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Research Article

Sustainable Livelihoods: Indigenous Knowledge As A Catalyst For Microentrepreneurs In Chhattisgarh

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ABSTRACT

Indigenous knowledge sources are fundamental in promoting sustainable livelihoods through micro-entrepreneurship, particularly in tribal-dominated regions like Chhattisgarh. With 44 percent of its area under forests, the state is rich in biodiversity resources, and the tribal community is highly dependent on rich natural resources. Indigenous practices are passed on from generations of experience and practices, with the evidence of cost-effective traditional systems for managing forests, water, and agricultural resources. These practices include agroforestry, rotational farming, and sacred grove conservation, which not only enhance biodiversity but also improve soil health and resilience against climate variability.

The state's tribal communities, including seven Particularly Vulnerable Tribal Groups (PVTGs), rely significantly on Minor Forest Produce (MFP) for medicine, food supplements, and income, especially during non-agricultural seasons. Nearly 1.3 million of MFP collector households sustain their livelihoods through collection and selling at the local Haats. However, despite the natural resources in the state of Chhattisgarh having the potential of growing micro-enterprises to transform livelihoods, only a minority achieve sustainability due to socioeconomic, cultural, environmental, and administrative challenges. Traditional knowledge systems hold intrinsic value, providing innovative solutions for resource management and biodiversity conservation. Additionally, these systems support climate adaptation strategies using drought-resistant crops, traditional irrigation methods, and practices like rainwater harvesting. Women, as custodians of bio-resource knowledge, play a critical role in sustaining traditional practices, particularly in micro-enterprises of nearly 68 types of MFP, along with conservation and management. However, climate change poses significant threats to these resources, disrupting ecological rhythms and threatening the livelihoods of tribal communities. There is a pressing need to integrate indigenous knowledge with modern development practices to ensure sustainable resource use and sustenance of livelihoods through micro-enterprises, mitigating the challenges that result in income stability. Based on the literature review, in this paper, we have examined the challenges and opportunities in leveraging indigenous knowledge for micro-enterprise promotion and sustainable livelihoods in Chhattisgarh. We have highlighted the importance of traditional knowledge as a genuine method of sustainable livelihood creation and advocated for government policies that protect and strengthen tribal social institutions, traditional knowledge, and the environment. By aligning indigenous practices with modern conservation strategies, policymakers can address implementation challenges and enhance the sustainability of livelihood programs.

Keywords: Indigenous Knowledge, Tribal, Livelihood, Micro-entrepreneurship, Climate Change, Circular Economy, Chhattisgarh

Introduction

Chhattisgarh is a biodiversity hotspot with 44% forest cover, and 40% of the population depends on Minor Forest Produce (MFP) for the sustenance of livelihoods like revenue, medicine, and food, especially in non-agricultural seasons. Chhattisgarh is primarily home to tribal communities who depend largely on subsistence farming for their livelihood. The region is full of natural resources—forests, grazing areas, water sources, soil, nutrients, and biodiversity—supported by a diverse production system. Rural livelihoods and micro-enterprise promotion projects aim to improve the agricultural and non-farm sectors, utilising these natural resources to uplift impoverished communities. The tribals, indigenous people of the state, are more dependent on forest-based products in comparison to other areas. Approximately 20.8 million people (77% of the population) reside in rural areas, engaging in forestry, agriculture, and allied activities. A third of the state's population comprises Scheduled Tribes, predominantly residing in the forested regions of the North and South, heavily reliant on forests for their livelihoods. Chhattisgarh is home to five Particularly Vulnerable Tribal Groups (PVTGs) - Baiga, Kamhar, Birhore, Pahari Korba, and Abujhmadiya communities. Among the total 20,126 villages in the state, over 12,500 are situated within 5 km of forest areas across 25 districts, identified as potential villages for the recognition of Community Forest Rights (CFRs) under the Forest Rights Act, 2006. According to SECC 2011, 72% of the population falls under the auto-inclusion and deprived category. Despite its rich natural resources, Chhattisgarh ranks among the bottom ten states in terms of per capita income.[1] Therefore, traditional and indigenous knowledge is crucial for reducing the effects of climate change for these forest-dependent communities. The significance of Indigenous knowledge certainly encompasses sustainable behaviour and cultural norms tied to the ecosystem and biodiversity. Globally, about 85% of the traditional medicines derived from plants are used for primary healthcare. There is a prime need to document not only the indigenous knowledge and practices but also linkages with the scientific research domain in general and devise community-friendly communication strategies for service-based enterprises. This knowledge and practice need to be converted into easily navigable computerised databases for easy access to this knowledge and practice. The transfer of this invaluable indigenous knowledge manuscripts may be interpreted and translated into other modern Indian languages. The PVTGs of Chhattisgarh, in general, and Bastar region, in particular, are well known for their unique and distinctive tribal culture and heritage along with uncodified social norms and laws. Each tribal group in Chhattisgarh has their distinct knowledge and practices to sustain their livelihoods through micro-enterprises. It provides valuable insights into resource management, conservation tactics, and adaptation strategies. There are many sustainable resource management practices that are vast knowledge repositories for indigenous people. This indigenous knowledge has been manifested over generations, together with their own pristine systems for managing forests, water, and agricultural land. There are instances of practices like controlled burning of forests, which enhance soil health and biodiversity. There is agroforestry and poly-culture farming, which improves soil health and biodiversity and reduces climate vulnerability. The practices of rotational farming and crop diversification provide resilience against pests, diseases, and climate variability. The preservation of sacred groves ensures the maintenance of biodiversity hotspots. The conservation of biodiversity with indigenous knowledge covers the association of flora and fauna identification, medicinal plants and ecological functions of species. This biodiversity maintenance is crucial for ecosystem resilience. These indigenous practices protect and restore ecosystems, aiding in carbon sequestration and water regulation, resulting in soil fertility improvement. There is a unique system of education and knowledge transfer which passes through oral traditions, organising rituals, and group activities. These interventions ensure the continuation and relevance of traditional knowledge, and educating the next generation builds community resilience and promotes environmental responsibility. The challenges posed by Climate Change disrupt phenological cycles, affecting plant growth and yield and increasing pests and diseases. The reassessment of MFP protection methods is necessary due to climate change impacts. The core strategy of all the government schemes and programmes is to provide food security and stable income for marginalised groups, integrating traditional and modern approaches combined with contemporary conservation and sustainable trading methods. There are several areas in Chhattisgarh state that are difficult to approach, as well as several tribes who find it difficult to communicate well. Traditional knowledge of these tribes is required to be documented and utilised better for livelihood options.

There is an urgent need to focus on the micro-enterprises dedicated to improving rural livelihoods through natural resource utilisation to prioritise boosting the local economy. However, the sustainability of these ventures often faces challenges due to insufficient integration of climate change considerations and circular economy principles during the design phase, including socio-economic-legal factors. To ensure long-term viability, the implementation strategy must include ecological considerations and uphold intergenerational equity principles, prioritising the conservation of natural resources for future generations. The emphasis on resource regeneration becomes crucial for enhancing the circular economy.

A detailed examination is required to clarify the roles and responsibilities of various stakeholders, such as government agencies, cooperatives, and local communities, in shaping effective policies through practices. The investigation should emphasise inclusive decision-making processes, ensuring the active involvement of diverse stakeholders, especially communities with historical experience in managing natural resources.

Collaborative strategies should enhance dialogue among stakeholders to promote the sustainability of micro-enterprises and pave the way for a greener future. The Indian government has launched numerous schemes and programs to promote rural livelihoods, focusing on farm, non-farm, and natural resource-based enterprises, particularly on common lands like forests. International organisations (e.g., World Bank, United Nations, JICA, IFAD, FAO) play a significant role in strengthening livelihoods through rural micro-enterprises through targeted initiatives. Environmental sustainability is a critical concern for the longevity of these projects, requiring a balance between economic and ecological considerations.

The article provides insights and recommendations for policymakers, practitioners, and researchers focused on integrating trade policies with Sustainable Development Goals (SDGs) and climate action. It explores the intersection of Indigenous knowledge, rural livelihoods, entrepreneurship, trade policies, SDGs, and climate resilience in the context of Chhattisgarh's micro-enterprises, mostly based on the availability of resources. Findings are drawn from a systematic review of relevant literature, offering practical guidance for sustainable development. Many projects fail to integrate climate change and socioeconomic factors during their design phase, leading to sustainability challenges. Key aspects, such as ecological considerations, indigenous knowledge and intergenerational equity principles, must be prioritised during project preparation to conserve natural resources for future generations. Before initiating livelihood promotion projects, comprehensive studies must evaluate climate change impacts, adaptation strategies, and socioeconomic factors. Pre-assessments should include participatory environmental impact analysis to anticipate and address potential environmental and social challenges incorporating traditional knowledge and practices. Despite pre-assessment efforts, implementation often encounters bottlenecks due to environmental and social challenges. Extensive research is necessary to understand the implications of these issues and propose solutions for effective project management. The link between poverty and climate change highlights the disproportionate impact on impoverished communities, necessitating focused strategies incorporating indigenous knowledge.

State MFP Sector: A Resource Base for Promoting Entrepreneurship

Chhattisgarh, with 44% of its geographical area under forest cover, is a rich repository of biodiversity and accounts for 12% of India's total forest area. The state's forests offer immense potential for fostering entrepreneurship, particularly in the Minor Forest Produce (MFP) sector, which supports nearly 40% of the population. These resources are utilised for medicinal, dietary, and income-generating purposes, especially during non-agricultural seasons, providing a critical safety net for rural livelihoods. The trade of specified MFP, such as Tendu leaves, is organised by the Chhattisgarh State Minor Forest Produce (T&D) Cooperative Federation. The Federation operates through a robust three-tier cooperative structure involving forest-dependent communities in resource collection and trade. Approximately one-fourth of rural households actively participate in selling Tendu leaves at government procurement centres, contributing to an estimated annual trade of ₹1,000 Crore. The trade of non-specified MFP, including medicinal plants and other forest products, generates over ₹750 Crore annually. However, this sector is largely unregulated, leading to unsustainable harvesting practices and lower prices for gatherers. Establishing localised value-addition units and promoting sustainable harvesting incorporating traditional knowledge can unlock significant entrepreneurial potential, ensuring better returns for collectors and conserving forest resources. Currently, most processing and industrial units related to MFP are located outside the state, resulting in missed opportunities for local employment and entrepreneurship. Encouraging the establishment of processing units within Chhattisgarh can stimulate local economic activity and create a value chain that directly benefits the forest-dependent communities. The state of Chhattisgarh constitutes 20,126 villages, out of which more than 12,500 villages are situated within 5 km of forest areas across 25 districts, making it a significant hub for Indigenous communities along with age-old practices. These villages are mapped as potential candidates for Community Forest Rights (CFRs) recognition under the Forest Rights Act of 2006. Despite these opportunities, several challenges impede the effective propagation and preservation of indigenous knowledge and practices. As per the SCEE 2011, 72% of the population falls under the deprived category. The state ranks among the lowest 10 in the per capita income index, reflecting widespread poverty and limited economic resilience. Economic hardships overshadow efforts to preserve and propagate indigenous knowledge as communities prioritise survival over tradition. Indigenous communities have a rich cultural heritage, including sacred grove protection, crop harvesting rituals, Ghotul (youth dormitories), and taboos. This indigenous knowledge is increasingly threatened by modernisation, migration, and changing lifestyles, leading to a gradual erosion of cultural identity. The communities boast a vibrant tradition of craft, folk music, and dance, with clans and sects associating themselves with specific instruments and art forms. However, these practices often lack recognition and market support, leaving them undervalued and at risk of extinction. Traditional knowledge systems are not adequately documented or disseminated, making them inaccessible to younger generations. Communities have limited access to information, resources, and funds that could support better governance of natural resources and enhance the relevance of indigenous practices. Movements like Satnam and Kabeerpanth have instilled values of social harmony and simplicity, but their influence on preserving indigenous practices has diminished over time. Integrating these philosophies with contemporary livelihood strategies remains a challenge. While modernisation offers economic opportunities, it often conflicts with the sustainable practices rooted in indigenous knowledge. The challenge lies in complementing age-old practices with modern tools and

techniques to ensure they remain relevant and beneficial. Recognition of CFRs under the Forest Rights Act offers a pathway to strengthen community governance, but the implementation is often delayed or inadequate. The policies frequently fail to integrate indigenous knowledge into natural resource management frameworks, undermining its potential contribution to sustainability. To overcome these challenges, it is crucial to document and promote indigenous knowledge through participatory approaches, provide platforms for traditional crafts and arts, and ensure equitable access to resources. By bridging the gap between traditional wisdom and modern tools, Indigenous communities can reclaim their cultural identity while enhancing economic resilience.

Entrepreneurial Avenues

Promoting sustainable practices and training collectors to improve the quality and quantity of MFP harvested with an emphasis on the sustained growth of the MFP for the future. Setting up small and medium enterprises (SMEs) to process MFP into market-ready products such as herbal medicines, dietary supplements, and natural cosmetics. Creating direct market linkages, e-commerce platforms, and branding initiatives for Chhattisgarh's MFP products to enhance visibility and profitability. In this context, the state Government has taken some proactive steps by establishing independent unit marketing linkage outlets like Chhattisgarh Herbals. This is a premium brand of forest-based products with marketing outlets. Similarly, C-MART and Sanjeevani are also marketing avenues to support micro-entrepreneurs. Developing cooperative or community-owned enterprises that integrate gatherers into the business model, ensuring equitable profit sharing. With strategic interventions and investment in capacity building, infrastructure, and market development, Chhattisgarh's MFP sector can emerge as a significant driver of rural entrepreneurship and sustainable economic growth. The Government of Chhattisgarh (2023) has declared “the State a Herbal State with the objective of conserving plant resources in their natural form. Cultivation of medicinal plants inside and outside the forest, non-destructive harvesting, promotion of organised trade and promotion of MFP-based industries for processing of MFP to generate additional employment opportunities in the state, improvement of socioeconomic status of rural communities and provision of health cover are the main activities taken up by the MFP Federation to achieve the objectives of the herbal state.” Ecosystem for Promoting Livelihoods through Micro-Enterprises in Chhattisgarh. Chhattisgarh's forest-based economy presents immense potential for enhancing livelihoods through micro-enterprises, particularly focusing on MFPs. The state's ecosystem comprises a network of government initiatives, cooperative structures, community institutions, and private partnerships, which collectively aim to empower local communities while ensuring sustainable resource management. A total of 139 functional VDVKs (Vandhan Vikas Kendras) have been established under the central government scheme to facilitate MFP collection and business, ensuring better economic returns for collectors. These centres engage 1,500 self-help groups (SHGs) directly, while 6,000 SHGs are mapped within the MFP supply chain, benefiting approximately 100,000 women members. The state government and central Govt have declared MSP for 68 MFPs to safeguard the income of collectors. In 2022-23, six lakh collector households received benefits amounting to ₹250 crores. However, only 10% of the total MFP volume is currently covered under MSP, leaving a significant gap in price realisation for collectors. The recognition of CFRs under the Forest Rights Act of 2006 has gained momentum, with approximately 3,000 CFR resource management titles distributed across the state. These rights empower communities to manage and conserve forest resources in alignment with their livelihood and cultural needs. Over 7,887 JFMCs, comprising 27.63 lakh members, manage forest resources spanning 33,190 sq. km. These committees are supposed to enable participatory forest management, ensuring a structural space for community engagement in forest conservation and resource utilisation. Despite these frameworks, significant challenges hinder the full realisation of the potential of forest-based livelihoods. More than 80% of MFPs are traded in open markets at prices often below the declared MSP. Limited training in sustainable harvesting, aggregation, primary processing, and value addition affects the quality and competitiveness of MFP products. Minimal use of technology in the supply chain reduces efficiency and transparency. Overharvesting and inadequate restoration efforts threaten the long-term availability of MFPs. Women, who are primary NTFP collectors, often lack visibility and representation in decision-making processes. Top-down approaches and weak convergence between departments limit integrated and localized livelihood promotion strategies. The ecosystem provides several avenues for leveraging forest resources to improve livelihoods. Enhancing income from sustainably produced forest products through better aggregation, processing, and market linkages. Promoting activities such as nursery development, biodiversity regeneration, and sustainable harvesting of MFPs. Encouraging the use of forest foods and farm-forest linkages to reduce dependence on external food and farm inputs. Strengthening connections between forest restoration and agriculture for improved water, pollination, and nutrition outcomes. The following strategies are essential for addressing the challenges and harnessing the opportunities. Provide skill development for MFPs' pre- and post-harvest practices. Establish functional spaces for women in decision-making within the MFP value chain. Develop community-driven rules for MFP harvesting and promote biodiversity-focused forest restoration. The investment needs to be grown to invest in primary storage, processing units, and technology for improved supply chain management. Enhancing convergence among stakeholders for integrated and community-centric livelihood programs. Build consumer awareness around sustainable forest products and responsible consumption. The success of the ecosystem hinges on collaborative partnerships among stakeholders. The Minor Forest Produce Federation of Chhattisgarh will provide policy support, issue guidelines, and monitor program implementation. SHGs, JFMCs, and cooperatives may play a central role in operationalising sustainable practices and ensuring

grassroots participation. The CSOs (Civil Society Organizations) and CBOs (Community-Based Organisations) may facilitate capacity building, innovation, and market linkage development. Engage in developing value chains and fostering demand for processed NTFPs. By strengthening this ecosystem, Chhattisgarh can create a sustainable model for promoting livelihoods through micro-enterprises, ensuring economic empowerment while conserving its rich forest biodiversity.

Strategic Gaps and Insights from the Literature

The literature review reveals gaps in addressing environmental and socio-economic-legal dimensions in rural livelihood projects, potentially hindering long-term circular economy objectives. It highlights the oversight that undesirable environmental activities may disproportionately affect economic or ethnic factors in promoting rural livelihoods. Community institutions and adaptation strategies may play a pivotal role in the effective design and implementation of strategies, fostering awareness within communities. The critical gap in the design and execution of rural livelihood projects significantly impacts their goals and outcomes. The recently launched Pradhan Mantri Janjatiya Unnat Gram Abhiyan flagship program of the central government emphasises marketing policy for skill development, entrepreneurship promotion, and enhanced livelihoods. The marketing policy aims to create a robust ecosystem that enables tribal communities to achieve sustainable livelihoods and self-reliance through skill development, entrepreneurship promotion, and diversified income generation activities. The focus will be on connecting skill development initiatives with market-driven opportunities and fostering local economic growth. The key element of the Marketing Policy is the convergence of Skill Development integration. Facilitate access to long-term skill development programs and professional courses for tribal youth through initiatives such as the Skill India Mission and Jan Shikshan Sansthan (JSS) to align skill training with local and regional market demands to enhance employability and entrepreneurial potential. Encourage tribal youth to establish enterprises by providing training, mentorship, and access to resources. Develop marketing skills and linkages for entrepreneurs to effectively position their products and services in competitive markets. For livelihood and market linkage facilitation. Further, the government plans to establish Tribal Multipurpose Marketing Centres (TMMCs) as hubs for aggregation, branding, and sale of tribal products, ensuring better price realisation. Strengthening agricultural and allied activities through enhancing marketing and value addition for agricultural produce, animal husbandry, and pisciculture, with a special focus on FRA Patta holders, along with collaborations with government agencies, private entities and NGOs to develop market linkages for these sectors. Livelihood diversification and branding support the development and branding of unique tribal products to create niche markets. Developing promotional strategies, including e-commerce platforms, exhibitions, and social media campaigns, to reach wider audiences. Sustainability and community engagement encourage sustainable practices in production and resource utilisation to maintain ecological balance and long-term viability, and they actively involve tribal communities in decision-making processes to ensure ownership and alignment with local aspirations. There is a need to integrate skill development with entrepreneurship and livelihood opportunities, ensuring that tribal communities are well-positioned to thrive in dynamic markets while preserving their cultural and indigenous knowledge and practices. In recent times, rural livelihood sustainability has become increasingly evident. To recognise the need for indigenous knowledge adaptation strategies, it is crucial to assess the vulnerability of micro-enterprises to climate change impacts, encompassing factors such as shifting weather patterns, extreme events, and changes in resource availability. To enhance the resilience of supply chains and micro-enterprises, integrating circular practices becomes imperative, emphasising resource regeneration and adaptability to climate-induced disruptions. Efforts to explore local sourcing and production aim to reduce the environmental footprint of supply chains while bolstering community resilience. Prioritising the development and implementation of climate change adaptation strategies includes diversifying income sources, implementing water conservation measures, and adopting agroecological practices. Policy advocacy becomes essential for supporting circular economy initiatives and providing incentives for micro-enterprises embracing sustainable practices. Collaboration with local governments is key to creating a policy environment aligning with circular economy principles and climate change mitigation and adaptation goals. Establishing monitoring and evaluation mechanisms is crucial for tracking the environmental, social, and economic impacts of circular economy practices within micro-enterprises. This ensures continuous improvement and refinement of circular strategies based on real-world performance. Success stories and lessons from traditional knowledge and practices within circular micro-enterprises can inspire replication in other rural areas, fostering a culture of knowledge sharing and learning. The intricate relationship between the circular economy, rural micro-enterprises, and climate change concerns is vital for sustainable development. A comprehensive assessment of local natural resources, considering micro-enterprises dependence on these resources, informs circular economy practices, understanding the lifecycle of resources, waste streams, and opportunities for regeneration. Integrating circular economy principles into the design phase of micro-enterprise projects minimises waste, maximises resource efficiency, and promotes sustainability. Resource-sharing models contribute to reducing environmental impact and enhancing economic viability. Promoting sustainable practices within micro-enterprises emphasises eco-friendly production methods, renewable energy sources, and responsible waste management. Continuous capacity-building programs for micro-enterprise owners and local communities raise awareness about circular economy principles, incorporating climate change considerations. Empowering

entrepreneurs with the knowledge and skills needed for circular business models is vital. Facilitating collaborative networks among micro-enterprises enhances collective resource management, sharing best practices, and strengthening market access. Collaboration with local communities, NGOs, and government agencies creates a supportive ecosystem for circular micro-enterprises, aligning with sustainable and climate-resilient business practices. Tabres et al. (2022) examined that rural entrepreneurship thrives on eco-focus, social capital, and socio-economic-environmental interconnections for sustainability. Kanitkar (1994) highlighted the cultural and indigenous traditions' influences on rural entrepreneurs and recommends establishing a guided entrepreneurship system credit policies and local challenges to promote the viability of micro-enterprises. Saxena (2008) emphasised considering social ecosystem factors linking environmental protection to well-being analysis, focusing on entrepreneurship schemes and proposing initiatives for sustainable micro-enterprises, emphasising social factors and effective governance. Sen (2021) emphasises the importance of quality community institutions in implementing progressive policies derived from practices studying the implementation of programmes that hinder the impact on intended beneficiaries. FAO of UN (2011) emphasises the importance of understanding social trends and leveraging indigenous market knowledge, which is crucial in addressing the complex environmental and social challenges associated with sustainable forest management. Behera (2011) concludes that bridging the cultural gap between institutions and communities is essential, and the success of micro-credit programs depends on factors like solidarity, self-help, accountability, and determination to eradicate poverty. Gill (2023) recognised the gaps between existing laws and their implementation and emphasised the importance of considering economic, social, and Indigenous cultural factors in achieving equal opportunities for women in business and the workplace. Pingle (2020) stated that Micro-enterprises have the potential to provide sustainable livelihoods for women in entrenched poverty, but only a small number achieve success. Social capital and community networks play a significant role in initiating micro-enterprises while being on the outskirts of the community, which can be beneficial. State and non-state actors can support micro-entrepreneurs by integrating them into broader networks and providing childcare and medical care assistance. Cultural influences, especially within Muslim communities, also impact the growth of micro-enterprises. Among the interviewed micro-entrepreneurs, only a few were successful, highlighting the importance of entrepreneurial opportunities and factors like marital status and social connections. Chand (2022) observed that agriculture plays a crucial role in improving rural livelihoods, maintaining ecological balance, and achieving sustainable development goals. Transitioning young farmers to non-agricultural sectors can be facilitated through labour-intensive MSMEs. Connecting agri-food processing to production and enhancing value chains can generate rural employment and increase farmers' income. Key areas of discussion include growth, innovation, employment, food security, climate change, and policy reforms. A paradigm shift is needed with changes in regulations, technology advancements, private sector involvement, and efficiency to transform the agriculture sector and contribute to India's development. Coordinated action between the central government and states is vital for agricultural progress. Petareet et al. (2016) shared that the rainfed and forest-based livelihood system in Jharkhand has lower yields, except for vegetables. Interventions should consider the demand-supply dynamics and impact of climate change. The state has faced droughts and declining rainfall, leading to decreased food production. Jharkhand holds the potential for enhancing crop productivity and promoting micro-enterprises based on non-timber forest products. Strategies must address social, economic, and environmental challenges for sustainable rural livelihoods. Jagger et al. (2014) stated the relationship between tenure and forest income in 271 tropical villages. State-owned forests generate higher forest income per household and per hectare compared to privately and community-owned forests. The level of rule enforcement and congruence affects forest income, with negative associations in state-owned and community forests and positive associations in privately owned forests. Policy reforms should consider the potential negative effects on smallholder forest income when emphasising enforcement and addressing overlapping claims. Factors like ecosystem diversity, forest conditions, population density, and market access also influence tenure-income relationships. Wunderet et al. (2014) observed the perception that forests serve as common safety nets and resources for seasonal gap-filling. Forest extraction is found to be a less common response to shocks compared to other alternatives. The households relying on forests for coping strategies are a minority and tend to be asset-poor, primarily in villages specialised in forest-related activities. Forest resources' overall importance as a buffer during agricultural harvests and unexpected hardships may be less significant than previously believed. The Study examines households' responses to shocks and strategies employed to bridge income shortfalls during seasonal fluctuations. Angelsen et al. (2014) observed through a comparative analysis of environmental income in 24 developing countries, finding that approximately 28% of total household income comes from environmental sources, with natural forests accounting for 77% of this income. The share of environmental income is higher for low-income households, and while the differences across income levels are less significant than assumed, the highest income quintile has five times more environmental income than the lowest quintiles. Environmental income plays a significant role in supporting rural livelihoods by providing immediate consumption, acting as a safety net, and facilitating asset accumulation and poverty alleviation. This has implications for understanding rural livelihoods and designing interventions related to natural resource access and use. Schafer et al. (2020) stated that Chhattisgarh, a state rich in natural resources, relies heavily on agriculture despite its low contribution to the gross state domestic product. The mining-driven manufacturing sector leads the state's growth, resulting in uneven development and widening income gaps. Resource strain

has affected the region's natural systems, disrupting the balance of the ecosystem. Limited access to agricultural finance and markets, along with climate change impacts, particularly on women and tribal households, pose significant challenges. The state's climate action plan focuses on risk mitigation and adaptation through integrated natural resource management, climate-smart agriculture, and value chain approaches. However, low access to technology, marginal agriculture dependence, limited skills, and resource management capacity hinder sustainable development and disproportionately affect women. Zhang et al. (2015) highlighted the establishment of operational units within the Water Resources Department (WRD) to enhance project implementation and management. Training centres were proposed to build capacity among WRD, Water User Associations (WUA) and farmers. The project focused on improving women's access to and involvement in irrigation and water management, as well as addressing institutional and social barriers. Efforts were made to minimise adverse impacts on indigenous peoples, and the project had negligible negative environmental effects, with positive impacts reported in the post-project survey. Sati et al. (2008) shared that micro-enterprises have played a crucial role in promoting participatory development and equity in rural mountain regions, particularly for women. The importance of environmental conservation and have capitalised on market linkages and increasing literacy rates. The rise of organic food offers a transformative opportunity for both the mountain economy and women's social and economic status. However, state initiatives are needed to promote crop diversification, enhance production, and ensure quality control to support the growth of agri-business-based micro-enterprises. Karmarkar (2008) emphasised the need to strengthen microfinance for rural economic development, focusing on financial inclusion and affordable services for disadvantaged groups. The SHG-bank linkage model is highlighted as a key aspect, promoting access to funds and social impact for women. Various mechanisms and programs, such as Kisan credit cards and support from institutions like SIDBI and NABARD, have been utilised to provide microcredit and automate processes. Initiatives like Grain Banks have improved food security and reduced reliance on informal lenders. Government programs like SGSY have further enhanced financial inclusion. Credit-plus approaches and subsidy components should be examined to ensure sustainable development in microfinance. The review of the document "Agricultural Extension - Time2Change" by the National Institute of Agricultural Extension & Management (MANAGE) (2018) Agriculture is vital for rural livelihoods and sustainable development, with 11 out of 17 Sustainable Development Goals directly linked to it. Transitioning young farmers to non-agricultural sectors can be facilitated through labour-intensive MSMEs. Connecting agri-food processing to production and value chains can generate rural employment and increase farmers' income. Policy reforms, technology advancements, and private sector involvement are crucial for transforming the agriculture sector. Coordinated action between the central government and states is necessary for agricultural progress and overall development. Aquib et al. (2021) emphasised the service sector, also known as the tertiary sector, plays a crucial role in the socioeconomic development of a country. In India, it contributes more than half of the GDP and serves as the backbone for the primary and secondary sectors. The sector encompasses various industries and provides essential facilities and infrastructure for the production and distribution of goods. Despite challenges in maintaining accurate statistical records, the service sector accounts for a significant portion of employment in India. Reforms are needed to accelerate its growth, create quality jobs, and attract investments, especially considering India's large and youthful population. Ramalho et al. (2012) analysed gender-based legal differences in 141 economies to understand the persistent income and property ownership disparities between men and women. The report emphasises the need to ensure that women entrepreneurs and workers benefit from business regulation improvements. Factors like access to infrastructure, education, healthcare, and social norms are crucial in creating a favourable business environment for women. Indicators such as accessing institutions, building credit, property ownership, job opportunities, and access to courts shed light on the gender dimensions of laws and regulations. By addressing these issues and promoting gender equality, governments can foster a more inclusive environment for women in business and the workforce. Das (2011) shared that promoting Micro and Small Enterprises (MSEs) on a sustainable basis faces challenges such as limited access to finance, inadequate infrastructure, low product quality, and social security concerns. The majority of MSEs in India are informal, and industrial clusters have been a prominent intervention. However, these interventions have not adequately reached rural enterprises, highlighting the need for region-specific policies. The heterogeneity of MSEs requires a resilient support system, and existing entrepreneurship training programs need improvement. Comprehensive measures and targeted policies are needed to address these challenges and foster innovation, infrastructure development, and social security for MSEs. Agrawal (2022) observed during the Study of programmes of Tata Trusts focusing on enhancing rural livelihoods through innovation, digital capabilities, and new-age technologies. With a multi-thematic approach aligned with the UN Sustainable Development Goals, initiatives like the Lakhpati Kisan project empower tribal households in agriculture, benefiting thousands of households. Leveraging technology, Tata Trusts support social sector startups and drive impactful innovations through the Foundation for Innovation and Social Entrepreneurship (FISE). Rani and Divakar (2020) found the impact of the Graduation Model on World Vision India's Area Development Programmes in Andhra Pradesh during the Study of the Centre for Agrarian Studies. The Study found that most beneficiaries chose microenterprise-based livelihoods, with 76% generating cash flow within a month. Regular meetings and peer-to-peer learning were crucial for building confidence and capacity. However, around 25% of the population was excluded from mainstream Self-Help Groups (SHGs). The program should focus on the extremely poor and prioritise indicators like food security, income security, and health security to address

poverty effectively. World Vision India plans to form collectives among rural households, providing technical support and market resources. The Study showed positive returns on investment for non-farm activities, indicating the potential for improvement even among the ultra-poor with the right support systems. Usha et al. 2017: The 'Agri-Start-up program' is a part of the AC and ABC scheme launched by the Ministry of Agriculture and Farmers Welfare in India. It empowers agricultural professionals to establish Agri-ventures and Agri-clinics, providing advisory services to farmers and creating self-employment opportunities. Over 53,000 candidates have been trained, resulting in approximately 23,000 startups and reduced rural youth migration. The program emphasises identifying gaps in input supply and marketing, showcasing inspiring stories of young entrepreneurs who have generated employment and facilitated rural growth. Lingam (2023) discussed the development of rural entrepreneurship in India, highlighting concerns regarding sustainability and societal biases. Government schemes like SVEP and MSDE programs aim to support rural micro-enterprises and provide mentoring. The NRLM and FDRVC promote value chain-based enterprises through producer enterprises. Support from industry experts, the establishment of incubation centres, and active participation of local NGOs and CSOs are recommended to address implementation challenges, Pingal et al. (2019), in their book "Transforming Food Systems in Rising India" stated the insights on agricultural food policy, highlighting imbalances in the nutrient composition of the food system and the evolving role of women in rural areas. They emphasise the need for an intersectional approach that considers various dimensions of food systems. Uneven development patterns and climate change pose challenges to achieving sustainable rural livelihoods and ensuring food security. Balancing urban food demand, rural prosperity, environmental sustainability, and nutritional security are essential objectives. Anantha et al. (2009) explored the importance of agriculture and allied micro-enterprises for rural livelihoods, highlighting the unsustainability of land-based livelihoods for small farmers. It emphasises the need for alternative employment opportunities in response to changing socioeconomic and environmental trends. The interconnection between agriculture, natural resources, and micro-enterprises is crucial, and policies should focus on strengthening the natural resource foundation and creating an enabling environment for micro-enterprise activities. This approach can improve living standards and enhance resilience in rural areas. The review of relevant literature highlights the risks and consequences associated with promoting rural livelihoods through micro-enterprises, emphasising the need for measures to mitigate these risks. It outlines the principles, rules, guidelines, and procedures for assessing socioeconomic, legal, and environmental risks and challenges faced by micro-enterprises. Estimating and budgeting the costs of risk mitigation measures is discussed, along with the responsible agencies for addressing project risks and impacts. Compliance with national and state environmental regulations and international standards is crucial for the effective management of environmental and social aspects. The implementation framework for environmental and social management is identified as a bottleneck in promoting sustainable rural livelihoods through micro-enterprise growth.

Methodology

From an empirical action research perspective, our goal is to gain a comprehensive understanding of the vulnerabilities faced by MFP-dependent communities. This investigation will delve into economic, ecological, and social dimensions, offering deep insights into the specific challenges these communities encounter due to the impacts of climate change on MFPs and livelihood options. Further, this research aims to determine the economic vulnerabilities of MFP-dependent communities. By illuminating the economic risks associated with changing MFP availability, this analysis provides an empirical insight into the economic dimensions of vulnerability. Within an empirical framework, we seek to generate a nuanced map of ecological vulnerabilities using ecological assessments. This mapping visually illustrates the intricate relationships between climate change, MFP availability, and the ecosystems vital to the livelihoods of these communities. In the domain of this research, we develop context-specific climate adaptation strategies with community members. These strategies integrate traditional knowledge with innovative approaches, capturing empirical insights from indigenous knowledge and contemporary adaptation practices.

Discussion:

- *Climate Change, Indigenous knowledge livelihoods, entrepreneurship and circular economy*:

The literature review examines the global perspectives on climate change and circular economy in rural livelihood projects, revealing a critical gap in understanding the role of natural resource-based micro-enterprises in sustainable development and the integration of socio-economic-legal factors in project design. Smith et al. (2020) stated that as global temperatures rise and the frequency of extreme weather events increases, agricultural systems face heightened vulnerability to disruptions, resulting in reduced crop yields and compromised food security for vulnerable populations. In this context, the reliance on Minor Forest Produce (MFP) as a safety net becomes of paramount significance, providing an alternative source of sustenance and income diversification. Allen et al. (2021) observed that the impact of climate change on forest ecosystems extends beyond altered precipitation patterns. Elevated temperatures can lead to the proliferation of pests and diseases, negatively affecting MFP-bearing species and their overall health. Morin et al. (2018) stated that changing climate conditions may influence the phenology of certain plant species, impacting the

timing of their growth, flowering, and fruiting, subsequently affecting the availability of MFPs. The implications for communities facing the impacts of climate change on MFPs are profound. In regions heavily dependent on MFPs for their livelihoods and sustenance, the changing climate introduces new challenges that compound existing vulnerabilities. For these communities, which often have limited alternative income sources, MFPs historically served as a safety net during times of crop failure or economic downturns. However, as climate change disrupts traditional agricultural systems, communities may increasingly rely on MFPs to bridge gaps in food and income security. This situation underscores the urgency of examining the climate effects on MFPs, recognising their potential vulnerability and the need to preserve this critical safety net.

• *Minor Forest Produce (MFP) Sector and trade of the Micro-enterprises, present scenario:*
The harvest and sale of Minor Forest Products (MFPs) play a crucial role in sustaining the livelihoods of 60% of households in Chhattisgarh. This age-old practice among forest fringe and dwelling communities contributes significantly, providing an annual income of approximately Rs. 5000 to Rs. 6000 per household (MoTA, 2017). Since its inception, Chhattisgarh has demonstrated political commitment and implemented programs to promote forest-based livelihoods. Initiatives by the Chhattisgarh Minor Forest Produce Federation, including value addition and MFP sales through Van Dhan Kendras, coupled with the provision of Minimum Support Price (MSP), have aided primary cooperative members and Self-Help Groups (SHGs) in augmenting their income from forest engagements. In the fiscal year 2021-22, the MFP federation facilitated the trade of 0.42 million metric tons of MFPs valued at Rs. 120 crores.[2] Approximately 41.22% of the state's geographical area is covered by forests, primarily consisting of moist deciduous forests with high MFP potential (FSI 2021). Despite the lack of data sources to interpret the impact of state-promoted forest-based livelihood intensification activities on forest cover and biodiversity, there appears to be no significant negative impact, as indicated by the Forest Survey of India (FSI) data. According to FSI data, there was a 0.3% increase in forest area from 2017 to 2021.[3] While the state government is actively working to expand community-based forest governance through the Community Forest Rights Act, it also promotes symbiotic community-forest interaction to enhance the income of micro-enterprises. There is a recognised need for holistic interventions through entrepreneurial engagements across the three production phases (pre-production, production, and post-production). These interventions present economic opportunities in terms of a restoration economy and a green supply-value chain economy. Such initiatives have the potential to generate economic benefits, including income, employment, savings, and dividends, from the responsible consumption and sustainable production of forest products and ecosystem services, benefiting both local communities and global systems. India has demonstrated significant advancements in its Sustainable Development Goals (SDG) journey, as reflected in the consistent improvement of the NITI Aayog SDG India Index & Dashboard score over the years. The positive momentum toward SDG achievement is particularly notable in the nationwide performance in Goal 1 (No Poverty), Goal 3 (Good Health & well-being), Goal 6 (Clean Water and Sanitation), Goal 7 (Affordable and Clean Energy), Goal 11 (Sustainable Cities), and, notably, Goal 13 (Climate Action). Key focus areas for accelerating SDG progress include the elimination of Hunger and malnutrition, strengthening global health through the implementation of a One Health Approach, and ensuring the delivery of quality education.[4]

In the G20 New Delhi Leaders Declaration (2023), “the SDG performance in these priority areas requires concerted and accelerated action. Notably, the score for SDG 2 (Zero Hunger) in 2020 is 47, up from 35 in 2019. However, there is a pressing need to enhance research cooperation on climate-resilient and nutritious grains, such as millets, quinoa, sorghum, and other traditional crops, including rice, wheat, and maise. This emphasis aims to build more sustainable and climate-resilient agriculture and food systems, contributing to the strengthening of global supply chains and the promotion of a fair-trade system aligned with a green future. The actionable interventions are strengthening research cooperation on climate-resilient and nutritious grains, building more sustainable and climate-resilient agriculture and food systems, with a specific focus on soil health, enabling access to affordable, safe, nutritious, and healthy diets, fostering the progressive realisation of the right to adequate food, utilising technology to revolutionise efforts in the fight against malnutrition.” An examination of Chhattisgarh's endeavours to tackle the issues encountered by forest-based micro-enterprises reveals proactive measures taken by the state. These initiatives encompass the declaration of Chhattisgarh as a "Herbal State," initiatives in medicinal plant cultivation, the promotion of non-destructive harvesting, and support for MFP-based industries. However, future efforts should prioritise addressing challenges related to unregulated trade, unsustainable harvesting practices, and the vulnerability of these enterprises to climate impacts. Continuous discourse, deliberation, and examination are essential to explore the role of existing community institutions, minimum support prices (MSP), and community engagement in fostering a circular economy within the design and implementation of micro-enterprise projects, ensuring the long-term sustainability of natural resources. The repercussions of climate change on Chhattisgarh's forests and micro-enterprises underscore the imperative for prompt adaptation measures. It examines how incorporating circular economy principles embedded with Indigenous knowledge and climate resilience delineates precise strategies to alleviate the impacts of shifting temperature and moisture levels on Minor Forest Produce (MFP) production cycles. In-depth research will be conducted to comprehend the qualitative impacts of climate change on communities, accentuating vulnerabilities that micro-enterprises may face.

Conclusion

By integrating principles of sustainable resource management, ecosystem restoration, and capacity-building, these strategies aim to empower communities, enhancing their resilience and minimising the negative impacts of changing MFP availability. We strongly insist on providing practical insights to guide the formulation and implementation of effective climate adaptation measures within MFP-dependent environments for sustainable livelihoods. There is a scope for further research and in-depth Study to delve into the significance of socio-legal, economic, and environmental regulations in fostering rural livelihoods through entrepreneurial activities. The specific objectives include an exploration of sociocultural practices supporting livelihoods in Chhattisgarh, an analysis of government policies related to environmental and social laws, an examination of the roles played by communities and institutions in promoting livelihoods, and the provision of recommendations for an alternative system or guideline based on the Study's findings. Our findings suggest comprehending the challenges posed by socioeconomic and environmental laws in the context of promoting rural livelihoods, shedding light on both successful and problematic practices. There is a methodical need for a thorough analysis of the current state of law implementation and its repercussions on rural livelihoods. The following solutions can be explored to address potential challenges and alleviate the negative impacts of promoting rural livelihoods through micro-enterprises; there is a need to formulate a comprehensive guideline for quick reference to provide a robust framework during the project's preparatory phase, delivering explicit guidance and strategies for managing socioeconomic, legal, and environmental considerations. Advocating active participation of marginalised communities in decision-making processes and integrating socioeconomic, legal, and environmental management planning into village planning. Inclusive approaches can effectively address challenges and ensure sustainable outcomes. Integration of indigenous knowledge held by community institutions, leveraging their expertise and practices for efficient project implementation and management. Initiation of awareness-building campaigns targeting micro-enterprises, entrepreneurs, ecosystems, and community institutions, emphasising the potential socioeconomic, legal, and environmental impacts of livelihood promotion. This will enhance understanding of the importance of accountable practices. Establishment of an accessible and responsive Grievance Redressal Mechanism specifically tailored to address socio-legal, economic, and environmental challenges that may arise during the promotion of rural livelihoods through micro-enterprises. Implementation of regular monitoring and feedback mechanisms that concentrate on socio-legal, economic, and environmental aspects. This approach will facilitate the timely identification of challenges and enable adjustments to ensure sustainable outcomes. Investigation of the Vulnerabilities of MFP-Dependent Communities to Climate Change Impacts: We require an in-depth exploration of the intricate vulnerabilities experienced by communities relying on Minor Forest Products (MFPs), encompassing economic dependence, resource constraints and ecological disruptions arising from evolving climatic conditions. Strengthening Community Resilience through Adaptation Strategies through formulating adaptation strategies aimed at mitigating the adverse effects of varying MFP availability. By examining the potential of diversification, capacity-building initiatives, and ecosystem restoration approaches, this research seeks to delineate practical pathways for enhancing community resilience. The policy measures to support MFP-dependent communities need to be ensured by analysing policy gaps and opportunities to integrate MFP-related considerations into broader climate adaptation and sustainable development frameworks. There is a serious need for interventions in sustainable livelihood practices, prevention of destructive practices, and community engagement in promoting livelihoods through micro-enterprises.

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