Firms, trade, and productivity

IGC INDIA EVIDENCE PAPER

India's growth depends on dynamic firms, but MSMEs face persistent barriers like informality, poor infrastructure, and limited access to finance and skills.

- Climate risks—heat, floods, and pollution—are already reducing productivity, especially in informal and labour-intensive sectors.
- Green industrialisation offers opportunities for competitiveness and resilience, but MSMEs need targeted support to participate.
- Better management, technology adoption, and access to quality inputs are key to firm upgrading but remain unevenly distributed.
- Severe skill mismatches and high informality in labour markets hinder productivity, with over 90% of the workforce in informal jobs and limited access to effective vocational training.

This paper calls for evidence-based reforms to address structural constraints and align productivity, inclusion, and sustainability goals.

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Introduction

India's economic trajectory since liberalisation has combined significant achievements with persistent structural challenges. The 1991 reforms ushered in a period of market-led growth fuelled by services, rising consumption, and macroeconomic stability. Between 1991 and 2020, GDP grew at over 6% annually, led by sectors such as IT and finance. However, beneath this headline growth lie deeper issues: manufacturing has stagnated, private investment remains subdued, and employment creation has not kept pace with demographic needs.

Today, India's growth model leans heavily on services, which account for over 53% of gross value added (GVA)—a high share for a lower-middle-income country. Meanwhile, the manufacturing sector—typically a driver of productivity and job creation in developing economies—has struggled. Industrial policies like Make in India have not substantially shifted sectoral composition or driven labour absorption at scale. At the same time, agriculture, which still employs over 40% of the workforce, remains characterised by low productivity. Inequality persists: the top 10% of earners command more than 57% of national income, and social disparities by caste, gender, and geography limit the inclusiveness of growth.

To sustain momentum and achieve middle-income aspirations, India must generate over ten million jobs annually, improve infrastructure and human capital, and adapt to rising climate risks. At the centre of this transformation lie firms—as creators of jobs, engines of productivity, and enablers of structural change.

Across the world, dynamic firms have underpinned national development: from Toyota and Sony in Japan to Samsung in South Korea and Huawei in China, industrial champions have driven upgrading and competitiveness. These firms benefited from state support, access to finance, skilled labour, and long-term investments in innovation. By contrast, economies where firms remain small, informal, and undercapitalised—like much of India's enterprise landscape—face slow productivity growth and limited job creation.

In India, MSMEs account for 30% of GDP and employ over 110 million people, yet they face binding constraints: limited finance, poor infrastructure, weak management, and regulatory burdens. Many MSMEs struggle to formalise, scale, or adopt modern technologies. India risks a growth slowdown without a dynamic private sector, even as macroeconomic conditions remain broadly stable.

India's GDP has grown at an average of 6.5% in recent years, but this does not mark a structural acceleration. Concerns over sluggish private investment persist—especially in sectors that can drive long-term productivity. Unlocking a new growth phase will require reforms that formalise enterprises, boost skilling and female labour force participation, and strengthen public institutions. The digital public infrastructure (for example, Aadhaar, UPI), financial inclusion, and growing green economy offer important building blocks.

Climate change adds a new urgency. Indian firms are both contributors to and victims of environmental degradation. Industrial sectors like manufacturing and logistics account for over 30% of final energy consumption, much of it fossil-based. At the same time, climate risks are rising: nearly 75% of Indian districts are vulnerable to extreme events—heatwaves, floods, droughts—that affect workers, supply chains, and infrastructure. These shocks threaten to amplify poverty and deepen regional disparities.

Green industrialisation offers a path to reconcile these tensions. Firms that adopt low-carbon technologies tend to become more efficient, attract ESG-aligned capital, and are more resilient to volatility. India's growing electric mobility and clean energy sectors offer opportunities to build new ecosystems—from battery manufacturing to hydrogen infrastructure. According to NITI Aayog, widespread adoption of electric vehicles could reduce emissions by over a gigatonne and generate energy savings worth INR 15 lakh crore by 2030.

Global markets are increasingly tying access to sustainability. The EU's Carbon Border Adjustment Mechanism (CBAM), ESG-linked finance norms, and net-zero commitments are reshaping trade and investment. Indian exporters that fail to decarbonise risk exclusion from global supply chains. Investors are also shifting: a growing share of institutional capital favours firms with credible sustainability pathways.

Despite this momentum, challenges abound. India's R&D expenditure remains below 0.7% of GDP. MSMEs, especially informal ones, face barriers to accessing clean technologies due to high costs and limited awareness. Larger firms may lead decarbonisation, but ecosystem-wide change requires broader institutional support.

Policy is moving. India's Production Linked Incentive (PLI) schemes, the National Hydrogen Mission, and the development of voluntary carbon markets signal a shift toward a green industrial strategy. However, these efforts need to be supported by deeper reforms: improving land and energy access, upgrading worker skills, streamlining regulation, and enhancing urban infrastructure. Lessons from Germany's green *Mittelstand* or South Korea's Green New Deal offer useful models of transition grounded in SME competitiveness and state-

industry collaboration. In India, embedding climate goals within industrial policy can help avoid the traditional trade-offs between growth and the environment.

Firms are not just units of production—they are vehicles for employment, technology adoption, and economic resilience. Building dynamic, competitive, and green firms is essential for India's future, not only as a response to climate change but also to secure long-term prosperity, reduce inequality, and enhance global competitiveness.

Research and policy must now converge on identifying where and how evidence can shape firm growth in India, understanding barriers to green technology adoption, evaluating the impact of climate policies on MSMEs, and mapping how industrial and trade policy can align with sustainability goals. India's development will be measured not just by the speed of its growth but by how inclusive, resilient, and sustainable that growth proves to be. Drawing on the International Growth Centre's Evidence Paper on Firms, Trade, and Productivity (Atkin et al., 2024), this synthesis paper explores the key opportunities in India where academic evidence generation could most effectively inform policy and firm-level strategies that align productivity, employment, and environmental sustainability goals.

Climate stressors and firm productivity

I. Heat stress and labour productivity

Occupational heat stress is an escalating challenge in India, particularly in labour-intensive sectors such as construction, agriculture, and manufacturing. As temperatures rise due to climate change, workers face declining productivity, increased absenteeism, and serious health risks. Vulnerable groups—such as informal workers, women, and older people—are disproportionately affected.

Evidence from across India shows widespread impacts. Venugopal et al. (2016) found that 62% of surveyed workers reported reduced productivity due to heat, 30% experienced absenteeism, and 25% reported wage losses linked to heat-related fatigue or illness. Han et al. (2024) highlight that 60% of construction workers experienced productivity declines on hotter days, with older workers and women most affected. Globally, productivity losses from heat already stand at 10%, with projections suggesting this could rise to 30–40% by 2100 under high-emissions scenarios (ILO, 2019).

In India, heat stress has also been linked to broader economic outcomes. Somanathan et al. (2021) show that high temperatures reduce manufacturing output via lower worker productivity and higher absenteeism—effects observed

at the firm level and in aggregate economic data. Gupta and Somanathan (n.d.) further show that workers without access to cooling are significantly more likely to miss work during extreme heat, emphasising the role of basic environmental protections.

The risks are particularly acute for informal workers. For example, among female brick kiln workers, productivity falls by 2% for every 1°C rise above 35°C. The National Resources Defense Council (NRDC) has called for stronger safeguards for outdoor labourers, including health monitoring, cooling shelters, and heat insurance.

Mitigation will require a multi-pronged approach: engineering solutions (for example, ventilation, shaded worksites), administrative changes (for example, adjusted work hours), and increased access to protective gear and healthcare. However, uptake remains limited and uneven.

Future research could evaluate the cost-effectiveness of heat adaptation strategies and their impact on firm performance. There is a need to understand behavioural responses to heat exposure, particularly among informal and migrant workers, and to assess gender-differentiated impacts. Evidence on how public interventions—such as heat action plans, targeted insurance, or climate-resilient infrastructure—can reduce productivity losses and health risks will be critical for designing equitable adaptation strategies across sectors and regions.

II. Climate shocks to micro, small, and medium enterprises (MSMEs)

Floods and extreme weather events are becoming more frequent and intense across several Indian states, including Kerala, Assam, Tamil Nadu, and Odisha. These climate-related shocks present major risks for Micro, Small, and Medium Enterprises (MSMEs), disrupting supply chains, affecting firm entry and survival, and testing the adequacy of financial tools like insurance in supporting recovery.

The 2015 South India floods provide a stark illustration of MSME vulnerability. In Tamil Nadu, over 20,000 small and medium industrial units reported significant losses. According to the Confederation of Indian Industry (CII), MSMEs in industrial clusters around Chennai, Cuddalore, Thiruvallur, and Tuticorin suffered near-total damages to property and operations. These disruptions halted production and triggered cascading effects across supply chains, including price spikes in essential commodities and widespread economic losses.

Insurance—a potentially critical instrument for recovery—remains underutilised. The World Bank notes that in flood-prone regions of India, insurers may refuse

coverage or impose unaffordable premiums, leaving firms financially exposed[1]. Despite initiatives like the Pradhan Mantri Fasal Bima Yojana (PMFBY), insurance penetration remains limited, particularly among MSMEs.

The longer-term consequences of such disasters can be severe. Fatica et al. (2024), in a study of European firms, found that flood-induced water damage led to an average 2% loss in assets and a 4.5% drop in sales in the year following the event. Employment also declined, with little evidence of medium-term recovery. Firms with higher debt burdens or greater exposure were likelier to close, highlighting the compounding risks for financially fragile businesses.

In India, the economic cost of natural catastrophes is rising rapidly. The Swiss Re Institute estimated that such events caused USD 12 billion in economic losses in 2023 alone—well above the USD 8 billion annual average over the past decade[2]. Despite this, there is still a gap in tailored insurance products and risk-sharing mechanisms suited to the needs of small firms.

Organisational resilience remains key. A Skouloudis et al. (2020) review emphasises the importance of strategic approaches—such as risk assessment, emergency preparedness, and adaptive capacity building—in bolstering SME resilience to flash floods. Integrating disaster risk reduction into business models can mitigate the long-term impacts of extreme events.

Given the increasing frequency and severity of floods and cyclones, urgent attention is needed to strengthen the resilience of Indian MSMEs. Strengthening resilience requires a mix of policy and market-based solutions: expanding access to insurance and financial instruments, integrating climate risk into urban and industrial planning, and incentivising investment in climate-resilient infrastructure.

India needs further research to identify scalable, cost-effective strategies that protect MSMEs from climate shocks. Priorities include assessing the impact of targeted adaptation subsidies, understanding why firms underutilise available insurance, and evaluating the role of local governments and business associations in post-disaster recovery.

III. Understanding and mitigating impacts of air pollution on productivity

Air pollution is emerging as a significant and under-recognised constraint on labour productivity in India. Recent evidence suggests that cognitive and

[1] Financial Resilience against Climate Shocks and Disasters: World Bank April 2023
[2] Swiss Re Institute January 2025: India's economy and insurance market: growing rapidly, but mind the risk hot spots

physical performance are adversely affected even at pollutant levels considered acceptable by existing standards.

Batheja et al. (2023) analysed worker performance in Indian call centres and found that increased concentrations of PM2.5, carbon monoxide (CO), and ozone (O_3) led to substantial reductions in productivity. A one standard deviation increase in PM2.5, CO, and O_3 was associated with productivity declines of 11.8%, 10.8%, and 6.0%, respectively. Strikingly, CO concentrations below the World Health Organization's recommended thresholds still accounted for over half of the observed productivity losses, underscoring workers' vulnerability to even moderate pollution levels[3].

Similarly, Hill et al. (2024) document how exposure to air pollution and extreme heat negatively impacts agricultural workers. Their findings point to broader economic implications regarding worker health and earnings, increased farm payroll costs, and reduced agricultural output[4].

These studies emphasise the need for integrated policy responses that recognise the cumulative effects of air pollution and heat stress on labour productivity. Strengthening ambient air quality regulations—particularly for PM2.5 and CO—is critical, even where pollutant levels currently fall within "safe" limits. Regulatory improvements must be accompanied by workplace-level interventions such as improved indoor air filtration, access to clean energy alternatives, and incorporation of environmental risk assessments into occupational health standards.

As air quality continues to deteriorate in many Indian cities and rural belts, protecting labour productivity will require tighter environmental regulation and greater investment in workplace resilience. These steps are essential not just for public health but also for sustaining economic growth in the face of worsening environmental stressors.

This area presents significant opportunities for further research. Key gaps include understanding sector-specific impacts of pollution on productivity, quantifying long-term effects on earnings and firm performance, and evaluating the cost-effectiveness of mitigation strategies such as filtration technologies or green infrastructure. Research could also explore how workers adapt behaviourally or physiologically to sustained exposure and how these responses differ across genders, income groups, and occupations. Identifying the most vulnerable workers and firms would help policymakers design more targeted subsidies, health protections, and public awareness campaigns. This

[3] Batheja, A., et al. (2023) More than particulate matters: Pollution and productivity in Indian call centers
[4] Hill et al. (2023) Air pollution, weather, and agricultural worker productivity

area also requires investments in stronger and more comprehensive datasets that track key indicators of indoor and outdoor air pollution exposure—enabling researchers to identify causal pathways better, monitor real-time risks, and assess the cumulative impact of air quality on productivity and wellbeing.

Constraints to firm upgrading in India

I. Barriers to firms upgrading: Demand, inputs and know-how

Several barriers hinder firm upgrading, innovation, and global competitiveness in developing economies (Atkin et al., 2024). A central challenge is limited market demand, particularly the lack of access to wealthier consumer markets or integration into global value chains, which reduces the incentive for firms to improve quality. In addition, restricted access to high-quality inputs due to import barriers or cost-related challenges hampers firms' ability to innovate and enhance productivity.

Another significant obstacle is the deficiency of managerial and technical know-how. Many firms lack the skills necessary for effective process improvements or product innovation. Organisational challenges, such as inefficient management structures, internal resistance to change, and misaligned employee incentives, compound this problem and slow the adoption of advanced technologies or practices.

The underdevelopment of consulting and training markets further weakens the support system for firms seeking to upgrade. While skilled consultants and managers may be available, their services are often costly and slow to be absorbed into firm operations. Moreover, government policy interventions, though well-intentioned, frequently fall short due to poor design, limited funding, or weak monitoring and evaluation mechanisms.

Finally, measurement issues complicate efforts to track and support firm upgrading. Many studies rely on indirect metrics like Total Factor Productivity (TFP), which may not capture the nuances of technological adoption or product quality improvements. There is a growing need for research on and analysis of more direct and reliable indicators to assess firm progress better and inform policy design.

II. Management practices and firm performance

A growing body of empirical evidence links better management practices to improved firm performance, including productivity, quality control, and energy efficiency. Bloom et al. (2013), in a landmark randomised field experiment on

large Indian textile firms, introduced 38 standardised managerial practices across five domains—factory operations, inventory, quality control, HR, and order tracking. The firms that adopted these practices saw substantial gains: higher productivity, lower inventory and defect rates, improved data use, and long-term expansion. Importantly, the main constraint was not cost but lack of information—highlighting the role of knowledge diffusion.

In the U.S. context, Bloom et al. (2019) show that a striking 40% of the variation in management quality occurs within firms, across plants of the same company. This plant-level variation strongly correlates with performance indicators like profitability, innovation, and survival—even after controlling for firm-wide characteristics. The findings emphasise the importance of localised factors in shaping managerial effectiveness.

Management practices also affect environmental outcomes. Bloom et al. (2010) found that in the UK, better-managed firms are more energy efficient, consuming less energy for the same output. This correlation persists after controlling for industry, size, and technology, suggesting that energy efficiency may be a byproduct of sound organisational practices—though causality remains to be established.

Moreover, management quality has direct implications for export success. Manova et al. (2021) find that better-managed firms are significantly more likely to export, enter more markets, and offer higher-quality products. The study, spanning data from China and the U.S. and field evidence from India, highlights that management explains more of the variation in export success than traditional productivity measures.

For India, this presents a compelling policy avenue—investing in managerial upgrading can enable firms to access high-quality international markets, meet regulatory and consumer expectations abroad, and improve their chances of long-term success in global value chains.

III. Technology diffusion and adoption

Technology diffusion from developed to developing countries—particularly through North-South trade—is far more complex than a simple knowledge transfer. As Rieber and Tran (2002), David Dollar (1986), and Schiff and Wang (2008) emphasise, this process is often hindered by deep structural frictions, institutional weaknesses, and unequal absorptive capacities that limit the extent to which developing economies can benefit from global technological advances.

At the core of this challenge is the recognition that technological progress in developing countries is deeply dependent on innovations originating in high-income countries. However, the benefits of this innovation can only materialise

if developing countries have the absorptive capacity to internalise and apply foreign technologies. Absorptive capacity is not just about knowledge—it hinges on the availability of critical infrastructure, a skilled workforce, and strong institutions. Developing countries' continued technological edge is sustained by localised learning ecosystems, network effects, and the high fixed costs of industrial innovation, which are not easily replicated in less developed contexts.

Crucially, technology does not simply "trickle down." Its diffusion depends on multiple enabling factors: cost and capital differentials between developed and developing countries, openness to trade and investment, and—most importantly— developing countries' ability to adopt and adapt these technologies. Technological spillovers remain incomplete or ineffective without deliberate domestic efforts to create learning environments—through robust education systems, industrial clusters, and indigenous capability-building. In this light, trade liberalisation alone is inadequate. It must be accompanied by targeted policies that cultivate the capacity to absorb and deploy imported know-how.

Schiff and Wang (2008) lend empirical weight to these insights, demonstrating that while both North-South and South-South R&D trade flows contribute to productivity growth in developing countries, the gains from North-South flows are significantly higher—particularly when countries possess higher levels of human capital. Their findings underscore the central role of education in enabling technology absorption. Although foreign direct investment (FDI) and trade openness are positively linked to productivity, their impact pales compared to the embodied knowledge in high-quality imports.

In sum, technology diffusion is not an automatic dividend of globalisation. It is a complex, mediated process that demands supportive domestic conditions. Harnessing its full potential requires more than just openness—it calls for a strategic policy agenda centred on learning, institutional reform, and long-term investments in absorptive capacity. Only then can developing economies escape the low-productivity trap and move toward sustained technological upgrading.

Factor market constraints

I. Labour: Skill mismatch and informality

India's firms face acute labour market constraints that significantly impede productivity and growth. Despite having one of the world's youngest workforces, a deep skills mismatch persists between what the education system supplies and what employers need. Formal vocational education remains limited, with only a small proportion of youth accessing structured, job-relevant training.

Even graduates from engineering and technical programs are frequently found unemployable due to outdated curricula, weak industry linkages, undertrained instructors, and a lack of soft skills such as communication, problem-solving, and adaptability.

Structural inequalities—by caste, gender, and geography—exacerbate these challenges, creating uneven access to training and employment opportunities. According to Fernando et al. (2023), 69% of surveyed firms identified labour-related issues as the primary impediment to growth, citing a shortage of skilled workers and complex, often burdensome, labour regulations. With over 90% of India's workforce engaged in informal employment, most workers lack access to structured training, stable career progression, or legal protections.

Hiring in such an environment is fraught with friction. Firms often rely on informal networks for recruitment, narrowing their talent pool and reinforcing existing social biases. High search and onboarding costs deter firms—particularly SMEs—from experimenting with new recruitment approaches. On the jobseeker side, limited access to accurate market information, financial constraints, and overly optimistic beliefs about job prospects hinder efficient job matching. These demand- and supply-side frictions result in low match quality, high turnover, and underutilisation of talent—ultimately curbing firm-level innovation and scale.

In response, India has introduced a range of skilling programs. The Pradhan Mantri Kaushal Vikas Yojana (PMKVY) offers sector-specific training to enhance employability. Industrial Training Institutes (ITIs) run over 130 trade-specific courses, and the Dual System of Training (DST)—such as the GITI–Tata Motors collaboration—blends classroom instruction with hands-on industry exposure.

As India transitions to a greener economy, demand for new skill sets rises. The Skill Council for Green Jobs (SCGJ) and the Green Skill Development Programme (GSDP) offer training in renewable energy, waste management, and biodiversity conservation to align workforce development with sustainability goals. However, supply still lags far behind. A 2024 Reuters report noted that India faces a shortfall of 1.2 million skilled workers in the clean energy sector—expected to grow to 1.7 million by 2027. Despite producing over a million engineering graduates annually, few have relevant knowledge of renewable technologies. Attrition in the sector remains high—up to 20%—raising costs and delaying project execution. Private actors like Tata Power are investing in workforce training, but these efforts are piecemeal.

Despite India's heavy investment in skilling initiatives, significant questions remain about their effectiveness and scalability. Research is needed to identify which vocational training and apprenticeship models—particularly those

embedded in informal labour markets—lead to sustained employment and productivity gains. Studies evaluating the long-term impact of industry-led skilling programs are limited. Further work could explore how social networks in hiring affect match quality, how labour regulation reforms influence hiring and retention practices, and what mechanisms reduce attrition in green sectors. A deeper understanding of labour market frictions, especially among SMEs and informal firms, could inform better-targeted policy design for India's evolving workforce.

II. Financing gaps and credit access

Studies have consistently shown that limited access to finance impedes MSME growth. Choudhury and Goswami (2019) and Kabir and Mansouri (2021) find that financial constraints are the most prominent barrier to MSME growth, especially in developing countries like India. While institutional finance is crucial for the sector's development, MSMEs largely depend on informal sources due to difficulties meeting the stringent requirements of banks and financial institutions. Challenges include lack of collateral, complex procedures, credit information asymmetry, and high-risk perception by lenders. Financial constraints also prevent firms from investing in high-quality physical capital, reducing productivity. The literature also highlights that government schemes have had mixed results, and significant financing gaps persist—especially for unregistered and informal MSMEs, which are under-researched. The study emphasises that improvements in legal frameworks, competitiveness, credit policy, and information infrastructure are critical to improving credit flow. An IMF study[5] found that MSMEs with better access to financial services tend to engage more in export markets and exhibit improved business performance.

Kulkarni et al. (2023) show that increasing the branch presence of private banks significantly improves credit access and investment in underserved areas, especially for young and small firms. Notably, lending rates remained largely unchanged, implying that quantity constraints—rather than cost—are the main bottleneck. Alternative sources of capital, such as **equity-based financing**, have been highlighted by the IFC to reduce risk exposure and support firm growth without increasing debt burdens [6]

Although the barriers to MSME finance are well-documented, gaps persist in understanding which financial instruments are most appropriate for different firm types and growth stages. More evidence is needed on the effectiveness of digital lending models, alternative credit scoring, and fintech platforms in expanding access without increasing default risks. The reasons behind the limited uptake of public schemes remain underexplored. Empirical studies could also examine how improved credit access affects firms' ability to adopt new technologies, engage in export markets, or invest in low-carbon solutions. The

role of equity-based finance, particularly in reducing risk exposure for early-stage firms, remains under-studied in the Indian context.

III. Land market frictions and industrial constraints

Land remains a fundamental constraint to firm growth in India, especially for manufacturing enterprises. Unclear land titles, rigid land-use regulations, fragmented holdings, and dysfunctional rental markets raise transaction costs and discourage investment. Mehta (2022) finds that in land-intensive sectors, firms in states with greater land fragmentation see output and employment growth fall by 11.8 and 9.9 percentage points, respectively. Younger and privately-owned firms are especially affected, while public enterprises and incumbents are shielded by bureaucratic familiarity and access to administrative channels. Furthermore, younger and privately-owned manufacturing firms are particularly vulnerable to land market frictions. Older firms and public sector enterprises appear less affected, likely due to established relationships with local authorities and easier access to bureaucratic processes. The adverse effects also extend to labour productivity and firm entry rates, signalling both intensive and extensive margins of impact.

Importantly, the study traces these effects to specific land market frictions—namely poor land records and weak land rental markets. In states with more pending court cases related to land disputes or lower land leasing activity among agricultural households, the negative impact of land fragmentation on firm outcomes is markedly worse. These findings strongly support the interpretation that the difficulty in transacting for land—rather than broader economic underdevelopment—constrains firm expansion.

Underutilisation of industrial land further compounds these constraints. Tewari (2020) finds that only about 37% of land in Special Economic Zones (SEZs) is being used nationwide, with approximately 45% of designated processing area land lying vacant, representing a major inefficiency in how industrial land is allocated and managed. A performance audit by the Comptroller and Auditor General (CAG) of India reinforces these concerns, highlighting serious lapses in land allotment and utilisation, including instances where land was acquired for industrial development but remained idle—raising critical questions about the efficacy and accountability of land acquisition processes.

Addressing these land-related bottlenecks is crucial for boosting India's firm growth and industrial productivity. It will require accelerating comprehensive land titling programs to provide legal clarity, reduce transaction costs, and build investor confidence. Additionally, regular audits and proactive reallocation of underutilised land in SEZs are essential to ensure optimal use. Transparent and equitable land acquisition processes—rooted in stakeholder consultation, timely compensation, and legal safeguards—must be institutionalised to build public

trust and reduce conflict. Integrating environmental and social impact assessments into land policy can help reconcile industrial development with ecological sustainability and the protection of agricultural livelihoods. Together, these reforms can enable more efficient, inclusive, and sustainable land use for industrial growth.

India's land markets are among the least studied yet most binding constraints on firm expansion. Academic work could examine the causal impact of recent titling and digitisation efforts (for example, SVAMITVA) on land market liquidity and investment behaviour. There is little systematic evidence on the functioning of land leasing and pooling models in peri-urban or industrial areas or on institutional innovations like land banks that facilitate SME land access. The governance of SEZs and industrial parks—particularly how land allocation and underutilisation affect firm entry and productivity—remains underexplored. Further, interdisciplinary research integrating spatial data, administrative records, and firm outcomes could inform more efficient and equitable industrial land policy.

Entrepreneurship, informality, and the green transition

I. Entrepreneurship and innovation ecosystems

Entrepreneurship has been a powerful driver of economic growth in advanced economies—spurring competition, catalysing innovation, and generating employment. A growing body of research confirms that higher levels of entrepreneurial activity are associated with stronger economic outcomes. For example, Rusu et al. (2022), in a 12-year panel study across 27 EU countries, found that improved entrepreneurial performance correlates positively with national competitiveness and GDP growth. However, the quality of entrepreneurship matters: Ordeñana et al. (2024) show that while innovative entrepreneurship is positively linked to economic growth, high-growth entrepreneurship (in terms of firm size alone) does not show a significant effect, highlighting the importance of ventures that introduce new products or services over those that merely scale.

In the Indian context, entrepreneurship is expected to play a pivotal role in economic development. Government initiatives such as Startup India have helped nurture a vibrant startup ecosystem. However, important questions remain around how well incubators and accelerators identify and support high-potential entrepreneurs and the extent to which training programs and venture capital translate into firm growth and innovation. Given the emphasis on quantity, a critical research priority is understanding how to foster more

innovative and resilient entrepreneurs capable of generating lasting economic and social value.

Future research could evaluate the effectiveness of startup incubators, accelerators, and training programs in fostering innovative entrepreneurship, especially in Tier 2 and 3 cities. There is also scope to explore what types of funding (for example, venture capital, concessional finance) best support long-term innovation and how entrepreneurial ecosystems can be made more inclusive, particularly for women and first-generation entrepreneurs.

II. Persistence of informal firms

Despite decades of growth and industrialisation, India's employment landscape remains dominated by informality. As of the early 2010s, 93% of total employment and 86% of non-agricultural employment were informal, with informal settings accounting for over two-thirds of manufacturing jobs (Mehrotra et al., 2012; Storm, 2015). This persistence challenges classical development models (Lewis, 1954; Ranis and Stewart, 1999), which posit that structural transformation should gradually shift labour from low-productivity informal work to higher-productivity formal employment.

Scholars such as Sanyal (2007) and Bhattacharya (2017) have attributed this pattern to structural dualism and exclusionary growth. Indian capitalism, they argue, displaces labour from traditional sectors without creating sufficient formal employment, resulting in a proliferation of survivalist, low-productivity work reliant on household labour and resources.

Empirical work by Raj and Sen (2016) highlights the constraints preventing informal firms—especially family-run enterprises—from growing or formalising. These include the lack of capabilities such as registration, bookkeeping, and external linkages, all strongly correlated with firm growth. Integration into formal supply chains through subcontracting arrangements can facilitate upward mobility, but geography remains a key determinant. Firms located near urban centres, transport corridors, or state capitals have better prospects, while those in remote or disadvantaged regions—often with large SC/ST populations—face structural barriers related to poor infrastructure and limited human capital.

Informality is thus sustained not only by economic constraints but also by institutional and spatial inequities. Addressing informality requires more than access to finance; it calls for a systemic approach involving capability development, infrastructure investment, spatial inclusion, and regulatory outreach.

Global forces further shape these dynamics. Chakraborty et al. (2024) show that rising Chinese import competition—particularly after WTO accession—led

formal Indian firms to increase subcontracting to informal units. While this helped reduce costs, it also deepened precarious employment and informalisation across value chains.

Operating outside regulatory frameworks, informal firms typically bypass standards on labour, sustainability, and taxation (Chen, 2012; La Porta and Shleifer, 2014). While this reduces compliance costs, it also limits access to state support, cleaner technologies, and green skills training. Weak institutional reach hampers the state's ability to regulate or support these enterprises, making informality a protective buffer and a barrier to inclusive, sustainable development.

More evidence is needed to understand what enables informal firms to transition into formality—particularly in underserved geographies. Research priorities include assessing the effectiveness of supply chain integration, capability-building programs, and infrastructure investments in fostering upward mobility. Additionally, the labour and environmental consequences of informal subcontracting under global trade pressures remain underexplored and could inform better policy and regulation.

III. Sustainability and green upgrading in SMEs

Sustainable manufacturing is emerging as a key strategic priority for Indian SMEs, with growing evidence that environmental responsibility can drive competitiveness and profitability. Das and Rangarajan (2020) identify two key enablers of sustainability adoption: proactive government policy (such as CSR regulations, training schemes, and environmental awareness programs) and collaborative networks among SMEs. These networks help firms overcome resource constraints by sharing best practices and responding collectively to stakeholder expectations.

Empirical studies underscore the link between sustainability and firm performance. Gupta and Gupta (2020) find that environmentally responsible practices—such as energy conservation, waste management, pollution control, and ISO 14001 compliance—enhance financial outcomes, customer satisfaction, and innovation capabilities. These results align with stakeholder and resource-based theories, positioning sustainability not as a compliance burden but as a source of competitive advantage.

Field research by Jayaraman et al. (2012) in ISO 14001-certified paint manufacturing firms further confirms that investments in recycling, emission control, and closed-loop systems improve operational efficiency and consumer perception. A related consumer survey revealed that urban Indian customers were willing to pay a premium for environmentally friendly products, suggesting clear market benefits to green production.

Shankar et al. (2017), using a multi-criteria decision-making framework (DEMATEL), highlight the "6R" practices—reduce, reuse, recycle, recover, redesign, and remanufacture—as critical levers for sustainable transition. These practices enhance resource efficiency, reduce costs, and help firms meet global sustainability standards—especially important as international buyers in the US and EU increasingly demand environmental compliance across supply chains. For Indian SMEs, this offers a way to align with global norms and a path to new export opportunities and long-term resilience.

More evidence is needed on which policy instruments (for example, subsidies, training, and tax credits) most effectively incentivise sustainability adoption among SMEs. There is also a need to understand how buyer-supplier dynamics influence green upgrading in supply chains and what institutional arrangements—such as cluster-level collaborations or digital sustainability platforms—can help smaller firms overcome cost and capability barriers to sustainable production.

IV. Employment, green transition, and industrial policy

India's economic structure has become increasingly service-oriented in its domestic output and global trade. Services now dominate value addition, urban employment, and export competitiveness. While this transformation has powered growth, it raises critical questions about the future of manufacturing and the inclusiveness of economic development—particularly for India's large pool of low- and semi-skilled workers who remain tied to agriculture and informal activities.

As India pursues a green growth agenda, the link between structural transformation and employment becomes even more complex. Green transitions, by nature, disrupt existing sectors while creating new ones. There remains deep scepticism—among firms, policymakers, and workers—about whether this transition will generate meaningful and sustained employment. Historically, Indian policy has prioritised employment generation over direct income enhancement, but in the context of green growth, even job creation remains an open question.

This uncertainty presents a significant research opportunity to rigorously assess where green sectors—such as renewable energy, electric mobility, energy efficiency, sustainable agriculture, and circular economy models—are likely to generate durable employment. Key questions include: What types of green jobs can absorb workers from the informal sector? Which skills are transferable, and where are retraining efforts most needed? What role can MSMEs and urban clusters play in generating green livelihoods?

One critical area of focus is the nature of India's energy transition—from fossil fuel dependence to renewable energy and critical mineral reliance. While this shift aligns with global climate goals and improves India's energy security—especially given its limited fossil reserves—it also exposes the economy to new vulnerabilities.

Empirical studies that map the employment intensity of emerging green sectors across states and districts are needed. Research can also help identify which green value chains are most viable for domestic manufacturing, how to design retraining programs that align with industry demand, and what policy frameworks can support a just transition—especially for workers in carbon-intensive industries. Furthermore, the trade-offs between energy security and critical mineral dependency deserve greater analytical attention, particularly in shaping India's long-term green industrial policy.

Conclusion

India's economic ambitions in the coming decades will be defined not only by how fast it grows but by the kind of growth it chooses to pursue. Firms—particularly those in the manufacturing and MSME sectors—will be central to this journey. They are engines of output and employment and the primary vehicles through which innovation, technological upgrading, and environmental transitions will occur. This report has highlighted the multifaceted constraints Indian firms face and the urgent need for coordinated policy, institutional support, and targeted research to unlock their potential.

Across sectors and firm types, one theme stands out: the productivity of Indian firms is closely linked to the quality of their external environment—access to reliable infrastructure, functioning factor markets, managerial and technical know-how, and regulatory clarity. At the same time, climate change introduces a new layer of complexity. Firms in India face growing exposure to heat stress, floods, and air pollution—all of which directly impact productivity, especially in labour-intensive and informal sectors. These effects are not merely future threats; they shape firm behaviour and economic outcomes today.

The transition to a greener economy offers both risks and opportunities. For some firms—particularly those able to access ESG-aligned capital or integrate into low-carbon value chains—sustainability can drive competitiveness and resilience. Other firms, especially smaller or informal enterprises, risk being left behind without tailored support. Therefore, policy must be adaptive, combining horizontal reforms—such as improved land and credit markets—with targeted instruments to accelerate green adoption and inclusion. Expanding the reach of production-linked incentives, strengthening industrial clusters, and supporting

shared infrastructure for sustainable manufacturing can help build a more level playing field.

The firm-level upgrading agenda remains critical. Management practices, access to quality inputs, and the ability to absorb new technologies strongly correlate with productivity and export success. However, these capabilities are unevenly distributed, and interventions often fail to scale without complementary institutions—such as consulting markets, vocational training ecosystems, and functioning enforcement mechanisms. Similarly, entrepreneurial dynamism is uneven, with gaps in access to capital, mentoring, and networks—particularly for women and first-generation entrepreneurs.

Perhaps most pressing is the challenge of informality. A large share of India's firms—and its workers—operate outside the formal regulatory and financial system, missing out on support for upgrading, skilling, or green investment. Addressing informality requires more than compliance enforcement. It demands ecosystem-level changes that build firm capabilities, improve infrastructure, and integrate small enterprises into formal supply chains. Without this, India risks locking a large part of its economy out of the productivity and sustainability gains necessary for long-term development.

Finally, a recurring message in this paper is the need for high-quality, context-specific evidence to inform this agenda. While there is a growing body of research on firm behaviour, major gaps remain—in understanding the causal impacts of climate adaptation, the effectiveness of credit and training interventions, the pathways from informality to formalisation, and the distributional consequences of the green transition. Closing these gaps is essential to design policies that work at scale and reach the most vulnerable firms and workers.

India's development story will ultimately hinge on whether its firms can become not just more productive but more inclusive and sustainable. With the right institutional support, policy ambition, and research investment, Indian firms can drive a growth model that is fit for the challenges of the 21st century—resilient to climate risks, anchored in equity, and competitive on the global stage.

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