



## Innovation indicators, universities, and the uneven innovation ecosystem in India: A sociological analysis

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### Abstract

Innovation has increasingly become one of the central frameworks through which national development, economic competitiveness, and institutional performance are measured in contemporary societies. In India, innovation indicators such as the Global Innovation Index (GII), India Innovation Index (III), National Institutional Ranking Framework (NIRF), patents, research productivity, startup ecosystems, and university rankings have emerged as important mechanisms for evaluating institutional and national progress. However, innovation cannot be understood merely as a technological or economic phenomenon. It is deeply embedded within structures of power, institutional inequality, knowledge hierarchies, regional disparities, and political economy. This paper critically examines innovation indicators in India and analyses the role of universities within the broader innovation ecosystem. Drawing upon sociological perspectives on knowledge production, institutional power, and neoliberal governance, the paper argues that innovation indicators often privilege elite institutions, market-oriented knowledge systems, and formal technological outputs while marginalizing socially embedded, regional, and inclusive forms of innovation.

The study further examines how universities are increasingly transformed into entrepreneurial and competitive institutions operating within market-oriented frameworks of ranking, funding, and commercialisation. While elite institutions such as the Indian Institutes of Technology and the Indian Institute of Science dominate the innovation landscape through research funding, patents, and industry collaboration, most public universities continue to struggle with inadequate infrastructure, weak research ecosystems, and limited institutional autonomy. The paper also highlights structural challenges including low R&D expenditure, regional disparities, weak university–industry linkages, digital inequality, and the mismatch between education and employability. It concludes that innovation in India must move beyond narrow technocratic and economic measurements toward a more socially inclusive and regionally balanced innovation ecosystem that recognizes knowledge as a social process rather than merely an economic resource.

**Keywords:** Innovation ecosystem, India Innovation Index, Global Innovation Index, universities, higher education, institutional inequality

### Introduction

#### Innovation beyond Technology and Economic Growth

Innovation has emerged as one of the most influential concepts shaping contemporary development discourse across the world (Schumpeter & Swedberg, 2010; Rogers, 2003) <sup>[16]</sup>. Governments, international organizations, universities, and industries increasingly consider innovation as the foundation of economic competitiveness, scientific advancement, and institutional progress. In policy language, innovation is often associated with technological development, startup culture, patents, digital transformation, and knowledge economies. However, such interpretations frequently reduce innovation to measurable economic outputs while ignoring the social, cultural, and institutional conditions through which innovation actually emerges. From a sociological perspective, innovation is not simply a neutral process of technological advancement. Rather, it is embedded within structures of power, institutional hierarchies, policy regimes, and systems of knowledge production. Innovation therefore reflects broader social relations that determine whose knowledge becomes legitimate, whose institutions receive recognition, and which regions gain access to resources and opportunities. The Indian innovation ecosystem demonstrates these contradictions very clearly. Over the last two decades, India

has attempted to position itself as a global innovation-driven economy through initiatives such as Startup India, Atmanirbhar Bharat, Digital India, National Education Policy 2020<sup>[8]</sup>, and various innovation ranking frameworks. Simultaneously, India's rise in the Global Innovation Index has been celebrated as evidence of the country's transition toward a knowledge-based economy. However, beneath these achievements lies a deeply unequal innovation structure characterised by regional disparities, institutional concentration, uneven research capacity, and unequal access to technological infrastructure. Innovation in India remains concentrated within a small number of metropolitan regions and elite institutions, while large sections of universities, rural populations, and marginalised communities remain structurally excluded from innovation networks.

Universities occupy a central position within this transformation. In contemporary knowledge economies, universities are no longer expected to function merely as institutions of teaching and learning. They are increasingly required to produce research, generate patents, create startups, collaborate with industries, attract venture capital, and contribute directly to economic growth. Innovation indicators now measure universities according to research productivity, patents, commercialisation, institutional ranking, and entrepreneurial activities. This shift reflects the

broader transformation of higher education under neoliberal governance where academic institutions increasingly operate according to market-oriented performance metrics (Etzkowitz, 2008; Gibbons *et al.*, 1994) <sup>[5]</sup>. As a result, universities are being restructured into competitive knowledge enterprises rather than public institutions committed primarily to social transformation and critical inquiry.

This paper critically analyses innovation indicators in India and examines the role of universities within the broader innovation ecosystem. It argues that innovation indicators are not neutral measurement tools but institutional mechanisms that shape policy priorities, distribute legitimacy, and reproduce existing inequalities. By focusing on institutional structures, university rankings, research ecosystems, and regional disparities, the paper highlights how innovation systems simultaneously produce opportunities and exclusions. The analysis further demonstrates that innovation in India cannot be understood only through technological outputs and economic growth. Instead, innovation must be situated within the larger sociological framework of knowledge, power, inequality, and institutional transformation.

### **Methodology**

This study adopts a qualitative and interpretive research methodology to critically examine innovation indicators and the role of universities within India's innovation ecosystem. The research is situated within the broader sociological tradition of critical institutional analysis, which focuses on how systems of knowledge production, governance, and institutional power shape developmental processes and reproduce social inequalities. Rather than treating innovation indicators as neutral statistical tools, the study analyses them as socially constructed mechanisms that influence policy priorities, institutional legitimacy, and the distribution of academic resources.

The study primarily relies on secondary data analysis and critical policy review. Data for the study were collected from official reports and policy documents published by institutions such as NITI Aayog, the Ministry of Education, the World Intellectual Property Organization (WIPO), the Organisation for Economic Co-operation and Development (OECD), University Grants Commission (UGC), and the National Institutional Ranking Framework (NIRF). In addition, scholarly books, peer-reviewed journal articles, and research studies related to innovation systems, higher education, neoliberal governance, and knowledge economies were systematically reviewed.

Methodologically, the paper employs qualitative content analysis to identify and interpret major themes such as institutional inequality, regional disparity, research funding, digital divide, entrepreneurial governance, and the marketisation of higher education. The analysis is theoretically informed by Pierre Bourdieu's concept of symbolic power and academic capital, Michel Foucault's framework of governmentality, and sociological critiques of neoliberalism. These perspectives help explain how innovation rankings and institutional indicators operate not only as evaluative mechanisms but also as technologies of governance that shape institutional behaviour and reproduce hierarchies within higher education. The study is exploratory and critical in nature and aims to provide a sociological understanding of the uneven innovation

ecosystem in India and its implications for universities and knowledge production.

### **Innovation as a Socially Constructed Process**

The concept of innovation has evolved significantly over time. Early economic thinkers such as Joseph Schumpeter understood innovation primarily as a process of technological change and economic transformation (Schumpeter & Swedberg, 2010). According to Schumpeter, innovation occurs when new products, technologies, or methods are introduced into economic systems, generating creative destruction and industrial transformation. Later scholars expanded this understanding by emphasizing organizational change, institutional adaptation, and knowledge transfer. However, contemporary sociological approaches move beyond purely economic interpretations and argue that innovation is socially constructed through institutional systems, cultural norms, and relations of power. From a sociological perspective, innovation is not simply the production of new technologies. Rather, it involves the institutional recognition of certain forms of knowledge as valuable and legitimate. Pierre Bourdieu's concept of symbolic power helps explain how dominant institutions define what counts as innovation (Bourdieu, 1988) <sup>[1]</sup>. Innovation indicators privilege measurable outputs such as patents, citations, startup investments, and research publications. Consequently, forms of knowledge rooted in local practices, indigenous systems, informal economies, and grassroots creativity often remain invisible within formal innovation systems. Innovation therefore becomes closely linked with institutional legitimacy and access to resources.

Michel Foucault's concept of governmentality also helps explain the rise of innovation rankings and measurement systems (Foucault, 1980) <sup>[4]</sup>. Through innovation indices and institutional rankings, governments indirectly regulate universities and states by encouraging them to align with predefined standards of performance. Innovation indicators operate not only as measurement tools but also as technologies of governance. Universities and states begin restructuring themselves according to ranking systems, funding criteria, and policy benchmarks in order to gain legitimacy and competitive advantage. In this way, innovation indicators shape institutional behavior and policy priorities without direct coercion. Contemporary innovation systems are also shaped by neoliberal transformations. Under neoliberal governance, universities increasingly function as entrepreneurial institutions integrated into market economies. Knowledge becomes commodified, research becomes commercialised, and academic success becomes linked with market relevance. This transformation changes the very meaning of higher education. Universities are now expected to contribute directly to economic productivity, technological competitiveness, and global rankings. Such developments illustrate how innovation is deeply embedded within broader political and economic structures.

### **Global Innovation Index and the Politics of Measurement**

The Global Innovation Index has become one of the most influential frameworks for evaluating innovation performance across countries (Leogrande, 2024). Developed initially by INSEAD and later managed by the World

Intellectual Property Organization, the GII measures innovation through indicators such as institutions, infrastructure, research investment, patents, market sophistication, and creative outputs. While the index appears objective and technical, it also reflects deeper ideological assumptions regarding development and modernization. The GII privileges formal, institutionalised, and capital-intensive forms of innovation that align closely with Western models of knowledge production. Countries with advanced research universities, strong patent systems, high R&D expenditure, and extensive technological infrastructure dominate the rankings. Consequently, innovation becomes associated with institutional arrangements already prevalent in advanced capitalist economies. This creates a hierarchy where countries in the Global South are often viewed as innovation laggards unless they conform to these institutional standards.

The sociological significance of the GII lies in its ability to shape policy behavior globally. Governments increasingly reform higher education systems, startup ecosystems, and innovation policies in order to improve their rankings. This reflects a broader transformation where development itself becomes measured through innovation performance. Countries no longer compete only through industrial output or economic growth but through innovation capacity and knowledge production. India's rise within the Global Innovation Index is frequently celebrated as evidence of progress (Jain, 2020) <sup>[6]</sup>. However, improvement in rankings does not necessarily indicate equitable development. Much of India's innovation growth remains concentrated within urban technology clusters, digital economies, and elite institutions. Large sections of the population continue to experience exclusion from research infrastructure, digital access, and quality higher education. Thus, the GII simultaneously highlights growth and reproduces global and internal inequalities.

### **India Innovation Index and Competitive Federalism**

The India Innovation Index introduced by NITI Aayog represents a major attempt to institutionalize innovation governance at the state level (NITI Aayog, 2019) <sup>[14]</sup>. The index evaluates states according to parameters such as human capital, investment, business environment, knowledge workers, safety and legal systems, and knowledge outputs. On the surface, the index appears to promote decentralised development and policy innovation. However, it also functions as a mechanism of competitive federalism where states are encouraged to compete for institutional legitimacy, investment, and economic recognition. The India Innovation Index reflects broader neoliberal transformations within governance structures. States are increasingly expected to function like competitive economic entities rather than welfare-oriented institutions. Policy success becomes associated with startup ecosystems, venture capital, foreign investment, and business-friendly reforms. This transformation shifts the role of the state from provider of social welfare to facilitator of market-oriented development.

The rankings also reveal strong patterns of regional inequality. States such as Karnataka, Maharashtra, Tamil Nadu, Telangana, and Delhi consistently dominate the innovation landscape because they already possess stronger institutional infrastructure, urban technological clusters, research ecosystems, and investment networks. In contrast,

states such as Bihar, Jharkhand, Chhattisgarh, and Odisha continue to struggle due to structural disadvantages including weak educational infrastructure, lower industrial development, and inadequate research investment. This uneven geography of innovation reflects an internal core-periphery structure within India. Innovation ecosystems become concentrated in metropolitan regions where universities, industries, digital infrastructure, and venture capital networks already exist. Peripheral regions remain dependent on limited state investment and weak institutional support. Consequently, innovation indicators do not merely measure inequality. They also reinforce it by directing attention and resources toward already dominant regions. The India Innovation Index also demonstrates selective recognition of knowledge systems. Informal innovation, local creativity, traditional practices, and community-based problem-solving receive little institutional visibility because they cannot easily be measured through formal indicators. Innovation therefore becomes narrowly associated with market-oriented and technological outputs while socially embedded forms of knowledge remain marginalised.

### **Universities and the Transformation of Knowledge Production**

Universities have historically functioned as institutions responsible for education, intellectual inquiry, and social transformation. However, within contemporary knowledge economies, universities are increasingly expected to become engines of innovation, entrepreneurship, and economic growth. This transformation reflects broader shifts in the relationship between higher education, markets, and state policy. The Triple Helix model developed by Etzkowitz emphasizes that innovation emerges through interactions between universities, industries, and governments (Etzkowitz & Leydesdorff, 2000) <sup>[3]</sup>. Universities generate knowledge, industries commercialize it, and governments provide policy support and funding. Within this framework, universities become central actors within innovation ecosystems. Their success is increasingly measured through patents, publications, startups, technology transfer, research funding, and industry collaboration.

In India, this transformation is visible through policy initiatives such as the National Education Policy 2020<sup>[8]</sup>, Institutions of Eminence, Atal Innovation Mission, incubation centers, and startup-oriented reforms (Ministry of Education, Government of India, 2020; University Grants Commission, 2017) <sup>[8, 20]</sup>. Universities are encouraged to strengthen research ecosystems, commercialize innovation, and develop entrepreneurial cultures. Higher education institutions are increasingly integrated into national development agendas centered on technological modernization and global competitiveness. However, this transformation also produces contradictions. Universities are simultaneously expected to function as public institutions committed to social inclusion and as competitive market-oriented institutions seeking rankings, investment, and institutional prestige. Academic success becomes increasingly quantified through measurable outputs rather than critical intellectual engagement or social relevance. This shift alters the nature of academic work itself. Faculty members face pressure to publish, secure grants, generate patents, and attract institutional funding. Research priorities increasingly align with commercially viable and technologically profitable fields while critical social

sciences and community-based research receive comparatively less institutional support. Innovation therefore restructures the institutional culture of universities by prioritizing measurable productivity and market relevance.

### **Elite Institutions and Institutional Hierarchies in Indian Higher Education**

The Indian higher education system is characterised by deep institutional inequalities (Krishna, 2019) [12]. Elite institutions such as the Indian Institutes of Technology, Indian Institute of Science, and a few central universities dominate research funding, scientific output, patents, and institutional prestige. In contrast, the majority of state universities and affiliated colleges struggle with inadequate infrastructure, faculty shortages, limited laboratories, and weak research ecosystems. The dominance of elite institutions reflects the unequal distribution of academic capital within the higher education field. Institutions possessing greater symbolic prestige attract more funding, stronger faculty, better students, and greater industry collaboration. This creates a cycle of cumulative advantage where already dominant institutions continue strengthening their research ecosystems while weaker institutions remain marginalised. The IIT system represents one of the most significant examples of institutional concentration within India's innovation ecosystem (Sharma *et al.*, 2024). IITs receive substantial government support, maintain international collaborations, and possess strong industry linkages. Their research output contributes significantly to India's global scientific visibility. Similarly, the Indian Institute of Science functions as India's premier research-intensive institution with strong interdisciplinary research capabilities.

However, the concentration of resources within elite institutions creates structural imbalance across the higher education system. Most universities in India primarily function as teaching institutions with limited capacity for advanced research. Faculty members often manage heavy teaching loads with minimal research support. Laboratories remain underdeveloped, research grants remain inaccessible, and institutional autonomy remains constrained. This inequality also reflects broader social and regional disparities. Elite institutions are concentrated within economically developed urban regions, while universities in peripheral states often lack institutional investment. As a result, innovation capacity becomes geographically concentrated within select metropolitan regions and elite institutional networks.

### **NIRF Rankings and the Marketisation of Higher Education**

The National Institutional Ranking Framework has emerged as one of the most influential mechanisms for evaluating universities in India (Ministry of Education, Government of India, 2020) [8]. NIRF measures institutions according to parameters such as teaching resources, research productivity, graduation outcomes, outreach, and perception. While the framework aims to create accountability and quality assessment, it also reflects broader processes of marketization within higher education. NIRF transforms complex educational processes into quantifiable indicators. Universities are evaluated according to publications, citations, patents, placements, funding, and

institutional reputation. Such measurement systems create a competitive environment where universities increasingly prioritize performance metrics over broader educational and social objectives. From a sociological perspective, rankings operate as systems of symbolic power. Higher-ranked institutions accumulate legitimacy, prestige, and institutional recognition. This symbolic capital further translates into material advantages including research grants, student demand, faculty recruitment, and industry partnerships. Consequently, rankings reproduce existing hierarchies within the higher education system.

The domination of IITs and elite institutions within NIRF rankings reflects this concentration of academic capital. Institutions with stronger funding, infrastructure, and historical prestige consistently outperform resource-constrained universities. Thus, rankings often reinforce institutional inequality rather than democratizing educational quality. NIRF also contributes to the neoliberal restructuring of universities by encouraging institutions to behave competitively. Universities increasingly focus on branding, visibility, entrepreneurial activities, and measurable productivity in order to improve rankings. Educational institutions therefore begin operating according to market logic where performance, competition, and reputation become central institutional priorities.

### **Research Funding, R&D Expenditure, and Structural Constraints**

Research funding remains one of the most significant structural challenges within India's innovation ecosystem (OECD, 2018). India's gross expenditure on research and development remains substantially lower than advanced economies. While countries such as the United States, South Korea, and Israel invest more than two percent of GDP in R&D, India's expenditure continues to remain below one percent. Low investment in research significantly limits innovation capacity across universities and research institutions. Many universities lack modern laboratories, digital infrastructure, and interdisciplinary research centers necessary for advanced scientific work. Limited funding also affects faculty recruitment, international collaboration, and doctoral research opportunities. Research funding in India is also highly concentrated. Elite institutions receive a disproportionately large share of research grants while state universities and smaller colleges struggle to access funding opportunities. This unequal distribution reproduces institutional hierarchies and weakens the possibility of developing inclusive national research ecosystems.

The commercialisation of research further shapes funding priorities. Research projects aligned with industrial applications, digital technologies, and commercially viable innovation receive greater institutional support compared to socially oriented or critical research. This creates disciplinary imbalance where technological and applied sciences dominate funding structures while humanities and social sciences remain marginalised. Another major challenge is bureaucratic governance. Delays in approvals, rigid administrative systems, and regulatory uncertainty often restrict innovation within universities. Faculty members frequently encounter procedural obstacles in accessing grants, establishing collaborations, and conducting interdisciplinary research. Such bureaucratic constraints weaken institutional flexibility and slow down innovation processes.

### **Digital Divide and Uneven Innovation Geographies**

Innovation ecosystems increasingly depend upon digital infrastructure, technological connectivity, and access to information systems (Lundvall, 1992) <sup>[7]</sup>. However, digital inequality remains a major structural barrier within India. While metropolitan cities and technologically advanced regions possess strong digital ecosystems, large rural populations continue to experience limited internet connectivity and weak technological infrastructure. This digital divide has significant consequences for higher education and innovation. Universities located within urban technology clusters benefit from access to digital laboratories, research databases, startup networks, and industry collaboration. In contrast, universities in peripheral regions struggle with inadequate internet access, limited ICT infrastructure, and weak research connectivity. The uneven distribution of digital infrastructure reinforces regional concentration within innovation systems. Cities such as Bengaluru, Delhi, Chennai, Hyderabad, and Mumbai dominate India's technological landscape because they possess integrated ecosystems of universities, industries, venture capital, and digital networks. Rural and economically weaker regions remain structurally excluded from these innovation circuits.

The COVID-19 pandemic further exposed these inequalities. Universities and students lacking digital access faced severe educational disruptions. The shift toward online learning and digital research highlighted how technological infrastructure has become central to educational participation and knowledge production. Digital inequality also intersects with social inequality. Students from economically marginalised backgrounds often lack access to devices, internet connectivity, and technological resources necessary for participation within digital learning systems. Thus, innovation ecosystems reproduce broader social inequalities through differential access to technological infrastructure.

### **Employability, Skill Crisis, and Knowledge Workers**

One of the major contradictions within India's innovation ecosystem is the gap between educational expansion and meaningful employment (Naik, 2017) <sup>[10]</sup>. Over the last three decades, India witnessed massive growth in engineering colleges, technical institutions, and STEM education. This expansion produced a large technically educated workforce. However, the growth of educational institutions has not always translated into high-quality employment or innovation-oriented work. A significant portion of engineering graduates remain underemployed or employed in low-skilled occupations unrelated to their qualifications. This reflects a structural mismatch between higher education and labour market demands. Universities often emphasize degree production rather than critical skill development, research training, and innovation capacity. The employability crisis also reflects deeper institutional issues within higher education. Many institutions lack qualified faculty, modern curricula, practical training systems, and research exposure necessary for innovation-oriented education. Consequently, graduates frequently possess formal credentials without corresponding technological or analytical capabilities.

The expansion of startup culture has also generated contradictory outcomes. While startup ecosystems are celebrated as symbols of innovation, many technology

platforms rely upon precarious labour arrangements rather than high-end scientific innovation. The rapid growth of delivery platforms and gig economies illustrates how digital capitalism can simultaneously produce technological expansion and labour insecurity. This contradiction demonstrates that innovation alone cannot guarantee equitable development. Without quality education, institutional investment, and socially oriented policy frameworks, innovation ecosystems risk producing uneven labour markets characterised by precarity and exclusion.

### **Toward an Inclusive and Socially Responsible Innovation Ecosystem**

The Indian innovation ecosystem requires significant structural transformation if innovation is to become socially inclusive and regionally balanced. Current innovation indicators largely privilege economic growth, market competitiveness, patents, and institutional rankings while overlooking broader social dimensions of knowledge and development. An inclusive innovation ecosystem must recognize that innovation is not limited to elite institutions, technological industries, and urban startup cultures (Pachava *et al.*, 2025). Local knowledge systems, grassroots creativity, indigenous practices, community problem-solving, and socially embedded innovation must also receive institutional recognition. Universities should function not merely as market-oriented research centers but as democratic public institutions committed to social transformation and critical inquiry.

Reducing regional disparities remains essential. Peripheral states and public universities require greater investment in research infrastructure, digital connectivity, faculty development, and institutional autonomy. Without addressing structural inequalities, innovation systems will continue concentrating within already privileged regions and institutions. The relationship between universities and society also requires rethinking. Universities should strengthen collaboration not only with industries but also with local communities, civil society organizations, and regional development initiatives. Knowledge production must become socially relevant rather than narrowly commercialised. Finally, innovation policy must move beyond narrow quantitative indicators. Measuring innovation solely through patents, rankings, and startup investments reduces knowledge to economic utility. A socially responsible innovation framework should incorporate equity, sustainability, accessibility, and collective well-being as central dimensions of innovation.

### **Conclusion**

Innovation has become one of the defining frameworks shaping development, governance, and higher education in contemporary India (Rogers, 2003; Drucker, 1985) <sup>[2, 16]</sup>. Through innovation indices, rankings, startup policies, and research reforms, innovation is increasingly presented as the pathway toward economic growth, global competitiveness, and technological modernization. However, this paper has argued that innovation cannot be understood merely as a technical or economic process. Innovation is deeply embedded within institutional structures, regional inequalities, systems of knowledge production, and relations of power. The Global Innovation Index, India Innovation Index, and NIRF rankings function not only as measurement systems but also as governance mechanisms that shape

institutional priorities and distribute legitimacy. These frameworks privilege formal, measurable, and market-oriented forms of innovation while marginalizing informal knowledge systems and socially embedded creativity. Simultaneously, the Indian higher education system reflects strong institutional concentration where elite institutions dominate research funding, patents, and innovation ecosystems while most universities struggle with limited resources and weak research infrastructure.

The analysis also demonstrates that India's innovation ecosystem is characterised by multiple structural contradictions including low R&D expenditure, weak university–industry linkages, digital inequality, regional disparities, and the mismatch between educational expansion and employability. Innovation remains concentrated within metropolitan technological clusters and elite institutional networks, leaving peripheral regions and marginalised communities structurally excluded. Universities therefore occupy a contradictory position within the contemporary innovation system. They are expected to function as entrepreneurial knowledge hubs while simultaneously fulfilling public responsibilities of education and social transformation. The growing marketization of higher education has increasingly shifted universities toward competitive performance-driven models centered on rankings, commercialisation, and measurable productivity.

Ultimately, the future of innovation in India depends not only upon technological advancement but also upon institutional democratization and social inclusion. Innovation policy must move beyond narrow technocratic measurements toward a broader understanding of knowledge as a collective social process. A socially inclusive innovation ecosystem requires equitable investment, regional balance, institutional autonomy, quality public education, and recognition of diverse forms of knowledge production. Without addressing these structural inequalities, innovation systems will continue reproducing existing hierarchies rather than creating transformative social development.

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