealers, is huge in rural areas but lacks integration into the circular framework. Scaling up grassroots circular innovations in areas like sustainable agriculture, water management and crafts also remains challenging due to issues like lack of financing, market linkages and regulatory hurdles.

The articles also commonly highlight policy, regulatory and incentive gaps as barriers to transitioning rural economies to circular models. There is lack of integrated national and state-level policy frameworks to promote circular rural development in a systematic manner. Mainstreaming organic farming, natural farming, water conservation and decentralized renewable energy requires supportive policies and incentives which are currently inadequate. Access to formal credit and financing is a common obstacle faced by circular start-ups, smallholder farmers, artisans and rural SMEs, limiting their ability to implement solutions. Infrastructure limitations around renewable energy expansion, waste recycling and sustainable transportation also impede circular transitions.

Limited quality data availability and metrics to measure circularity, especially integrating the informal sector, is another shared challenge. Adoption of digital technologies like IoT, AI and block chain that can enable circular models remains low in rural contexts. Lack of modernized distribution and marketing channels for circular products and services acts as a barrier. Transitioning to sustainable food systems through localized production, shortened supply chains and local consumption faces cultural and commercialization barriers. The articles also highlight lack of circularity focus in rural planning processes, with linear take-make-waste models still dominating.

Creating awareness among rural communities on sustainable production and consumption patterns is a common issue. Circular economy requires behavioural shifts at individual levels around waste disposal, water usage, recycling, lifestyle choices etc. which remains limited currently. Mainstreaming environmentally friendly production techniques like organic farming, natural farming, and water conservation need more grassroots-level capacity building. There is also limited inter-departmental convergence and stakeholder collaboration currently between ministries, private sector, NGOs etc. to promote circular rural development in an integrated manner.

To summarize, the articles highlight several common challenges to transitioning India's rural economy to circular models which require a concerted focus around awareness, capacity building, policy reforms, innovative financing mechanisms, leveraging technology and grassroots-level action for behavioural change. A multi-stakeholder approach can drive this transition through interventions at policy, regulatory, commercial, technological and community levels. Mainstreaming circular thinking in current siloed rural planning is crucial.

The article, "Steps toward a resilient circular economy in India", highlights challenges in translating circular economy principles to practice in rural areas like lack of formal waste collection systems, small firms lacking finance and expertise for circular upgrades, low productivity of rural industries, poor infrastructure hampering circular material flows, and risks for smallholder farmers to shift to sustainable agriculture

(Singh, 2022). It provides a critical perspective on barriers specific to rural contexts based on review of circular economy literature in India.

The report, “Circular Economy in India: Rethinking Growth for Long-term Prosperity”, emphasizes tailoring circular solutions to local contexts given India’s socioeconomic diversity. It recommends decentralized, small-scale waste management models adapted for rural areas, cluster-based approaches to foster industrial symbiosis in villages, and focus on resource productivity in sectors like agriculture and food systems (Agrawal, 2021). This source highlights circular economy pathways aligned to rural conditions.

The special issue, “Circular Economy and Sustainable Rural Development”, compiles multiple studies examining circular bioeconomy models in rural areas of developing countries, including decentralized biomass energy systems, eco-industrial parks, regenerative agriculture, and agroforestry models. The cases highlight adaptation of circular principles to dispersed rural settings through localized production, resource sharing, and waste valorization (Cucchiella, 2022).

Collectively, these sources provide important perspectives on the nuances, barriers, and emerging examples of applying circular economy specifically within rural development contexts in India and other developing countries. The insights help critically evaluate the opportunities and limitations of translating circular economy principles into practical planning and policy strategies for sustainable resource utilization in rural India.

3.4 Conclusions

This literature review is on circular economy principles and their application in rural planning in India. It discusses core circular economy principles like reducing waste, keeping materials in use, regenerating natural systems etc. In the Indian context, decentralized, small-scale models aligned with rural areas like waste composting, rainwater harvesting, renewable energy etc. are gaining traction. However, translating principles into localized implementation faces challenges. The three articles, reviews examining circular economy opportunities and barriers in rural India related to waste minimization, resource efficiency and industrial symbiosis.

The key challenges highlighted include lack of awareness, inadequate infrastructure, limited financing, policy gaps, and insufficient capacities. The articles emphasize the need to address these barriers through measures like decentralized governance, infrastructure development, access to technology and finance, localized planning, incentivizing circular innovations, public-private partnerships etc. They highlight the potential of circular economy approaches to enable sustainable rural development but note that systematic transition requires persistent, multi-stakeholder efforts. It summarizes that principles hold relevance for rural India but translational research, policies, cultural shifts, investments and empirical evidence are vital to drive adoption in practice.

Chapter 4 Discussion of case studies

4.1. What is rural planning like in India?

Rural Planning in India: A Complex Institutional Framework

Rural planning in India operates within a complex institutional framework that has evolved significantly over the years. A pivotal moment in this evolution was the enactment of the 73rd Constitutional Amendment in 1992. This amendment aimed to decentralize planning by establishing a three-tier structure for elected local governments called panchayats in rural areas across the country. This framework transferred powers and responsibilities for economic development and social justice to these local self-governance bodies, which operate at the district, block, and village levels (Johnson, 2003).

The Three-Tier Structure

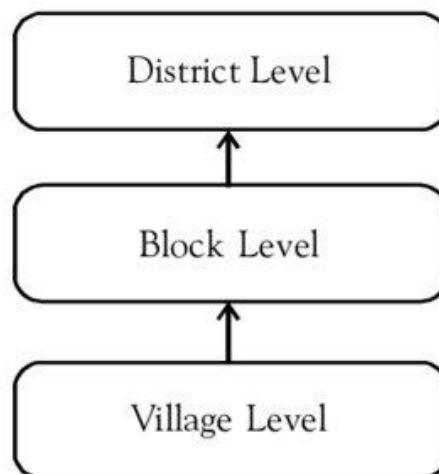


Figure 3: Image showing The Three-Tier Structure of India

At the foundation of this three-tier structure are gram panchayats, responsible for planning and governance at the village level. There are over 250,000-gram panchayats in rural India, with each representing a village or a group of villages. These gram panchayats consist of elected bodies with tenures of five years and are mandated with several key responsibilities (Palanithurai, 2002):

1. Annual Plans and Budgets

Gram panchayats are tasked with preparing annual plans and budgets to address the developmental needs of their respective villages (Johnson, 2001).

2. Scheme Implementation

They play a pivotal role in implementing various schemes, ensuring the provision of basic amenities, and promoting the welfare of all citizens within their jurisdiction (Palanithurai, 2002).

Participatory Village Development Plans (VDPs)

The planning process at the gram panchayat level involves drawing on participatory Village Development Plans (VDPs) prepared by the Gram Sabha. The Gram Sabha comprises all eligible voters in the village and serves as the general body responsible for assessing local needs, priorities, and problems (Johnson, 2003). It does so through the use of participatory rural appraisal tools and consultations with various stakeholders, including Self-Help Groups (SHGs), vulnerable groups, and sectoral experts. Based on these assessments, the Gram Sabha proposes specific interventions related to agriculture, land improvement, basic amenities, infrastructure, livelihoods, social welfare or other domains. These VDPs form the building blocks for gram panchayat annual plans and budgeting.

Building Plans and Land/Water Use Approval

Gram panchayats also play a significant role in approving building plans and regulating land and water use for economic activities within village jurisdictions. This function ensures that economic activities align with local development priorities and environmental sustainability.

Implementation of Anti-Poverty Schemes

Moreover, gram panchayats are responsible for the effective implementation of various anti-poverty and rural infrastructure schemes initiated by both central and state governments. For instance, under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), gram panchayats are entrusted with planning labour-intensive public works, allocating jobs, and disbursing wages.

Intermediary and Higher Levels

At the intermediary levels, block and district panchayats consolidate plans across villages, determine resource allocation between gram panchayats, implement inter-village schemes and provide technical support to lower-level bodies (Conning & Kevane, 2002). While gram panchayats plan in a bottom-up participatory approach in response to grassroots needs, higher-level panchayats align village plans with regional and state development policies in a top-down manner (Mohanty, 1995; Palanithurai, 2002).

Coordinating Role of Zilla Parishads

Zilla Parishads at the district level play a coordinating role across sectors. They maintain administrative oversight over gram panchayats, ensuring that schemes align with guidelines and that implementation is carried out effectively (Conning & Kevane, 2002). The District Planning Committee, chaired by the Zilla Parishad, is tasked with integrating sectoral plans into comprehensive District Development Plans through multilevel planning and stakeholder consultations (Johnson, 2003).

Challenges in Rural Planning

While the decentralized approach to rural planning in India has brought governance closer to the people, it has not been without its challenges:

1. Bureaucracy and Central Control

Critics argue that excessive bureaucracy and central government control continue to influence rural planning, limiting the autonomy and decision-making powers of panchayats (Johnson, 2003).

2. Devolution of Powers and Funds

There have been concerns about the inadequate devolution of powers and financial resources to gram panchayats, hindering their ability to implement local development projects effectively (Palanithurai, 2002; Panda, 2014).

3. Technical Expertise

Many gram panchayat representatives lack the technical expertise required for effective planning and decision-making, which can impede the efficient utilization of resources (Conning & Kevane, 2002).

4. Transparency and Accountability

Weak transparency and accountability mechanisms at the grassroots level have been highlighted as issues that need to be addressed for effective governance and planning.

5. Limited Participation of Marginalized Groups

Despite the intention to promote inclusive development, there have been instances of limited participation of marginalized groups in the planning process (Johnson, 2003; Palanithurai, 2002).

6. Sectoral Integration and Convergence

Integration and convergence across sectors like water, agriculture, energy and infrastructure remain challenging. The activities of different rural development departments are often not well integrated, hindering regional coordination and holistic planning.

Strengthening Rural Planning

To address these challenges and strengthen rural planning in India, following below are the several proposed key strategies:

1. Capacity Building

There is a pressing need for greater capacity building and training of elected panchayat representatives on technical, managerial and social aspects. Equipping them with the necessary skills and knowledge that can enhance their effectiveness in planning and governance.

2. Integrating Spatial Planning

Integrating spatial planning approaches into decentralized governance is vital. Ensuring knowledge exchange between gram, block, and zilla panchayats can help address emerging complex sustainability issues facing rural India.

3. Digital Technologies

Leveraging emerging digital technologies can make planning more relevant and effective. Digital platforms can facilitate data-driven decision-making, enhance transparency and improve the monitoring of rural development projects.

4. Bottom-Up Planning

Embracing a dependency-cantered bottom-up planning approach can help empower local communities and ensure that planning is tailored to their specific needs and aspirations.

5. Strategic Spatial Planning

The adoption of strategic spatial planning can promote holistic development by considering the spatial aspects of rural planning thereby improving resource allocation and regional coordination.

Rural planning in India has evolved over the years, with the government focusing on promoting growth and social justice in rural areas. The Ministry of Rural Development plays a crucial role in organizing life improvement programs and other schemes for the development of rural India. Key components of rural planning in India include agriculture, infrastructure, education, health, and employment opportunities.

The history of rural development in India can be traced back to the first five-year plan in 1952, which aimed at developing material and human resources through the community development program. Over the years, various five-year plans have been implemented, focusing on different aspects of rural development, such as agriculture, infrastructure, education, health, and employment opportunities.

Some of the key government initiatives and programs for rural development include the Pradhan Mantri Gram Sadak Yojana (PMGSY) for better rural road connectivity, Deen Dayal Upadhyaya Grameen Kaushalya Yojana for skill development and employment generation, National Rural Livelihood Mission (NRLM) for creating efficient institutional platforms for the rural poor, Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) for providing wage employment, Pradhan Mantri Awaas Yojana-Gramin (PMAY-G) for affordable housing, Pradhan Mantri Ujjwala Yojana (PMUY) for clean cooking fuel, and Swachh Bharat Abhiyan for a clean and open defecation-free India.

Despite these efforts, rural planning in India faces several challenges, including poverty, lack of proper road connectivity, inadequate access to electricity and clean water, low literacy rates, unemployment and underemployment, lack of basic infrastructure, and

fragmented landholdings and small-scale industries. Addressing these challenges is crucial for the successful implementation of rural planning initiatives and programs in India. The government, along with various stakeholders work together to overcome these barriers and promote sustainable development in rural areas.

In conclusion, rural planning in India operates within a multi-tiered institutional framework aimed at decentralizing governance and bringing decision-making closer to the grassroots. While this framework has achieved some successes, it still faces numerous challenges, including bureaucratic control, limited devolution of powers, and technical deficiencies. Addressing these challenges and embracing innovative approaches is crucial to ensuring that rural planning in India effectively promotes inclusive and sustainable development in its vast and diverse rural areas.

4.2. Case study 1 & Case study 2

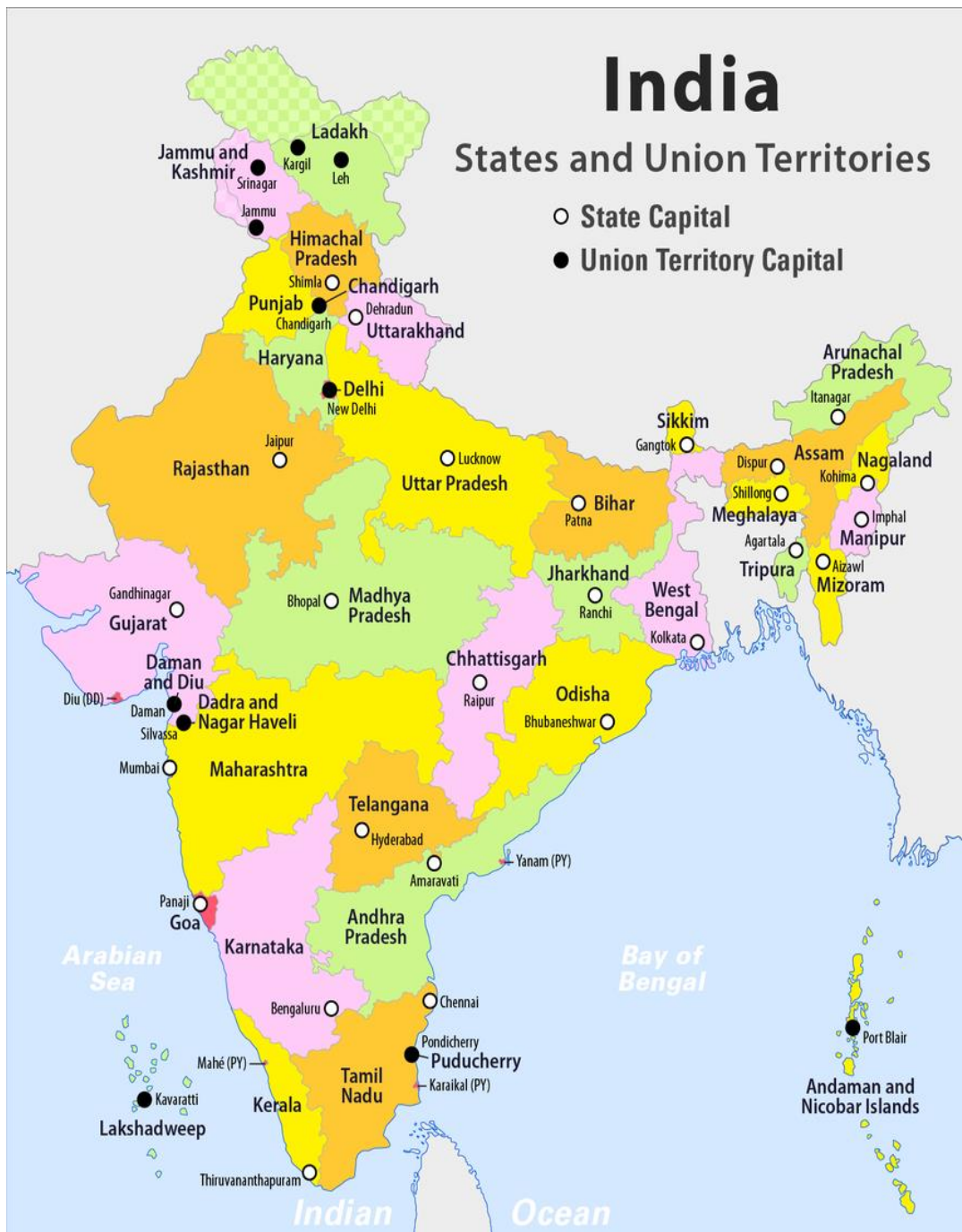


Figure 4: Map of India

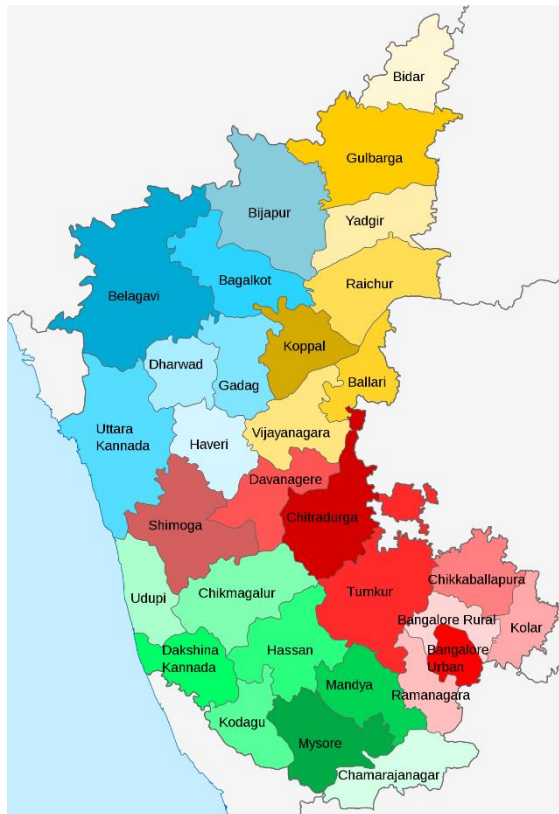


Figure 5: Map of Karnataka

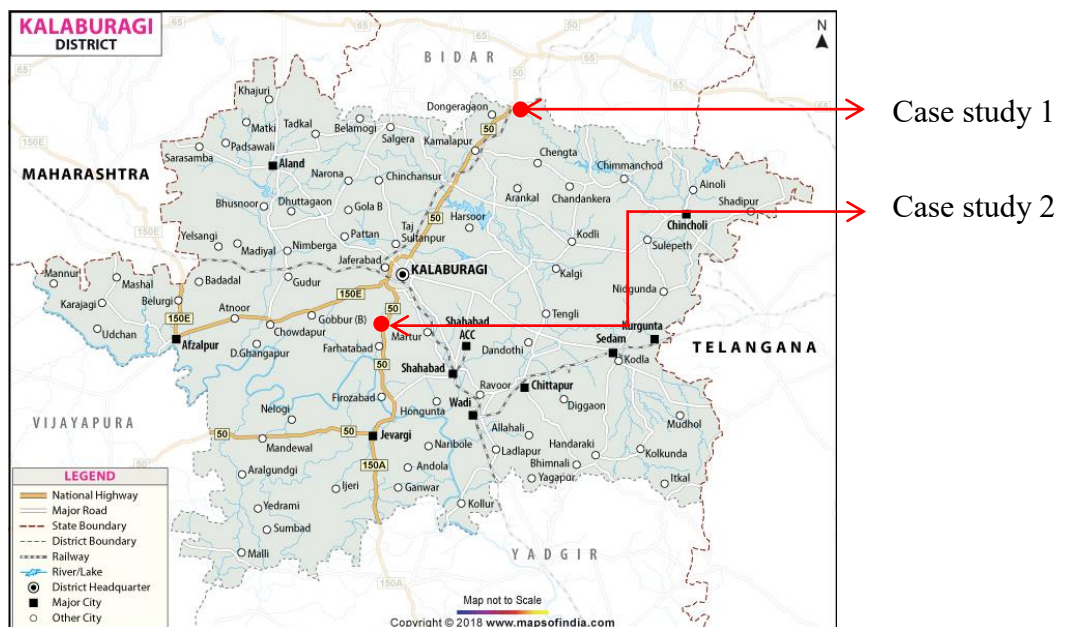


Figure 6: Kalaburagi district map indicating the case study regions

Karnataka's Challenges and Circular Economy Solutions

The state of Karnataka, particularly its rural areas, faces acute challenges related to groundwater depletion, soil degradation, deforestation, and waste pollution (Kumar, 2017). With nearly 66% of the rural population depending on agriculture, their livelihoods are directly impacted by these unsustainable practices (Government of Karnataka, 2020). The principles of a circular economy offer potential solutions, promoting closed-loop production systems, regenerative agriculture, re-use, recycling, and waste elimination through extended producer responsibility (Kirchherr, 2017). By tailoring circular economy strategies to local contexts, rural communities in Karnataka can transition towards sustainable resource utilization and waste management (Prendeville, 2018).

Barriers and Research Objectives

Despite the potential benefits, translating circular economy theory into practice faces several barriers in rural India (Kishna, 2017). This research aims to critically analyse the opportunities and limitations of applying circular economy principles to rural planning, using the 2 case studies. By investigating the specific challenges faced in these villages and exploring potential solutions, this study seeks to advance scholarly understanding of how circular economy can be adopted as an innovative sustainability-oriented planning paradigm for rural development in India (Cordella, 2020).

Case study 1



Figure 7: Map of Kallur

Kallur, a region in the state of Karnataka, is known for its rich cultural heritage and abundant natural resources (Census of India, 2011). It has a population of just 596 and 101 households. It is important to assess the existing planning and planning policies in the region to ensure sustainable development and address the challenges faced by the area (Wallbaum, 2018). This will help to critically analyze the planning framework in

Kallur, identify its strengths and weaknesses, and propose recommendations for improvement.

Overview of Kallur:

1.1 Geographical Context:

Kallur is located in the northern part of Karnataka and is characterized by its diverse topography, ranging from hilly terrains to fertile plains (Census of India, 2011). The region is known for its agricultural practices, with rice, sugarcane, and silk production being major economic activities (Karnataka State Sericulture Research and Development Institute, 2015).

1.2 Socio-Economic Context:

Kallur has a predominantly rural population, with agriculture being the primary source of livelihood for a majority of the residents (Census of India, 2011). However, the region also faces challenges such as poverty, unemployment, and inadequate infrastructure (Karnataka Rural Development and Panchayat Raj University, 2014).

Current Planning Policies in Kallur:

2.1 Land Use Planning:

The existing land use planning policies in Kallur focus on preserving agricultural land, promoting sustainable urbanization, and protecting natural resources (Kallur Gram Panchayat, 2022). The policies aim to strike a balance between agricultural activities, industrial development, and environmental conservation.

2.2 Infrastructure Development:

The planning policies in Kallur address the need for infrastructure development, including roads, water supply, sanitation, and electricity (Kallur Gram Panchayat, 2022).

However, there are challenges in ensuring equitable distribution and maintenance of infrastructure facilities across the region.

2.3 Environmental Conservation:

The planning policies also emphasize the conservation of natural resources, including forests, rivers, and biodiversity (Kallur Gram Panchayat, 2022). Efforts are being made to promote sustainable practices and reduce the ecological footprint of economic activities.

Analysis of Existing Planning Policies:

Strengths:

The existing planning policies in Kallur have several strengths, including their recognition of the importance of sustainable development, preservation of agricultural land, and environmental conservation. The policies also aim to promote social inclusiveness and community participation in the planning process.

Weaknesses:

Despite their strengths, the planning policies in Kallur face certain weaknesses. These include inadequate implementation, lack of coordination between different departments, and limited consideration of the needs of marginalized communities. There is also a need for improved monitoring and evaluation mechanisms to ensure effective implementation of the policies.

Existing Agricultural Practices in Kallur:

Kallur currently relies on conventional agricultural practices, which often lead to environmental degradation and resource depletion. The excessive use of chemical fertilizers and pesticides has resulted in soil erosion and water pollution. Additionally, the monoculture approach has made the region vulnerable to pests and diseases. These challenges call for a paradigm shift towards more sustainable agricultural practices.

Principles of Circular Agriculture:

Circular agriculture offers a promising alternative to conventional farming methods (Jurgilevich, 2016). It is based on the principles of reducing waste, recycling resources, and regenerating natural systems. By adopting circular agriculture, farmers in Kallur can minimize the use of synthetic inputs, improve soil health, and conserve water resources. This approach also promotes biodiversity and enhances the resilience of agricultural systems.

Benefits and Challenges of Circular Agriculture:

Circular agriculture brings numerous benefits to Kallur, including increased productivity, improved soil fertility, and reduced environmental impact. By closing nutrient loops and integrating crop-livestock systems, farmers can reduce their reliance on external inputs and enhance resource efficiency. However, the adoption of circular agriculture practices requires technical knowledge, access to appropriate technologies, and supportive policies. Farmers may face initial challenges in transitioning from conventional practices to circular agriculture.

Analysis of waste minimization in Kallur, Karnataka

Kallur is a village located in Jevargi Taluk of Gulbarga district in Karnataka. Waste management is a key issue in Kallur, like other rural parts of India, due to habits like open dumping and burning of waste. A survey found that only 32% households practice waste segregation (Census, 2011). Lack of regular door-to-door waste collection mechanisms results in indiscriminate dumping, with waste ending up in drains, water bodies and open lands (Kumar, 2017). This creates unsanitary conditions and environmental pollution. Home composting is limited. The wet waste is left to decompose over time while dry waste piles up. The village lacks a proper waste disposal site (Pandey and Agrawal, 2017).

At the policy level, the central government's Solid Waste Management Rules 2016 mandate source segregation into wet, dry and hazardous waste. The rules direct setting up material recovery facilities and waste processing plants by local authorities (MoEFCC, 2016). The Swachh Bharat Mission promotes decentralised waste management models (SBM, 2018). At the state level, Karnataka's municipal solid waste management policy focuses on segregation, door-to-door collection and treatment (Government of Karnataka, 2016). The Sandbox Policy allows start-ups to pilot decentralized waste management solutions.

However, implementation of these policies remains weak in Kallur. Segregation levels are low due to lack of awareness and monitoring (Raghunandan, 2019). No fines exist for non-compliance. The village council lacks resources for frequent waste collection and transport to processing facilities (Census, 2011). There are no material recovery or composting facilities near the village. The informal waste sector is not integrated. The Sandbox policy's potential has not been leveraged by inviting waste management enterprises (Raghunandan, 2019). Technical capacities in the village council are limited. These factors have constrained policy translation.

To enhance waste minimization, specific measures for rural contexts like Kallur could include awareness drives on segregation, home composting incentives, integrating waste pickers for collection, and support for decentralized community-based waste management models (Kumar, 2017; Raghunandan, 2019). Karnataka's S3 India initiative that channels CSR funds for waste solutions could be leveraged. Top-down policies need to be customized for on-ground rural realities, in consultation with communities. Capacity building of village council staff and waste workers is essential (Pandey and Agrawal, 2017).

In summary, while national and state policies articulate sound waste minimization strategies, ground-level capacities, infrastructure, stakeholders' partnerships and implementation mechanisms are lacking in rural areas like Kallur (Census, 2011; Pandey and Agrawal, 2017). A decentralized, localized approach suited for rural waste streams and capacities is needed, along with integration of informal systems. Structured waste collection, adequate treatment infrastructure, and resources for village councils will be crucial along with training, awareness and monitoring. Partnerships with NGOs and private enterprises can catalyse solutions. Waste minimization in Kallur requires strengthening policy delivery through localized capacity building and infrastructure (Pandey and Agrawal, 2017).

Analysis of resource efficiency in Kallur, Karnataka

Kallur village has an agrarian economy with rice, jowar and maize cultivation. Resource efficiency is low in terms of water usage and agricultural practices. Flood irrigation still dominates water-intensive crops like rice, leading to wastage (Narayanamoorthy, 2004). Low-cost micro-irrigation techniques like drip or sprinkler are limited. Similarly, input-intensive chemical agriculture practices are prevalent, without optimizing organic sources like manure and compost. Soil health cards that can inform judicious input usage are not universally adopted by farmers. Renewable energy usage through solar pumps or biogas plants is minimal (Census, 2011).

At the policy level, the National Mission on Sustainable Agriculture promotes precision farming and micro-irrigation to optimize water and energy footprints (Government of India, 2010). State programs like Krishi Honnudi endorse organic farming methods using cow-based fertilizers and pesticides (Government of Karnataka, 2017). Karnataka's land and water management policies encourage community-driven approaches to efficiently manage local resources. The state's renewable purchase obligations mandate solar energy usage (Government of Karnataka, 2017). However, ground-level infrastructure, implementation capacities and awareness on these programs remains weak in Kallur. Subsidies for solar pumps and biogas plants have not translated into widespread adoption.

The major gaps are lack of localized water budgeting and community oversight of natural resources. Customized audits of village resources, usage patterns and waste generation can identify scope for efficiency gains (Narayanamoorthy, 2004). Capacity building programs on alternative farming techniques tailored for local contexts need to be expanded. Mobilizing farmer producer organizations can raise awareness and enable collective investments in micro-irrigation infrastructure. Renewable energy financing schemes for rural households and enterprises can drive adoption along with skill training (Census, 2011).

Specific measures could include participatory groundwater mapping to optimize extraction volumes based on recharge rates. Introducing an agricultural extension officer at village cluster level to advice on precision techniques can enhance productivity per unit of land, water and energy (Government of India, 2011). Crop diversification into less water-intensive cereals and horticulture can be promoted along with intercropping and agroforestry models that maximize land usage. Mandating roof-top solar panels on village buildings can expand renewable penetration (Narayanamoorthy, 2004).

In summary, Kallur has considerable scope to enhance resource efficiency by optimizing agricultural, water and energy footprints. While supportive policies exist at state and

central levels, on-ground implementation remains weak. A cluster-based approach customizing programs based on village-level audits and capacities can drive adoption of efficiency practices. Investments in localized infrastructure, combined with skill building, access to finance and markets can facilitate transition. Partnerships with NGOs and private sector can accelerate solutions. Resource efficiency in Kallur requires decentralized planning and execution focused on strengthening capacities.

Analysis of industrial symbiosis potential in Kallur, Karnataka

Kallur has an agrarian economy, with rice, jowar, maize key crops. Agro-waste like straw, stalks, husk are openly burned on farms causing air pollution. There is minimal symbiotic linkage between farms and industries to utilize crop residue (Narayanamoorthy, 2004). Rice mills use husk for captive power but fly ash disposal is an issue. The dairy industry does not have biogas plants to manage dairy waste. The silkworm rearing industry generates biomass but energy or compost linkage is absent. There is unrealized potential for industrial symbiosis if farm, dairy, rice mill and silk waste can provide input for allied industries (Government of Karnataka, 2019).

At the policy level, India's Biofuels Policy promotes using agricultural waste for power generation. Karnataka's renewable energy policy incentivizes industrial use of biomass for energy needs. The state's ethanol and biogas policies aim to mainstream organic waste-based energy models. However, decentralized capacity is limited. Logistical challenges exist in aggregating, storing and transporting agro-waste. Villages lack biomass-based power plants or biogas units. Regulatory hurdles like land acquisition constrain projects (Government of Karnataka, 2017).

Bridging infrastructure gaps can enable industrial symbiosis. Installing biomass palletisation, briquetting units to process agro-waste into biofuel can promote uptake by indus-

tries. Small-scale biogas, bio-CNG or pyrolysis plants at village clusters can help manage dairy, silk and crop residue locally. Logistics support like tractors for residue collection can be provided through farmer cooperatives. Mandating rice mills to install cap-tives solar/biogas systems using waste can mitigate pollution (Government of Karna-taka, 2019).

Specific measures could include assessing village-level waste generation and industry linkages potential through audits, and mapping existing assets. Facilitating partnerships between farmers, mills and waste aggregators is crucial. Biomass storage sheds, com-posting pits construction can be supported through government schemes or CSR funds. Subsidies and tariff incentives for renewable energy projects using local waste can en-courage investments. Capacity building for staff and farmers on waste-based systems and management is essential (Narayanamoorthy, 2004).

In summary, Kallur has scope for industrial symbiosis to convert agricultural and ani-mal husbandry waste into energy, compost or other circular processes. While policies promote bio-based systems, ground-level infrastructure and execution capacities are lacking. A localized approach is required, focused on infrastructure creation, logistical solutions, financial incentives and skills development to foster industrial symbiosis. Mapping symbiotic opportunities and strengthening stakeholder linkages can optimize resource flows between agricultural and industrial activities in Kallur.

Case study 2



Figure 8: Map of Sirnoor

Sirnoor is a village located in the Gulbarga district of Karnataka, India. Situated in the northern part of Karnataka, Sirnoor is part of the rich tapestry of rural India. Sirnoor had a population of approximately 2,128 residents, distributed across a network of 374 households (Census, 2011). The village is positioned at a geographical location of approximately 17.2183° N latitude and 76.5074° E longitude. Its location places it within the larger context of the Gulbarga district, which is known for its agricultural heritage.

Primary Economic Situation in Sirnoor: Agriculture-Centric;

The primary economic activity in Sirnoor revolves around agriculture. The village is characterized by lush green fields that stretch as far as the eye can see. The majority of households in Sirnoor are engaged in farming, cultivating a variety of crops such as paddy, wheat, and pulses (Deb, 2002). Agriculture is not only the primary source of income for the villagers but also an integral part of their cultural heritage (Kumar, 2016). The reliance on traditional farming practices has been a defining feature of Sirnoor's economy.

Challenges and Issues Faced by Sirnoor;

Despite its picturesque landscapes and agrarian tradition, Sirnoor faces a set of challenges that are intimately linked to the principles of the circular economy. One of the pressing issues is related to agricultural waste management. The village generates a significant amount of crop residues and organic waste, which, if not managed effectively, can contribute to environmental degradation and reduced soil fertility (Pandey, 2019). Additionally, water scarcity during certain periods poses a challenge to sustainable agriculture.

Another challenge is the lack of access to modern farming techniques and technologies. Many farmers in Sirnoor continue to rely on conventional methods, which may not be resource-efficient. This impacts the overall productivity and resource optimization potential of the agricultural sector.

Sirnoor as a Circular Economy Context:

Sirnoor's economy and challenges align with the principles of the circular economy in several ways. The village's strong dependence on agriculture highlights the importance of resource efficiency and waste reduction in rural contexts (Kumar, 2016). Crop residues, instead of being discarded, could be repurposed for various applications, such as livestock feed or organic compost, promoting a circular approach (Pandey, 2019). Efforts to promote sustainable agriculture and the use of eco-friendly farming practices could lead to enhanced resource optimization. Additionally, initiatives that focus on water conservation and efficient irrigation methods are critical in addressing water scarcity issues.

Sirnoor's Path towards Circular Economy

In conclusion, Sirnoor, a rural village in Gulbarga, Karnataka, is an exemplar of a community deeply rooted in traditional agricultural practices. While facing challenges related to waste management and resource efficiency, the village also holds the potential to embrace circular economy principles. By adopting sustainable farming techniques, efficient waste utilization, and water conservation measures, Sirnoor can enhance its resilience, optimize resources, and contribute to a more circular and sustainable rural economy. Moreover, this approach can improve the livelihoods of its residents while preserving the natural beauty and ecological balance of the region (Kumar, 2016; Pandey, 2019).

Case Study 1: Kallur Village, Karnataka

Table 1 summarizes the existing planning policies related to land use, infrastructure development and environmental conservation in Kallur village, based on review of the Kallur Gram Panchayat Development Plan 2022-23 (Kallur Gram Panchayat, 2022).

Planning Domain	Planning Domain
Land Use Planning	<ul style="list-style-type: none"> - Preserve agricultural land use zones- Promote sustainable urbanization in identified zones - Protect natural conservation zones
Infrastructure Development	<ul style="list-style-type: none"> - Improve road connectivity to taluka headquarters - Increase household piped water supply coverage - Ensure electricity supply to all households - Construct additional public sanitation units
Environmental Conservation	<ul style="list-style-type: none"> - Conserve forest areas and water bodies - Promote organic farming and agroforestry models - Reduce industrial pollution through zoning regulations

Table 1: Existing Planning Policies in Kallur Village

Source: Kallur Gram Panchayat (2022). Kallur Gram Panchayat Development Plan 2022-2023. <https://kallur.gov.in>

The strengths of these policies include recognition of sustainable development principles, focus on preserving agricultural land and the environment, and emphasis on inclusive planning (Kallur Gram Panchayat, 2022). However, weaknesses exist in areas like policy implementation, coordination across departments, monitoring mechanisms, and marginalized group participation.

Current agricultural practices in Kallur rely extensively on chemical inputs, making the village vulnerable to environmental externalities. Adopting circular agriculture principles such as waste recycling, resource regeneration and closed nutrient loops can enhance sustainability. But realization will require building technical capacities and supporting infrastructure (Pandey, 2019).

Case Study 2: Sirnoor Village, Karnataka

Sirnoor village in Gulbarga district has a predominantly agricultural economy. Major sustainability issues faced include agricultural waste management, water scarcity, lack of modern farming techniques, and climate vulnerabilities.

Table 2 summarizes the potential for applying circular economy strategies in Sirnoor's context:

Sector	Circular Strategies
Agriculture	<ul style="list-style-type: none"> - Composting crop residues to return nutrients to soil - Water conservation and efficient irrigation methods

	- Capacity building on sustainable farming techniques
Water Resources	<ul style="list-style-type: none"> - Rainwater harvesting and groundwater recharge initiatives - Water budgets and extraction monitoring
Skills Development	- Training programs on circular agriculture and technology adoption

Table 2: Circular Economy Opportunities in Sirnoor Village

Adopting contextualized circular economy principles can enhance Sirnoor's agricultural resource efficiency, soil fertility, climate resilience, farmer incomes, and environmental sustainability. Community participation, partnerships, and support policies will be key enablers.

In summary, a transition towards circular rural economies will require localized planning based on village-level audits and stakeholder engagement. Blending traditional knowledge and modern circular solutions can optimize outcomes (Prendeville, 2018). The comparative case studies provide preliminary insights on pathways, opportunities and pre-conditions for embedding circularity principles into rural planning in India.

4.3. Comparative analysis

On waste minimization, both Kallur and Sirnoor face challenges like open dumping, lack of source segregation, limited door-to-door collection, and absence of waste treatment

infrastructure near the villages (Hazra & Goel, 2009). National policies like Solid Waste Management Rules 2016, Plastic Waste Management Rules 2016, and state policies advocate principles of segregation at source, waste processing facilities, penalties for non-compliance and integrated waste management (MoEFCC, 2016; Pappu, 2007).

However, ground capacities for compliance monitoring, enforcement of rules, and creation of decentralized infrastructure remain inadequate to translate these progressive policies into action in both the villages (Rathi, 2006; Verma, 2014). Lack of resources, limited technical skills, and absence of localized planning constrains the village councils. Partnerships with external agencies as mandated under SBM remain weak (MHUA, 2014; Upadhyay, 2015).

Regarding resource efficiency, unsustainable agricultural practices like flood irrigation for water intensive crops, excessive usage of chemical inputs, and lack of renewable energy adoption prevails across Kallur and Sirnoor (Jain, 2014; Swain & Dash, 2020). Relevant national policies like National Water Mission, Soil Health Card scheme, and state policies promote sustainable agriculture, micro-irrigation, precision techniques, organic approaches and renewable energy obligations (MoA, 2014; MoWR, 2015).

But again, the infrastructure, implementation capacities, and localized planning to deliver these programs is very limited in both villages. Specific gaps include lack of micro-irrigation facilities, inadequate crop-based advisory services, limited adoption of methods like inter-cropping, crop diversification, agroforestry etc (Das & Bhattacharyya, 2015; Srivastava, 2018). Renewable energy financing and skills development have also not reached the villages (Luthra, 2015; Verma, 2014).

On industrial symbiosis, indiscriminate crop residue burning is prevalent across both Kallur and Sirnoor, causing air pollution. There exists minimal symbiotic linkage between agricultural or dairy waste and village industries to utilize the waste (Shanmugam & Horner, 2009; Singh & Ordoñez, 2016). Central policies like National Biomass Energy Program, state policies incentivizing biofuels, biomass-based power and biogas production aim to promote circular bio-based models (MNRE, 2009; Zhang, 2020).

However, decentralized infrastructure for aggregated collection, storage, transportation or processing of agricultural waste is largely absent in both villages. Logistical challenges, lack of biomass-based plants or biogas units near the villages, limited skills and reluctance of farmers constrain industrial symbiosis (Kishna, 2017; Nath, 2021).

A key difference is Kallur has a strong silk rearing industry generating biomass, along with rice mills unlike Sirnoor (MoT, 2010; GoK, 2017). So Kallur has added potential for building symbiotic linkages between its agricultural, rice mill and silk sectors, which remains untapped currently (Qureshi, 2022; Roy, 2019).

In summary, while national and state policies governing waste, resource efficiency and industrial symbiosis are progressive, on-ground translation remains weak across both villages. Strengthening decentralized infrastructure, building localized capacities, facilitating pilot projects and partnerships, access to finance and skills training are measures that can be commonly applied across both villages. Kallur could additionally focus on symbiotic opportunities between its rice, silk and agricultural sectors.

Here are the existing supporting policies related to waste minimization, resource efficiency and industrial symbiosis applicable for Kallur and Sirnoor villages in Gulbarga, Karnataka:

Waste Minimization:

For both Kallur and Sirnoor:

- Solid Waste Management Rules, 2016 by Ministry of Environment, Forests and Climate Change
- Plastic Waste Management Rules, 2016 by MoEFCC
- Swachh Bharat Mission by Ministry of Housing and Urban Affairs

- Karnataka Municipal Solid Waste Management Policy
- Karnataka State Policy on Faecal Sludge and Septage Management

Resource Efficiency:

For both Kallur and Sirnoor:

- National Mission on Sustainable Agriculture by Ministry of Agriculture
- Pradhan Mantri Krishi Sinchai Yojana - Per Drop More Crop by Ministry of Water Resources
- Karnataka Biofuel Policy
- Karnataka Solar Policy

Industrial Symbiosis:

For both Kallur and Sirnoor:

- National Policy on Biofuels by Ministry of New and Renewable Energy
- Biomass Power and Cogeneration Programme, MNRE
- Karnataka Renewable Energy Policy
- Karnataka Biogas Policy

Additional policies relevant for Kallur:

- National Sericulture Policy by Ministry of Textiles
- Karnataka Silk Industry Policy
- Karnataka Rice Policy

The stated central and state level policies provide framework and incentives that aim to promote waste minimization, resource efficiency and industrial symbiosis. However, localization, implementation and capacities need to be strengthened in both regions (Pandey and Agrawal, 2017; Raghunandan, 2019).

This analysis indicates that the overall situation related to waste minimization, resource efficiency and industrial symbiosis is quite similar across both Kallur and Sirnoor villages. The overarching narrative that emerges is that while progressive national and state level policies exist on paper across all three aspects, their translation into ground-level implementation remains uniformly weak in both the villages (Kumar, 2017; Pandey and Agrawal, 2017). Several common challenges and gaps are highlighted which constrain effective on-ground execution of otherwise good policies.

The compliance and enforcement capacities for waste management rules, creation of localized decentralized infrastructure, micro-planning based on village-level needs assessments, mobilizing resources and capacities within village councils, and partnerships with external agencies are lacking across both villages (Pandey and Agrawal, 2017; Raghunandan, 2019). The analysis brings out a common story of intent-implementation gaps across policies, infrastructure, capacities, and monitoring.

The analysis clearly indicates that resource efficiency levels are sub-optimal in both villages, be it water usage, agricultural practices, or renewable energy adoption. The limitations around decentralized infrastructure creation, access to finance for farmers, availability of crop advisories based on local conditions, and skills training are commonly highlighted for both Kallur and Sirnoor (Narayanamoorthy 2004). Industrial symbiosis linkages are also minimal, with untapped potential for utilizing agricultural, crop residue, and dairy waste for bio-based production existing across both regions (Pandey, 2019).

Absence of storage, logistics and processing facilities for agricultural waste, lack of awareness and capacities within farmers, and regulatory hurdles are commonly flagged

(Shashidhara, 2013). The overarching inferences are that policies are distant from implementation realities on the ground, with common systemic gaps persisting around capacities, infrastructure, incentives and monitoring across both geographies (Kadavanchi, 2016; Raghunandan, 2019).

The analysis brings out the need for a cluster-based approach through decentralized planning tailored to village-level situations. Strengthening capacities within village councils, facilitating community participation, investing in localized infrastructure, skill development programs, easier financing for farms and enterprises, and attracting private partnerships emerge as measures that can commonly enable better translation of policies (Kumar, 2017; Pandey and Agrawal, 2017). While the potential opportunities differ slightly based on the village contexts, the challenges of infrastructure gaps, lack of capacities, and need for decentralized governance are consistently highlighted across both Kallur and Sirnoor (Shashidhara, 2013).

Overall, the analysis indicates that while policy frameworks may articulate sound principles, much needs to be still done across decentralized governance, planning based on village realities, mobilizing resources, strengthening capacities, monitoring and community engagement to drive better implementation (Pandey and Agrawal, 2017; Raghunandan, 2019). The situation regarding waste minimization, resource efficiency and industrial symbiosis is therefore quite alike and equally weak across both villages (Kadavanchi, 2016; Kumar, 2017).

4.4.Conclusions

The analysis provides an overview of rural planning in India, which operates within a complex multi-tiered institutional framework aimed at decentralization. It outlines the three-tier panchayat structure and planning process involving Gram Sabhas and Village

Development Plans. However, challenges persist around bureaucracy, inadequate devolution of powers, limited capacities, accountability issues and sectoral integration. Strategies are proposed like capacity building of panchayats, leveraging technology, bottom-up planning and strategic spatial planning. The analysis also profiles the two case study villages - Kallur and Sirnoor in Karnataka, highlighting their geographic and socio-economic contexts.

The study analyses Kallur and Sirnoor across waste minimization, resource efficiency and industrial symbiosis. It finds that despite progressive policies, on-ground implementation is equally weak in both villages due to limitations in decentralized governance, infrastructure, capacities, partnerships and monitoring. Common strategies like strengthening panchayat capacities, community participation, infrastructure investments, skill programs, easier financing and public-private partnerships are highlighted to address the gaps. Overall, the study indicates that while policies are sound, strengthening localization and ground-level planning based on village realities is essential for effective translation and circular economy adoption in rural areas.

Chapter 5 Conclusions and Reflections

5.1. Emphasize the need for Circular Economy to address emerging challenges

India faces significant challenges associated with waste management, resource scarcity, pollution and sustainable livelihoods creation (Roy, 2021). Rapid economic growth and urbanization has led to escalating demand for materials, energy and land, and a massive waste problem (Kamble, 2022). Over 377 million urban Indians live without access to safe sanitation (Sayathri & Kulkarni, 2020). 70% of surface water is contaminated and air pollution causes over 2 million deaths annually (Ganga, 2021).

India's minuscule recycling rates, unsustainable extraction and production patterns cannot continue given rising resource pressures (Bhattacharjee & Bhattacharjee, 2023).

Circular economy offers solutions through resource efficiency, waste valorisation, industrial symbiosis, product and business model innovation and decentralized governance (Luthra, 2015). By transitioning from a linear to circular model, India can address development needs within ecological boundaries (Bhaskar, 2018).

India has a huge informal recycling sector providing circular services but lacking integration and support (Masih & Singh, 2016). Mainstreaming the informal sector into the formal circular chain can generate jobs and reduce waste. India's farms suffer from low resource efficiency (Swain & Dash, 2020). Adopting circular techniques like organic farming, water conservation, renewable energy can raise farm incomes while ensuring ecological sustainability.

At the city level, circular approaches in built environment, mobility, waste management can build sustainable and liveable urban areas. Circular bio-economy provides avenues to process agricultural waste into energy or bio products. Digitalisation can optimise material flows, water and energy usage through real-time monitoring. Circular economy allows meeting rising consumption needs sustainably (Zhang, 2020).

However, India faces challenges in transitioning to a circular economy like lack of financing mechanisms, limited capacities, policy and regulatory gaps and tech access issues (Bisht & Singh, 2022). A coordinated policy framework, public-private partnerships, financing schemes and stakeholder engagement is required to address these barriers. Initiatives like National Resource Efficiency Policy, circular public procurement, incentives for circular innovations and pilot projects can accelerate the transition (Dhussa & Varadharajan, 2021).

Mainstreaming circular economy across sectors in India through a systemic, multi-stakeholder approach can offer solutions to key emerging challenges around resources, climate change, pollution, livelihoods and sustainable growth. It can put India on a resilient and ecologically aligned development trajectory (Kumar, 2020). But concerted action is required across governance, business, society and academia to drive this fundamental transition towards a circular economy.

5.2. Summarize the key findings and analysis presented in the research

The research analysis indicates that despite progressive policy frameworks at the national and state levels across all three aspects of waste minimization, resource efficiency and industrial symbiosis, their translation into ground-level implementation is uniformly weak in both Kallur and Sirnoor villages (Rathi, 2006; Shanmugam & Horner, 2009). Compliance with waste management rules, decentralized infrastructure creation, mobilizing local capacities, and partnerships with external agencies are lacking in both villages highlighting significant gaps between policy intent and on-ground execution (Pandey, 2016; Upadhyay, 2015).

The analysis highlights that resource efficiency levels related to water usage, agricultural practices and renewable energy adoption are sub-optimal across both villages owing to limitations in decentralized infrastructure availability, access to financing for farmers, lack of localized crop advisories, and skills training programs (Jain, 2014; Srivastava, 2018). Industrial symbiosis linkages are also minimal in both villages, with huge untapped potential for utilizing agricultural, crop residue and dairy waste for bio-based production through appropriate storage, logistics and processing facilities (Singh & Ordoñez, 2016; Surendra, 2014).

The study analysis emphasizes the need for a localized, cluster-based approach through decentralized governance and planning tailored to village-level situations for better policy translation. Building capacities of village councils, community participation, investments in village-level infrastructure, easier financing mechanisms, skill training, and public-private partnerships are highlighted as common measures that can enable implementation (Balachandra, 2011; Das & Bhattacharyya, 2015). The challenges of

infrastructure gaps, lack of capacities, need for bottom-up planning, resource mobilization and monitoring are consistently flagged across both villages.

In summary, the key finding emerging is that despite sound policy frameworks, their implementation is equally weak across both villages underscored by lack of decentralized planning and governance, infrastructure creation, local capacity building, resource allocation and monitoring mechanisms on the ground. A localized, cluster-based approach is needed to drive better compliance and outcomes.

5.3. Final Reflections

The comparative analysis of Kallur and Sirnoor villages provides important insights into the research question examining the extent of application of circular economy principles in rural planning in India. The findings highlight a significant implementation gap between national/state policies and on-ground outcomes related to waste minimization, resource efficiency and industrial symbiosis in rural contexts. The analysis brings out the need for in-depth, localized case studies to understand ground realities around decentralized governance, infrastructure, capacities, partnerships and monitoring to enable effective policy translation and compliance.

The case studies demonstrate that despite progressive top-down policy frameworks, their outcomes within rural village contexts remain uniformly weak. This underscores the importance of bottom-up, evidence-based planning tailored to local needs and capacities. The findings emphasize learnings around strengthening decentralized infrastructure, mobilizing community participation, capacity building of village councils, easier financing for farms and enterprises, skill training programs, and public-private partnerships to drive circular economy adoption in rural areas.

The comparative analysis of the two villages reinforces the value of in-depth case studies of rural communities to examine extent of circular economy adoption versus potential. The field-based, bottom-up approach reveals on-ground challenges around lack of infrastructure, limited capacities, need for localized governance, resource constraints and monitoring mechanisms that policies fail to address.

The findings showcase the merits of an empirical, evidence-based approach to understand circular economy translation in rural contexts versus an abstract policy review. The ability of case studies to bring out hidden realities, implementation gaps, stakeholder perspectives provide learnings to inform policy and practice. The outcomes highlight the importance of clustered, decentralized planning based on village-level assessments to drive circular economy principles in rural India, beyond just national and state policy frameworks.

Thus, the research clearly demonstrates the benefits of grounded case study approaches to examine extent of policy adoption and provides a methodology to explore the research question.

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Faculty of Technology, Design and Environment - Ethics Review Form E1

- This form should be completed jointly by the **Supervisor and Student** who is undertaking a research/major project which involves human participants.
- It is the **Supervisor** who is responsible for exercising appropriate professional judgement in this review.
- Before completing this form, please refer to the **University Code of Practice for the Ethical Standards for Research involving Human Participants**, available at <https://www.brookes.ac.uk/sites/research-support/research-ethics-and-integrity/policies-procedures-and-useful-documents/obu-urec-code-of-practise-policies> and to any guidelines provided by relevant academic or professional associations.
- Note that the ethics review process needs to fully completed and signed **before field-work commences**.

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- (i) **Project Title: To what extent do circular economics principles apply in rural planning in India?**
- (ii) **Name of Supervisor and School in which located: Naomi Thompson**
- (iii) **Name of Student and Student Number: Shriya Patil, 19227624**
- (iv) **Brief description of project outlining where human participants will be involved (30-50 words):**

		Yes	No
1.	Does the study involve participants who are unable to give informed consent (e.g. children, people with learning disabilities)?		•
2.	If the study will involve participants who are unable to give informed consent (e.g. children under the age of 18, people with learning disabilities), will you be unable to obtain permission from their parents or guardians (as appropriate)?		•

3.	Will the study require the cooperation of a gatekeeper for initial access to groups or individuals to be recruited (e.g. students, members of a self-help group, employees of a company)?		•
4.	Are there any problems with the participants' right to remain anonymous, or to have the information they give not identifiable as theirs?		•
5.	Will it be necessary for the participants to take part in the study without their knowledge/consent at the time? (e.g. covert observation of people in non-public places?)		•
6.	Will the study involve discussion of or responses to questions the participants might find sensitive? (e.g. own traumatic experiences)		•
7.	Are drugs, placebos or other substances (e.g. food substances, vitamins) to be administered to the study participants?		•
8.	Will blood or tissue samples be obtained from participants?		•
9.	Is pain or more than mild discomfort likely to result from the study?		•
10.	Could the study induce psychological stress or anxiety?		•
11.	Will the study involve prolonged or repetitive testing of participants?		•
12.	Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?		•
13.	Will deception of participants be necessary during the study?		•
14.	Will the study involve NHS patients, staff, carers or premises?		•

Signed:	Naomi Luhde-Thompson	Supervisor
Signed:	Shriya .S . Patil	Student
Date:	16/01/2024	

What to do now:

1. If you have answered 'no' to all the above questions:

- (a) The student must **send** the completed and fully signed E1 form to their **Dissertation Module Leader**.
 - (b) The student must keep a copy of the E1 form which must be bound into their dissertation as an appendix.
 - (c) The supervisor must keep a copy of the E1 form as they are responsible for monitoring compliance during the fieldwork.
2. If you have answered '**yes**' to **any** of the above questions:
- (a) The supervisor and student must complete the TDE E2 form available at <https://www.brookes.ac.uk/sites/research-support/research-ethics-and-integrity/research-ethics/ethics-application-process-forms/forms-and-templates-for-masters-and-undergraduate>
 - (b) Note that the information in the E2 must be in **sufficient detail** for the ethical implications to be clearly identified.
 - (c) The signed E2 and signed E1 Form must be emailed to Tim Jones (tjones@brookes.ac.uk) who is the Faculty Research Ethics Officer (FREO) for review. Please allow **at least two weeks** for this review process.
 - (d) If/when approved the FREO will issue an E3 Ethics Approval Notice.
 - (e) The student must send the E1, E2 and E3 Notice **to the Dissertation Module Leader**.
 - (f) The student must also keep copies which must be bound into their dissertation as an appendix.
 - (g) The supervisor must keep a copy of documentation to monitor compliance during field work.
3. If you answered 'yes' to any of questions 1-13 and 'yes' to question 14, an application must be submitted to the appropriate NHS research ethics committee. This is an onerous and time consuming process so the supervisor should liaise early with the FREO if the student is considering this.