INCLUSIVE TECHNOPRENEURSHIP: WOMEN ENTREPRENEURS, SOCIAL INNOVATION, AND GRASSROOTS MSME LINKAGES IN TELANGANA, INDIA

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Abstract
Inclusive techno-preneurship represents a paradigm shift in the way technology-driven entrepreneurship is conceptualized, particularly in developing economies. This paper examines inclusive technopreneurship through three interrelated lenses: the rise of women technopreneurs in rural settings, the emergence of social innovation and impact startups, and the role of Micro, Small, and Medium Enterprise (MSME) linkages and grassroots innovation in Telangana, India. Drawing upon a synthesis of secondary literature, government reports, and empirical case studies from Telangana, the study argues that inclusive technopreneurship is not merely a growth strategy but a socio-economic imperative for equitable development. The paper highlights the structural barriers women entrepreneurs face, including limited access to finance, digital infrastructure, and mentorship, while also documenting transformative models where rural women have leveraged technology to scale agri-enterprises, handloom cooperatives, and health-tech ventures. Social innovation and impact startups are analyzed as vehicles for addressing the last-mile delivery gaps in education, healthcare, and sustainable agriculture. Furthermore, the paper examines how MSME linkages with larger technology ecosystems and government schemes—such as T-Hub, WE-Hub, and TASK in Telangana—have catalysed grassroots innovation at the district and village level. The findings suggest that policy coherence, digital literacy programmes, gender-responsive financing, and ecosystem partnerships are critical enablers of inclusive technopreneurship. The paper concludes with actionable recommendations for policymakers, incubators, and civil society organisations to foster an innovation ecosystem that is equitable, scalable, and rooted in local realities.

***Keywords**: Inclusive technopreneurship, women entrepreneurs, social innovation, MSME linkages, grassroots innovation, Telangana*

1. Introduction

Entrepreneurship has long been celebrated as a driver of economic growth, innovation, and employment. However, conventional narratives of entrepreneurship have predominantly centred on urban, educated, and financially resourced individuals, often excluding rural communities, women, and economically marginalised groups from the innovation ecosystem. The concept of inclusive technopreneurship challenges this exclusion by advocating for technology-enabled entrepreneurship that is accessible, participatory, and transformative for all segments of society.

India, as one of the fastest-growing startup ecosystems globally, presents a compelling yet uneven picture of technopreneurship. While metropolitan hubs like Bengaluru, Hyderabad, and Mumbai have emerged as global innovation centres, the entrepreneurial dividends of this growth have not been uniformly distributed. Rural entrepreneurs, women, and small business owners continue to face systemic barriers that limit their participation in the digital economy. Telangana, one of India's youngest states, offers a particularly interesting case study—having made significant investments in technology infrastructure, incubation, and startup ecosystems through initiatives like T-Hub, WE-Hub, and the Telangana Academy for Skill and Knowledge (TASK), while simultaneously grappling with deep-rooted socio-economic inequalities in its rural districts.

This paper addresses a critical gap in the existing literature by examining inclusive technopreneurship at the intersection of gender, social innovation, and MSME development in Telangana. Specifically, it explores three interconnected sub-themes: (1) the experiences and challenges of women technopreneurs in rural entrepreneurship; (2) the role of social innovation and impact startups in addressing developmental challenges; and (3) the linkages between MSMEs and grassroots innovation ecosystems in the state.

The paper is organised as follows. Section 2 reviews the relevant literature. Sections 3, 4, and 5 analyse each of the three sub-themes in depth. Section 6 presents a discussion of cross-cutting findings. Section 7 concludes with recommendations and directions for future research.

2. Literature Review

2.1 Technopreneurship and Inclusive Growth

Technopreneurship—the convergence of technology and entrepreneurship—has emerged as a critical driver of innovation-led economic development (Bhatt & Bhatt, 2021). Scholars have

increasingly called for a more inclusive conceptualisation of technopreneurship that goes beyond high-growth startups to encompass social enterprises, grassroots innovators, and small-scale digital ventures (Prahalad, 2006; Yunus, 2007). The concept of inclusive innovation, as articulated by Foster and Heeks (2013), emphasises that innovations must target low-income populations, not just as consumers but as co-creators and beneficiaries.

In the Indian context, the National Policy on Skill Development and Entrepreneurship (2015) and the Startup India initiative have created a policy framework that aspires towards inclusivity. However, scholars like Korreck (2019) and Nambiar (2020) have noted that the benefits of these policies have largely accrued to urban, educated populations, leaving behind rural and marginalised entrepreneurs. Inclusive technopreneurship, therefore, demands deliberate policy interventions, ecosystem support, and community-centred approaches.

2.2 Women Technopreneurs and Rural Entrepreneurship

Gender and entrepreneurship is a well-established field of enquiry, yet the specific intersection of women's entrepreneurship with rural technology adoption remains underexplored (Baughn et al., 2006; Kelley et al., 2017). Research consistently demonstrates that women entrepreneurs face disproportionate barriers including limited access to credit, mobility constraints, cultural norms, and lower digital literacy (Datta & Gailey, 2012; IFC, 2020). In rural India, these barriers are compounded by inadequate infrastructure, social conservatism, and lack of access to markets (Srinivasan & Dhaliwal, 2018).

Despite these challenges, a growing body of evidence documents the transformative potential of women-led rural technopreneurship. Self-help groups (SHGs), digital cooperatives, and mobile-based agri-enterprises have demonstrated that rural women can not only adopt but also innovate with technology when provided with appropriate support (Kabeer, 2012; NRLM, 2022). Studies from Telangana and Andhra Pradesh have highlighted the role of SHG federations in enabling women to leverage digital payment platforms, e-commerce portals, and telemedicine services (Pattnaik & Bhatt, 2020).

2.3 Social Innovation and Impact Startups

Social innovation refers to new solutions—products, services, models, or processes—that simultaneously meet social needs and create new social relationships or collaborations (Murray et al., 2010). Impact startups, a subset of social enterprises, deploy technology to address developmental challenges at scale. The global social enterprise movement, catalysed by thinkers like Muhammad Yunus and C.K. Prahalad, has inspired a new generation of entrepreneurs to build ventures that are commercially viable and socially transformative (Prahalad, 2006; Yunus, 2007).

In India, impact startups have emerged across sectors including education technology (EdTech), agricultural technology (AgriTech), healthcare (HealthTech), and clean energy (CleanTech). Organisations like Villgro and Sankalp Forum have championed the growth of impact startups in rural and semi-urban contexts. In Telangana, state-supported incubators and innovation challenges have provided early-stage support for social entrepreneurs, though challenges related to scalability, funding, and talent retention persist (T-Hub Report, 2023).

2.4 MSME Linkages and Grassroots Innovation

Micro, Small, and Medium Enterprises (MSMEs) constitute the backbone of India's economy, contributing approximately 30% of GDP, 45% of exports, and employing over 110 million people (Ministry of MSME, 2023). Despite their economic significance, MSMEs often operate in relative isolation from larger innovation ecosystems, limiting their ability to adopt new technologies and scale operations. Grassroots innovation—innovations developed by local communities using locally available resources—has been identified as a powerful complement to formal R&D, particularly in agriculture, food processing, and handicrafts (Gupta, 2016).

The National Innovation Foundation and the Honey Bee Network, pioneered by Anil Gupta, have documented thousands of grassroots innovations from rural India. However, the challenge of linking these innovations to market opportunities and technology support remains formidable. In Telangana, government-led programmes such as the Telangana State Innovation Cell and cluster development schemes have attempted to bridge this gap, with mixed success (Government of Telangana, 2022).

3. Women Technopreneurs and Rural Entrepreneurship in Telangana

3.1 The Landscape of Women Entrepreneurship

Telangana is home to approximately 3.5 crore women, of whom a significant proportion reside in rural and semi-urban areas. The state's network of Self-Help Groups (SHGs) under the Society for Elimination of Rural Poverty (SERP) and the Sree Nidhi cooperative credit federation has created a robust grassroots financial ecosystem that

underpins women's entrepreneurial activity. As of 2022, Telangana had over 6 lakh SHGs with a combined membership of over 70 lakh women, many of whom have diversified into micro-enterprises spanning dairy, poultry, textiles, food processing, and digital services (SERP, 2022).

WE-Hub, India's first state-led incubator exclusively for women entrepreneurs, was established in Hyderabad in 2018. It has incubated over 3,000 women-led startups and enterprises across technology, social enterprise, and manufacturing sectors. WE-Hub's programmes—including pre-incubation, incubation, acceleration, and market linkage support—have provided critical scaffolding for women entrepreneurs who lack access to mainstream venture capital and mentorship networks (WE-Hub Annual Report, 2023).

3.2 Barriers and Challenges

Notwithstanding these enabling structures, women technopreneurs in rural Telangana continue to face significant barriers. Digital literacy remains a critical constraint—while mobile phone penetration has increased substantially, studies indicate that rural women are less likely than men to own smartphones or access the internet independently (TRAI, 2022). Cultural norms around women's mobility and autonomy limit their ability to attend training programmes, participate in markets, or travel for business development.

Access to formal credit remains another persistent challenge. Although Stree Nidhi and SERP provide microfinance, larger loans for technology investment—servers, equipment, software—are often inaccessible to rural women entrepreneurs without collateral. The gender credit gap in India is estimated at USD 158 billion, disproportionately affecting rural and semi-urban women (IFC, 2020). Additionally, the social reproductive burden—household labour, childcare, elder care—limits the time rural women can devote to their enterprises.

3.3 Transformative Models and Success Stories

Despite these barriers, several transformative models have emerged from Telangana that demonstrate the potential of women-led rural technopreneurship. The Pochampally IKAT Art Park, supported by the state government and NABARD, has leveraged e-commerce platforms to connect women weavers in Nalgonda and Suryapet districts directly with urban and global consumers, eliminating intermediaries and increasing weaver incomes by up to 40% (NABARD, 2022). Women SHG federations in Warangal and Karimnagar have adopted digital inventory management and online payments, significantly reducing operational inefficiencies.

In the AgriTech domain, women farmers in Nalgonda district have benefited from the integration of soil health monitoring apps and weather advisory services into SHG-linked agri-enterprises. The Rythu Bandhu and Rythu Bima schemes, while not exclusively targeted at women, have provided a financial safety net that has enabled women farmers to take measured entrepreneurial risks. These examples illustrate that inclusive technopreneurship for rural women requires not just technology access but an enabling ecosystem of finance, infrastructure, and social support.

4. Social Innovation and Impact Startups in Telangana

4.1 The Social Enterprise Ecosystem

Telangana's startup ecosystem, anchored by T-Hub—Asia's largest startup incubator—has progressively expanded its focus from pure-play technology startups to social innovation and impact ventures. As of 2023, T-Hub hosts over 400 active startups, of which approximately 15-20% operate in social sectors including rural healthcare, agricultural technology, education, and clean energy (T-Hub, 2023). The state government's proactive policy environment, including the Telangana IT Policy 2021-2026 and the Emerging Technology Policy, has created a conducive regulatory framework for impact-oriented ventures.

Impact startups in Telangana are addressing a diverse range of developmental challenges. In healthcare, ventures like Niramai Health Analytix (breast cancer detection using AI) and Swasth Digital Health have pioneered low-cost diagnostic solutions for rural populations. In education, platforms targeting first-generation learners in tribal and rural areas have gained traction, leveraging vernacular language content and offline-capable applications to overcome connectivity barriers. In agriculture, startups working on precision farming, micro-irrigation, and supply chain transparency have established partnerships with Telangana's farmer producer organisations (FPOs) and the state's e-market platforms.

4.2 Social Innovation as a Response to Development Gaps

Social innovation in Telangana has been particularly impactful in addressing what development scholars term 'last-mile' challenges—the difficulty of delivering services and opportunities to the most marginalised communities. The state's tribal populations in

districts like Bhadradri Kothagudem, and Jayashankar Bhupalpally face acute deprivation in healthcare, education, and livelihoods. Social enterprises working in these areas have developed innovative delivery models that combine community health workers, mobile health units, and digital diagnostic tools to extend healthcare coverage.

The COVID-19 pandemic served as an unexpected catalyst for social innovation in Telangana. The crisis accelerated the adoption of telemedicine, digital payments, and e-commerce among rural and peri-urban populations, creating new market opportunities for impact startups. Several ventures that had struggled to achieve market penetration before the pandemic reported significant user growth during 2020-2022, underscoring the role of necessity-driven innovation in unlocking latent demand.

4.3 Challenges of Scale and Sustainability

Despite these successes, impact startups in Telangana face persistent challenges of scale and financial sustainability. Impact investing remains nascent in India, and the relatively small ticket sizes characteristic of social enterprises often make them unattractive to mainstream venture capital. Grant funding from philanthropic foundations and government schemes provides initial support but is insufficient for scale-up. The tension between social mission and commercial viability—often described as the 'double bottom line' dilemma—requires impact startups to develop hybrid revenue models that balance earned income with grant and impact investment.

Talent retention is another significant challenge. Hyderabad's thriving tech sector offers attractive compensation packages that make it difficult for impact startups to compete for skilled talent. This talent gap is particularly acute in specialized domains such as AI, data science, and product management, which are increasingly critical for social innovation ventures. Addressing these challenges requires sustained policy attention, ecosystem partnerships, and the development of a robust impact investment market.

5. MSME Linkages and Grassroots Innovation in Telangana

5.1 The MSME Landscape in Telangana

Telangana is home to over 7 lakh registered MSMEs, employing approximately 40 lakh workers across sectors including pharmaceuticals, textiles, food processing, engineering, and information technology (MSME Development Institute, Hyderabad, 2022). The state's MSME sector is characterised by a dual structure—a relatively advanced pharmaceutical and IT-ITES cluster in Hyderabad and Rangareddy districts, and a predominantly traditional, low-technology artisan and agro-processing base in rural districts. This structural duality presents both a challenge and an opportunity for inclusive technopreneurship.

The Government of Telangana has implemented several schemes to support MSME development, including the TS-iPASS (single-window clearance), the Industrial Promotion Policy, and district-level cluster development programmes for key sectors such as Nirmala furniture, Warangal carpets, Etikoppaka lacquerware, and Karimnagar silverware. These clusters represent concentrations of artisanal MSMEs with deep local knowledge and craft traditions—precisely the kind of grassroots innovation assets that, if linked to technology and market ecosystems, could drive inclusive growth.

5.2 Grassroots Innovation: Assets and Gaps

Grassroots innovation in Telangana encompasses a rich diversity of local knowledge systems, traditional technologies, and community-based problem-solving practices. Farmers in the Telangana region have developed indigenous seed varieties, pest management techniques, and water conservation methods adapted to the specific agro-ecological conditions of the Deccan plateau. Artisans in craft clusters have innovated with natural dyes, weaving techniques, and material combinations that constitute valuable intellectual and cultural assets.

However, these grassroots innovations remain largely disconnected from formal innovation systems, intellectual property frameworks, and market linkages. Gupta (2016) has argued that the 'honey bee' model of linking grassroots innovators with technology institutions, markets, and policy frameworks is essential for translating local knowledge into economic value. In Telangana, this linkage function has been partially fulfilled by institutions such as the National Institute of Rural Development and Panchayati Raj (NIRD&PR) in Hyderabad, which conducts research and capacity building on rural innovation and development.

5.3 Technology Adoption and Digital Transformation in MSMEs

The digital transformation of MSMEs is a critical component of inclusive technopreneurship. Government programmes such as the Udyam Registration Portal, the GeM (Government e-Marketplace) platform, and the MSME Technology Centres have provided MSMEs with access to digital infrastructure and market opportunities. In Telangana, the TASK initiative has provided digital

skills training to over 5 lakh individuals, many of whom are employed in MSMEs or have used these skills to establish micro-enterprises.

Despite these efforts, technology adoption among rural MSMEs in Telangana remains limited. A survey conducted by the Telangana State Innovation Cell in 2022 found that only 23% of rural MSMEs had adopted digital payment systems, and fewer than 15% were utilising e-commerce platforms for sales. Barriers to technology adoption include cost, lack of awareness, inadequate internet connectivity, and limited technical support. Addressing these barriers requires a combination of infrastructure investment, digital literacy programmes, and context-appropriate technology solutions.

5.4 Ecosystem Linkages: T-Hub, WE-Hub, and Industry Partnerships

The integration of MSMEs and grassroots innovators into Telangana's broader innovation ecosystem is a work in progress. T-Hub's corporate innovation programmes and WE-Hub's industry partnership initiatives have created platforms for MSME-startup collaboration, though the scale of these linkages remains modest relative to the size of the MSME sector. Large corporations such as Microsoft, Google, and Amazon Web Services have established presence in Hyderabad and have initiated programmes supporting MSME digitalisation and startup mentorship, but these efforts have largely been concentrated in the city and its immediate periphery.

A more promising model is emerging through Farmer Producer Organisations (FPOs) and MSME clusters that are partnering with AgriTech and food-tech startups to develop integrated value chains. In the turmeric cluster of Nizamabad and the cotton textile cluster of Sircilla, FPO-startup partnerships have enabled digital quality grading, direct-to-consumer marketing, and supply chain traceability, improving both farmer incomes and enterprise competitiveness. These models, while nascent, suggest a pathway for inclusive technopreneurship that bridges the urban-rural divide.

6. Discussion: Towards an Inclusive Technopreneurship Ecosystem

The foregoing analysis reveals several cross-cutting themes that are critical for understanding and advancing inclusive technopreneurship in Telangana and beyond.

First, the importance of place-based approaches is evident across all three sub-themes. Generic startup policies designed for urban tech entrepreneurs are ill-suited to the realities of rural women entrepreneurs, grassroots innovators, and MSME clusters. Effective inclusive technopreneurship policy must be rooted in local context, sensitive to socio-cultural dynamics, and responsive to the specific market failures and institutional gaps that characterise different regional and sectoral settings.

Second, the centrality of ecosystem thinking is underscored by the evidence. Individual women entrepreneurs, social startups, and MSMEs do not operate in isolation—they are embedded in networks of relationships with suppliers, customers, financiers, mentors, regulators, and community organisations. The strength and inclusivity of these networks largely determines entrepreneurial outcomes. Building inclusive technopreneurship ecosystems, therefore, requires deliberate efforts to strengthen the connective tissue between actors—through platforms, intermediaries, and collective action.

Third, the evidence highlights the pivotal role of the state as an enabler and market shaper. Telangana's experience demonstrates that proactive state investment in innovation infrastructure (T-Hub, WE-Hub, TASK), supportive regulatory frameworks, and demand-side interventions (government procurement from MSMEs, SHG market linkage programmes) can significantly expand the frontier of inclusive technopreneurship. At the same time, the state must be careful not to crowd out private initiative or perpetuate dependency relationships.

Fourth, the analysis reveals significant gender gaps in technopreneurship that persist despite policy attention. Addressing these gaps requires not only gender-targeted programmes but also systemic changes in financial systems, digital infrastructure, and social norms. Male allyship, family support, and community sensitisation are as important as formal policy interventions in creating an enabling environment for women technopreneurs.

7. Conclusion and Recommendations

This paper has examined inclusive technopreneurship in Telangana through the lenses of women entrepreneurship in rural settings, social innovation and impact startups, and MSME linkages and grassroots innovation. The analysis demonstrates that while Telangana has made commendable progress in building innovation infrastructure and creating enabling policies, significant challenges remain in ensuring that the benefits of technopreneurship are equitably distributed across gender, geography, and economic class.

Based on the findings, the following recommendations are offered for policymakers, incubators, development organisations, and the private sector:

First, policymakers should strengthen gender-responsive financing by designing credit guarantee schemes, patient capital instruments, and blended finance models specifically tailored to the needs of women-led rural enterprises and social startups. The Stree Nidhi model could be scaled up and diversified to support larger investment needs beyond microfinance.

Second, digital infrastructure investment must be prioritised in rural and tribal districts of Telangana. Universal broadband connectivity, affordable devices, and digital literacy programmes—particularly for women and older entrepreneurs—are foundational prerequisites for inclusive technopreneurship.

Third, ecosystem intermediaries—incubators, accelerators, district-level innovation centres—should actively pursue outreach and inclusion strategies that bring rural entrepreneurs, women innovators, and grassroots MSME clusters into the formal innovation ecosystem. This requires satellite incubation facilities in district headquarters, vernacular language support, and culturally appropriate mentorship programmes.

Fourth, industry-MSME and startup-MSME partnerships should be incentivised through tax benefits, procurement preferences, and co-innovation grants. These linkages can accelerate technology adoption among MSMEs while providing startups with market access, domain knowledge, and social legitimacy.

Fifth, grassroots intellectual property must be systematically documented, protected, and valorised through geographical indications, traditional knowledge registers, and community IP frameworks. This will enable artisans and grassroots innovators to capture fair value from their innovations.

Inclusive technopreneurship is not a utopian vision—it is an achievable goal when technology, entrepreneurship, and social equity are pursued in concert. Telangana, with its vibrant innovation ecosystem and commitment to social development, is well-positioned to be a national and global exemplar of inclusive technopreneurship. Future research should focus on longitudinal studies of MSME technology adoption, gender-disaggregated impact assessments of startup support programmes, and comparative analysis of grassroots innovation models across Indian states.

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