

Role of NEP-2020 in Promoting Entrepreneurship and Innovation in the 21st Century

Prof.Dr.Yagnesh B. Purohit¹

¹Professor and Head, Shri I.J.Patel M.Ed. Course, Mogri,
Sardar Patel University, Vallabh Vidyanagar, Gujarat
Email ID:-ybpurohit@gmail.com

ABSTRACT

The National Education Policy (NEP) 2020 represents a major transformation in India's educational framework by shifting emphasis from rote learning and employment-oriented education towards multidisciplinary learning, creativity, critical thinking, skill development, research, innovation, and entrepreneurship. This paper examines the role of NEP-2020 in developing an entrepreneurial and innovation-oriented educational ecosystem suitable for the demands of the 21st century. The study analyses policy provisions related to multidisciplinary education, vocational integration, experiential learning, research and development, incubation centres, industry-academia collaboration, intellectual property, digital education, and flexible academic pathways. It further examines how these provisions can strengthen entrepreneurial intention, innovation capability, employability, and start-up creation among students. A case study of IIT Madras is presented to illustrate how an institutional ecosystem integrating research, incubation, interdisciplinary education, and industry linkages can translate academic knowledge into entrepreneurial outcomes. The paper also identifies implementation challenges including funding constraints, institutional disparities, faculty preparedness, risk aversion, weak commercialization mechanisms, and unequal access to innovation infrastructure. The study concludes that NEP-2020 provides an enabling policy architecture, while its entrepreneurial impact depends substantially on effective institutional implementation and ecosystem-level coordination.

Keywords: NEP 2020, Entrepreneurship Education, Innovation, Higher Education, Start-up Ecosystem, Industry-Academia Collaboration

1. INTRODUCTION

The transition towards a knowledge-driven and innovation-oriented economy has significantly changed the role of education in the 21st century. Higher education institutions are no longer expected to function exclusively as centres for knowledge transmission and degree acquisition; they are increasingly required to develop creativity, critical thinking, problem-solving ability, technological competence, employability, innovation capacity and entrepreneurial orientation. Entrepreneurship has consequently emerged as an important dimension of contemporary higher education because it enables students to transform knowledge and ideas into products, services, enterprises and socially relevant solutions. At the same time, innovation has become central to national competitiveness, productivity, employment generation and sustainable economic development.

India's National Education Policy (NEP) 2020 represents a significant restructuring of the country's education system with particular emphasis on multidisciplinary learning, experiential education, vocational education, research, innovation, flexibility and industry interaction. The policy envisages higher education institutions as important contributors to knowledge creation and innovation and specifically encourages institutions to establish start-up incubation centres, technology-development centres, centres for frontier research, stronger industry-academia linkages and interdisciplinary research programmes [1]. This orientation represents a shift from a predominantly qualification-oriented model towards an ecosystem in which education, research, innovation and entrepreneurship can operate as interconnected processes.

The entrepreneurial relevance of NEP-2020 becomes particularly important in the context of changing labour markets. Automation, artificial intelligence, digital platforms and emerging technologies are altering occupational structures and increasing demand for adaptable and innovation-oriented human capital. Traditional education models that focus primarily on memorisation and discipline-specific knowledge may be insufficient for such an environment. NEP-2020's emphasis on conceptual understanding, creativity, critical thinking, communication, collaboration and experiential learning therefore provides an educational foundation that can support entrepreneurial capability [1].

Entrepreneurship education is increasingly understood as more than the teaching of business-plan preparation or venture-management techniques. It involves developing opportunity recognition, entrepreneurial self-efficacy, creativity, risk assessment, experimentation, resource mobilisation and the capacity to respond to uncertainty. A systematic review of higher-education entrepreneurship education found evidence that experiential programmes and university extracurricular activities can contribute to entrepreneurial development, although the literature also contains methodological limitations and relatively few studies establishing strong causal relationships between educational interventions and long-term entrepreneurial outcomes [2]. This finding is relevant to NEP-2020

because the policy's success depends not merely on introducing entrepreneurship-related courses but on creating educational environments where students can repeatedly apply knowledge to authentic problems.

NEP-2020 also promotes multidisciplinary education, which has considerable implications for innovation. Contemporary entrepreneurial opportunities frequently arise at the intersection of disciplines. Artificial intelligence, biotechnology, renewable energy, healthcare technology, financial technology and sustainable development, for example, require knowledge extending beyond a single academic field. A multidisciplinary educational structure can expose students to diverse conceptual frameworks and enable them to combine technological, managerial, social and economic perspectives when identifying and addressing problems [1]. Research on embedding entrepreneurship education into non-business disciplines similarly indicates growing interest in integrating entrepreneurial learning within broader academic programmes rather than restricting it to conventional management and business education [3].

Another significant dimension is experiential and practice-oriented learning. Internships, live projects, industry interaction, problem-based learning, innovation competitions, apprenticeships and entrepreneurial projects provide opportunities for students to connect academic knowledge with real-world requirements. Recent systematic evidence concerning Indian higher education indicates that experiential learning mechanisms such as internships, live projects, industry partnerships and practical entrepreneurship programmes can contribute to employability and entrepreneurial intentions, while implementation challenges remain in areas such as funding, mentorship, faculty preparedness and industry-academia collaboration [4].

The policy also recognises the importance of institutional incubation and innovation infrastructure. The formal integration of incubation centres within higher education can establish a pathway through which student ideas and academic research move from conceptualisation to prototype development, validation and commercialisation. NITI Aayog has specifically identified NEP-2020's provisions concerning start-up incubation centres, technology-development centres and industry-academic linkages as mechanisms for embedding innovation and entrepreneurship within higher education institutions [5].

Digital transformation further expands this potential. Technology-supported entrepreneurship education can provide students with access to digital learning resources, online mentoring, entrepreneurial networks, simulation environments and global knowledge. Recent research examining entrepreneurship education from a technology-enabled perspective identifies entrepreneurial intention, entrepreneurial mindset, innovation and technology transfer, entrepreneurial learning, entrepreneurial ecosystem and self-efficacy among the major themes shaping contemporary entrepreneurship-education research [6]. Thus, the digital dimension of NEP-2020 can complement its broader entrepreneurial objectives.

The role of NEP-2020 should therefore be understood within a broader national innovation ecosystem that includes higher education institutions, research organisations, industry, incubators, investors, government programmes and start-up-support mechanisms. The policy provides an educational and institutional foundation, but the conversion of this foundation into entrepreneurial outcomes requires coordination among these actors. The contemporary policy environment increasingly views higher education as a contributor to research, innovation and entrepreneurship rather than merely as a supplier of graduates [5].

Despite these developments, a critical issue remains concerning implementation. The existence of policy provisions does not automatically result in entrepreneurial behaviour, successful innovation or start-up creation. Institutional capacity, funding, faculty expertise, mentoring, infrastructure, intellectual-property support, industry relationships and regional disparities can influence the effectiveness of entrepreneurship-oriented educational reforms. Recent systematic evidence on NEP-2020 implementation identifies infrastructure deficiencies, faculty-readiness issues, funding constraints and regional disparities as continuing barriers to effective implementation [7].

Against this background, the present paper examines the role of NEP-2020 in promoting entrepreneurship and innovation in the 21st century. It particularly focuses on the relationship between multidisciplinary education, experiential learning, research and innovation, incubation, industry-academia collaboration and entrepreneurial capability. The paper also considers the institutional conditions required to translate the policy's entrepreneurial vision into sustainable outcomes.

2. LITERATURE REVIEW

The literature on entrepreneurship education has expanded considerably as universities have increasingly recognised entrepreneurship as an important component of higher education. Earlier approaches frequently concentrated on business knowledge and venture-management skills, whereas contemporary research increasingly considers entrepreneurial mindset, opportunity recognition, innovation, self-efficacy and entrepreneurial intention. Carpenter and Wilson's systematic review of entrepreneurship education in higher education found that experiential programmes and extracurricular university activities provide some of the strongest evidence for entrepreneurial learning outcomes, while also highlighting methodological weaknesses in the existing research

base [2]. Their findings suggest that entrepreneurship education is most meaningful when students are exposed to practical experiences rather than relying exclusively on conventional classroom instruction.

The development of entrepreneurial capability is closely related to learning-by-doing. Entrepreneurship involves uncertainty, experimentation, decision-making and adaptation, characteristics that are difficult to reproduce through purely theoretical teaching. Experiential learning therefore provides an important pedagogical mechanism through which students can develop entrepreneurial confidence and practical problem-solving capabilities. In the Indian context, recent evidence indicates that internships, live projects, industry partnerships and hands-on entrepreneurship programmes are associated with entrepreneurial intentions and employability, although inadequate mentorship, faculty preparedness and institutional resources continue to constrain implementation [4]. A major development in the literature has been the movement of entrepreneurship education beyond conventional business schools. Entrepreneurship is increasingly incorporated into engineering, science, technology, social sciences and other disciplines. This development has particular relevance to NEP-2020 because the policy promotes multidisciplinary and interdisciplinary education. A systematic review of entrepreneurship education embedded within non-business courses demonstrates that entrepreneurship can be integrated into existing disciplinary curricula and that such integration provides opportunities for students to develop entrepreneurial competencies without requiring entrepreneurship to become a separate academic specialisation [3]. This supports the broader NEP-2020 vision of combining disciplinary knowledge with transferable and entrepreneurial capabilities.

Technology has also become an important component of contemporary entrepreneurship education. Kumar, Dwivedi and Kumar's systematic literature review covering entrepreneurship-education research from 2002 to 2022 identifies major research themes including gender and pedagogy, innovation and technology transfer, entrepreneurial intention, entrepreneurial mindset, entrepreneurial learning, entrepreneurial ecosystems, self-efficacy and the theory of planned behaviour [6]. The findings demonstrate that entrepreneurship education has evolved into an interdisciplinary research field in which educational processes interact with technology, innovation and behavioural factors.

The relationship between digital technology and entrepreneurial intention has received increasing attention. Digital learning environments can provide access to entrepreneurship resources, networks, simulations, collaborative platforms and global markets. A systematic review examining the relationship between digital technology, innovation and entrepreneurship education identifies digital technology as an increasingly important mechanism for developing entrepreneurial intention and motivation [8]. This is particularly relevant to NEP-2020 because digital education can extend entrepreneurial learning beyond the physical classroom and enable students from geographically dispersed institutions to access similar knowledge resources.

Research and innovation constitute another major dimension of the literature. Universities can contribute to entrepreneurship through the production of new knowledge, patents, prototypes and technologies. NEP-2020 explicitly encourages higher education institutions to strengthen research and innovation through incubation centres, technology-development centres, frontier research and industry-academic linkages [1]. The policy therefore provides an institutional mechanism for connecting research activity with entrepreneurial opportunity. NITI Aayog's analysis of the higher-education incubation ecosystem similarly identifies incubation as a mechanism through which students and researchers can translate ideas and research outputs into ventures addressing socioeconomic challenges [5].

The literature also increasingly considers the role of entrepreneurial ecosystems rather than treating entrepreneurship as an individual characteristic. An entrepreneurial ecosystem within a university can include students, faculty, laboratories, incubators, investors, mentors, industry partners, technology-transfer offices and institutional leadership. The effectiveness of entrepreneurship education is therefore influenced by the environment in which students attempt to apply entrepreneurial knowledge. Recent systematic literature on entrepreneurial potential in higher education identifies psychological, cognitive, attitudinal and behavioural factors as interconnected components of entrepreneurial potential and highlights the importance of institutional environments in shaping these outcomes [9].

The Indian higher-education context introduces additional considerations. NEP-2020 seeks to make higher education more flexible, multidisciplinary and skill-oriented while strengthening research and innovation. The policy's approach is consistent with a broader transformation of higher education from an employment-oriented system towards a knowledge and innovation ecosystem [1]. The Government of India's implementation framework further emphasises hands-on learning, research addressing industrial and societal requirements and the development of Research and Development Cells within higher education institutions [10].

Nevertheless, the implementation literature identifies a substantial difference between policy intention and institutional capacity. Recent systematic analysis of NEP-2020 implementation reports progress in areas such as curricular flexibility and vocational integration but also identifies persistent problems involving funding, infrastructure, faculty preparedness, digital access, administrative resistance and regional disparities [7]. These issues are particularly important for entrepreneurship because effective incubation and innovation require

laboratories, mentoring, financial support, intellectual-property assistance and industry connectivity. Institutions with limited resources may therefore find it difficult to implement the entrepreneurial components of the policy at the same scale as well-resourced institutions.

Another important issue concerns inclusivity. Entrepreneurship ecosystems can become concentrated around major metropolitan institutions and technologically intensive disciplines unless deliberate mechanisms are introduced to widen participation. NEP-2020's emphasis on multidisciplinary education, vocational learning and digital access creates potential for broader participation, but institutional implementation must ensure that entrepreneurship opportunities are available to students from different socioeconomic, geographical and disciplinary backgrounds. Recent literature on entrepreneurship education in India highlights institutional capacity, resource accessibility, curriculum relevance, digital infrastructure, industry collaboration and sociocultural constraints as factors influencing the effectiveness and inclusiveness of entrepreneurship education [11].

The literature also indicates that entrepreneurial outcomes should not be evaluated exclusively through the number of start-ups created. Entrepreneurial education can produce broader outcomes including entrepreneurial mindset, innovation competence, employability, self-efficacy, problem-solving capability and willingness to engage with uncertain environments. Extracurricular entrepreneurship education, for example, has been associated in systematic research with entrepreneurial mindset, entrepreneurial intention, entrepreneurial action and entrepreneurial competencies [12]. Accordingly, evaluation of NEP-2020 should include both immediate educational outcomes and longer-term innovation and enterprise outcomes.

A further issue concerns the relationship between entrepreneurship education and actual venture creation. Although many studies report positive relationships between entrepreneurship education and entrepreneurial intention, the transition from intention to sustained entrepreneurial action remains more complex. Factors such as access to capital, market conditions, family support, institutional infrastructure, mentoring and regulatory conditions can intervene between educational exposure and enterprise creation [2], [9]. Consequently, NEP-2020 should be viewed as an enabling educational framework rather than as a standalone determinant of entrepreneurial success.

The literature consequently reveals a significant **research gap**. Existing studies have examined entrepreneurship education, experiential learning, digital entrepreneurship, institutional incubation and NEP-2020 implementation separately, but comparatively limited research integrates these dimensions into a single policy-to-outcome framework. In particular, there is a need to examine how NEP-2020 provisions collectively facilitate the progression from multidisciplinary learning and skill development to ideation, experimentation, incubation, innovation and enterprise creation. The present study addresses this gap by conceptualising NEP-2020 as an interconnected entrepreneurial ecosystem in which curriculum reform, experiential learning, research, incubation, digital technology and industry collaboration function as complementary mechanisms for developing 21st-century entrepreneurial and innovation capabilities.

3. NEP-2020 AND THE TRANSFORMATION OF HIGHER EDUCATION FOR ENTREPRENEURSHIP AND INNOVATION

NEP-2020 establishes a structural foundation for integrating entrepreneurship and innovation into higher education by moving away from rigid disciplinary boundaries and predominantly content-based learning towards multidisciplinary, experiential, skill-oriented and research-driven education. The policy explicitly identifies research and innovation as important functions of higher education institutions and encourages the establishment of start-up incubation centres, technology-development centres, frontier research centres, stronger industry-academic linkages and interdisciplinary research [1]. This approach is particularly relevant to the 21st-century economy, where entrepreneurial opportunities increasingly emerge from the convergence of technology, business, social sciences, sustainability and emerging scientific fields.

3.1 Multidisciplinary Education as a Foundation for Entrepreneurial Thinking

Entrepreneurial opportunities are rarely confined to a single academic discipline. A healthcare start-up may require medical knowledge, artificial intelligence, data analytics, finance, regulatory knowledge and management expertise. Similarly, a clean-energy venture may require engineering, environmental science, economics, public policy and entrepreneurship. NEP-2020's multidisciplinary structure creates the possibility of combining such knowledge domains within a single educational pathway [1].

The policy's emphasis on flexible academic structures, multiple learning pathways and multidisciplinary institutions can therefore support a broader entrepreneurial mindset. Instead of viewing a student's competence exclusively through the lens of a specialised degree, the emerging model allows disciplinary knowledge to be supplemented with technological, managerial, vocational and creative capabilities.

The entrepreneurial learning pathway can consequently be conceptualised as:

Multidisciplinary Knowledge → Problem Identification → Creative Thinking → Opportunity Recognition → Experimentation → Innovation → Enterprise Creation

This transformation is important because entrepreneurship requires the ability to recognise relationships between apparently unrelated problems and knowledge domains. Multidisciplinary education can increase the range of perspectives available to students and consequently strengthen their capacity to develop novel solutions.

3.2 Experiential Learning and Entrepreneurial Competence

NEP-2020 advocates experiential, inquiry-driven and discovery-oriented learning rather than excessive dependence on rote learning [1]. This has direct relevance to entrepreneurship because entrepreneurial competence develops through experimentation, decision-making, problem-solving and interaction with real-world environments.

Project-based learning, internships, apprenticeships, field studies, innovation challenges, laboratory work and industry projects provide students with opportunities to confront practical problems. Such experiences can develop several entrepreneurial competencies:

opportunity recognition;
creativity and ideation;
problem-solving;
teamwork;
communication;
leadership;
decision-making;
resource management;
market understanding; and
tolerance of uncertainty.

Recent evidence on NEP-2020 implementation indicates that project-based learning, internships and industry interaction are increasingly being incorporated into higher-education structures to strengthen the relationship between academic learning and employment requirements [4]. The policy direction is therefore consistent with contemporary entrepreneurship education, where experiential learning is considered an important mechanism for translating theoretical knowledge into entrepreneurial capability.

3.3 Integration of Vocational and Entrepreneurial Education

NEP-2020 seeks to reduce the separation between academic and vocational education. This has important implications for entrepreneurship because many enterprises originate from technical and vocational competencies. Students possessing capabilities in areas such as manufacturing, food processing, design, agriculture, electronics, healthcare technology, digital services and renewable energy can potentially convert those skills into entrepreneurial opportunities.

The integration of vocational education can consequently produce a dual outcome:

Skill Acquisition → Employability

and

Skill Acquisition → Product/Service Development → Entrepreneurship

This dual orientation is particularly significant for India's large and diverse youth population. It allows education to support both conventional employment and self-employment or enterprise creation. The current implementation framework also incorporates skill-based learning through mechanisms such as the National Credit Framework, thereby creating greater scope for integration between academic, vocational and experiential learning [8].

3.4 Research and Innovation as Drivers of Entrepreneurship

NEP-2020 gives research a central role in higher education and encourages institutions to address industrial and societal problems through research and innovation [1]. The Ministry of Education's implementation framework emphasises hands-on learning and research directed towards industrial and societal requirements, together with Research and Development Cells within higher education institutions [12].

This creates a potential research-to-enterprise pathway:

Research Problem → Research Output → Intellectual Property → Proof of Concept → Prototype → Validation → Incubation → Commercialisation

The significance of this pathway lies in reducing the traditional separation between academic research and economic application. A research paper or laboratory finding can become more socially and economically valuable when supported by intellectual-property management, technology transfer, industry collaboration, funding and incubation.

NEP-2020's emphasis on technology-development centres and frontier research is particularly relevant to deep-tech entrepreneurship, where substantial scientific research is frequently required before commercialisation becomes possible [6].

3.5 Incubation Centres and Start-up Ecosystems

Institutional incubation represents one of the most direct mechanisms through which NEP-2020 can influence entrepreneurship. The policy encourages higher education institutions to establish start-up incubation centres and develop mechanisms for supporting innovation among students [6].

An effective university incubation system can provide:

mentoring;
laboratory and technical infrastructure;
prototype development;
intellectual-property assistance;
business-model development;
market validation;
industry connections;
investment access;
legal and regulatory guidance; and
opportunities for commercialisation.

The importance of incubation is reinforced by contemporary research on India's higher-education start-up ecosystem, which identifies industry-academia partnerships and incubation systems as important mechanisms for strengthening entrepreneurial activity [13].

The scale of institutional innovation infrastructure has also expanded. Government reporting indicates that **2,774 Institution's Innovation Councils** had been established across higher education institutions in 28 States and 6 Union Territories, while **100 institutions** had been supported through AICTE-funded IDEA Labs with industry participation for experiential learning [5]. These developments illustrate the movement from policy formulation towards institutional mechanisms for innovation and entrepreneurship.

3.6 Industry–Academia Collaboration

A university-based entrepreneurial ecosystem cannot operate effectively in isolation from industry. Industry provides knowledge about customer requirements, technological trends, production processes, commercial feasibility and market opportunities. NEP-2020 consequently places considerable emphasis on industry-academic linkages [1].

The relationship can be represented through four complementary functions:

University Contribution	Industry Contribution	Joint Outcome
Research expertise	Market knowledge	Commercially relevant research
Student talent	Practical exposure	Industry-ready graduates
Technology and IP	Commercialisation capability	Technology transfer
Innovation projects	Funding and mentorship	Start-up development
Academic laboratories	Testing and validation	Prototype development
Faculty expertise	Business networks	Knowledge-based enterprises

Recent research on start-up policy implementation in Indian higher education similarly emphasises the importance of industry-academia partnerships and incubation systems for developing a sustainable entrepreneurial ecosystem [13].

3.7 Digital Transformation and Emerging Technologies

The 21st-century entrepreneurial ecosystem is increasingly technology intensive. Artificial intelligence, machine learning, cloud computing, blockchain, robotics, biotechnology, Internet of Things, quantum technologies and advanced manufacturing are generating new entrepreneurial opportunities.

NEP-2020's technology-oriented approach provides an institutional foundation for integrating emerging technologies into education and research. Current implementation has expanded access to emerging technology education: during 2025–26, more than **2,100 AICTE-approved institutions** offered courses in artificial intelligence and other emerging areas, with an approved intake exceeding **2.80 lakh students** [11].

Digital transformation can influence entrepreneurship through three mechanisms:

Digital Learning: access to knowledge and skills.

Digital Innovation: development of technology-based products and services.

Digital Entrepreneurship: creation and scaling of technology-enabled enterprises.

The growing integration of artificial intelligence and emerging technologies into curricula is consequently important not only for employability but also for entrepreneurial opportunity recognition.

3.8 Intellectual Property and Commercialisation

Innovation without mechanisms for protecting and commercialising intellectual property may fail to produce sustainable economic value. NEP-2020's emphasis on research and innovation therefore needs to be complemented by institutional capabilities in patents, copyrights, technology licensing and commercialisation.

Higher education institutions should establish clear mechanisms through which students and faculty can move from:

Idea → Disclosure → IP Evaluation → Patent/Protection → Prototype → Industry Validation → Licensing/Start-up

This is especially important in engineering, biotechnology, pharmaceuticals, artificial intelligence and other technology-intensive fields where intellectual property can represent a significant component of enterprise value.

3.9 Institutional Autonomy and Innovation Culture

Entrepreneurship requires experimentation and tolerance for failure. Highly rigid academic systems can discourage experimentation because students and faculty may have limited opportunities to modify curricula, initiate interdisciplinary projects or pursue unconventional research.

NEP-2020 provides greater emphasis on institutional and faculty autonomy in curriculum, pedagogy and assessment within broader qualification frameworks [2]. Such autonomy can support innovation through:

interdisciplinary courses;
innovation laboratories;
flexible project structures;
industry-led modules;
entrepreneurship electives;
start-up internships;
innovation competitions; and
research-based learning.

The effectiveness of autonomy, however, depends on institutional governance and accountability. Recent research identifies institutional restructuring, digital transformation, multidisciplinary education and technology-oriented reforms among important implementation factors for NEP-2020 [14].

4. Analytical Framework for Evaluating the Entrepreneurial Impact of NEP-2020

The entrepreneurial contribution of NEP-2020 can be analysed through a five-stage institutional framework: **Input, Capability Development, Innovation Activity, Entrepreneurial Conversion and Outcome.**

Table 1. Analytical Framework for NEP-2020 and Entrepreneurship

Stage	NEP-2020 Intervention	Institutional Activity	Immediate Output	Long-Term Outcome
Input	Multidisciplinary curriculum	Cross-disciplinary courses	Broader knowledge base	Entrepreneurial capability
Capability	Skill and experiential learning	Projects, internships, workshops	Practical skills	Higher entrepreneurial readiness
Innovation	Research orientation	R&D, innovation challenges	Ideas, prototypes, IP	Technology innovation
Conversion	Incubation and mentoring	Incubators, IICs, start-up support	Validated ventures	Start-up creation
Commercialisation	Industry linkages	Technology transfer, investment	Market-ready products	Enterprise growth
Ecosystem	Digital and institutional infrastructure	Digital platforms, networks	Wider participation	Sustainable innovation ecosystem

This framework indicates that NEP-2020 should not be evaluated solely by counting the number of entrepreneurship courses introduced. Its effectiveness should be assessed through the complete institutional chain extending from educational exposure to entrepreneurial outcomes.

4.1 NEP-2020 Entrepreneurship Impact Matrix

An analytical assessment can be developed across six principal dimensions: curriculum flexibility, experiential learning, research and innovation, incubation, industry collaboration and digital capability.

Table 2. Indicative Institutional Impact Matrix

Dimension	Low Integration	Moderate Integration	High Integration
Multidisciplinary curriculum	<20% programmes	20–50% programmes	>50% programmes
Experiential learning	Occasional projects	Regular projects/internships	Embedded across programmes
Innovation activity	Limited competitions	Regular IIC activities	Continuous innovation pipeline
Incubation	No dedicated facility	Shared/incubation support	Dedicated full-service incubator
Industry collaboration	Guest lectures	Projects and internships	Co-development and commercialisation
Research-to-market linkage	Publications only	Selected technology transfer	Systematic IP-to-start-up pipeline
Digital entrepreneurship	Basic digital learning	Entrepreneurship platforms	AI/technology-enabled ventures
Entrepreneurial mentoring	Informal	Periodic	Structured mentor network

The matrix illustrates that entrepreneurial transformation is cumulative. A university possessing an incubator but lacking research infrastructure, mentoring or industry links may not generate sustained entrepreneurial outcomes. Conversely, an institution combining multidisciplinary education, experiential learning, research, incubation, industry collaboration and digital capability can potentially create a more complete entrepreneurial pipeline.

4.2 Key Performance Indicators

To evaluate NEP-2020's contribution empirically, higher education institutions can adopt a balanced set of quantitative indicators.

Table 3. Suggested Indicators for Measuring NEP-2020's Entrepreneurship and Innovation Outcomes

Category	Key Performance Indicator
Student engagement	Percentage of students participating in innovation/entrepreneurship activities
Skill development	Number of students completing entrepreneurship and innovation modules
Experiential learning	Percentage of programmes incorporating internships/projects
Innovation	Number of prototypes developed annually
Intellectual property	Patents filed/granted and other IP outputs
Incubation	Number of ventures incubated
Start-up creation	Student/faculty/alumni start-ups established
Funding	External funding attracted by incubated ventures
Industry linkage	Industry-sponsored research and joint projects
Commercialisation	Technologies licensed or commercialised
Employment	Jobs generated by institution-linked ventures
Inclusion	Participation of women and underrepresented groups
Sustainability	Number of ventures addressing environmental/social problems

These indicators enable institutions to distinguish between **activity**, **output** and **outcome**. For example, conducting an entrepreneurship workshop represents an activity; developing a prototype represents an output; and establishing a commercially viable start-up represents an outcome.

4.3 Institutional Entrepreneurial Readiness

An analytical readiness model can also be used to assess whether an institution possesses the conditions necessary for entrepreneurial development. Six dimensions are particularly relevant:

Curricular readiness

Faculty readiness

Infrastructure readiness

Research and IP readiness

Industry and investment connectivity

Incubation and mentoring readiness

A practical institutional assessment can assign each dimension a score from 1 to 5, where 1 represents very limited institutional capability and 5 represents highly developed capability.

Table 4. Institutional Entrepreneurial Readiness Framework

Dimension	Core Assessment Area	Weight
Curricular readiness	Multidisciplinary and entrepreneurship-oriented curriculum	20%
Experiential readiness	Internships, projects and problem-based learning	15%
Research readiness	R&D infrastructure and research activity	20%
Incubation readiness	Incubator, mentoring and prototype support	20%
Industry connectivity	Industry projects, investment and technology transfer	15%
Digital readiness	Emerging-technology and digital entrepreneurship capability	10%
Total		100%

The weighting gives greater importance to curriculum, research and incubation because these dimensions provide the structural foundation for sustainable innovation. The framework is intended for institutional benchmarking rather than as an official NEP-2020 government scoring system.

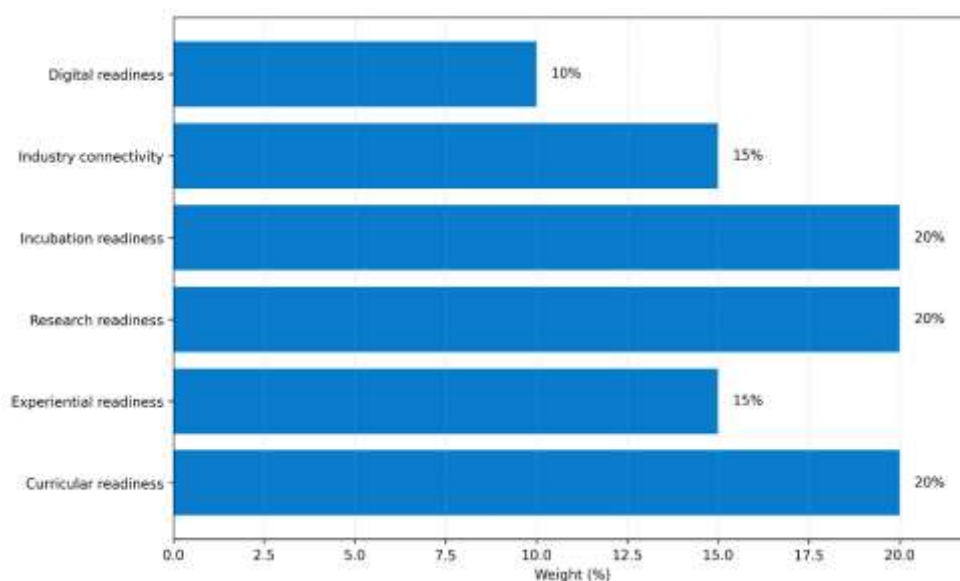


Figure 1. Institutional Entrepreneurial Readiness Framework: Relative Weight Assigned to Key Dimensions for Implementing NEP-2020.

4.4 From Policy to Entrepreneurial Outcome

The complete analytical pathway can therefore be expressed as:

NEP-2020 Policy Provisions

Multidisciplinary + Skill-Based + Experiential Education

Entrepreneurial Knowledge and Competencies

Research + Ideation + Innovation

Prototype + Intellectual Property

Incubation + Mentoring + Industry Linkage

Start-up Formation**Commercialisation and Employment Generation**

This pathway highlights an important distinction: NEP-2020 functions primarily as an **enabling framework**, while actual entrepreneurial outcomes depend on the quality and capacity of institutions implementing the framework.

Current evidence supports this interpretation. A 2026 systematic review of 50 studies reported positive evidence in areas such as flexible curriculum and vocational integration but also identified infrastructure gaps, faculty-readiness problems, inadequate funding and regional disparities as major implementation barriers [15]. Thus, the entrepreneurial potential of NEP-2020 is substantial, but its realisation is dependent upon institutional execution, resource availability and ecosystem connectivity.

4.5 Strategic Institutional Model

For practical implementation, higher education institutions can establish an integrated structure consisting of:

Entrepreneurship Cell → Institution's Innovation Council → Research and Development Cell → Incubation Centre → Technology Transfer/IP Cell → Industry Network → Investors and Funding Agencies

This integrated model prevents entrepreneurship activities from remaining isolated within individual departments. Instead, it creates an institutional pipeline through which a student's initial idea can receive academic guidance, technical assistance, intellectual-property support, incubation, industry validation and financial support.

Government implementation has already moved towards this ecosystem-based approach through Institution's Innovation Councils, Innovation and Entrepreneurship initiatives, Research and Development Cells, industry-linked laboratories and emerging-technology programmes [5], [12]. The next stage is therefore to strengthen the **quality, continuity and measurable outcomes** of these institutional mechanisms rather than treating their establishment alone as evidence of entrepreneurial transformation.

5. CASE STUDY: IIT MADRAS AS AN INSTITUTIONAL MODEL OF ENTREPRENEURSHIP AND INNOVATION

The Indian Institute of Technology Madras provides a useful institutional case for examining how the principles associated with NEP-2020 can be translated into an integrated higher-education entrepreneurship ecosystem. IIT Madras combines research, multidisciplinary education, innovation, incubation, intellectual-property management, industry interaction and entrepreneurship support through a network that includes the IIT Madras Incubation Cell, School of Innovation and Entrepreneurship, Research Park, Centre for Innovation and Nirmaan pre-incubator. The case is particularly relevant because NEP-2020 explicitly promotes start-up incubation, technology-development centres, frontier research and industry-academic linkages within higher education [1]. During FY 2025–26, IIT Madras incubated **112 start-ups**, achieving more than 100 incubations for the second consecutive year. Its cumulative incubation portfolio reached **567 start-ups**, while the institution reported **431 patent filings** during the same financial year [15]. The start-ups covered sectors including artificial intelligence, machine learning, quantum technologies, semiconductors, robotics, aerospace, defence, batteries, climate technology, biotechnology, healthcare, agritech and advanced manufacturing [15]. These areas correspond closely with the emerging technology domains that are increasingly important for India's 21st-century innovation economy.

Table 5. Selected Entrepreneurship and Innovation Indicators of IIT Madras

Indicator	FY 2024–25	FY 2025–26
Start-ups incubated during the year	104	112
Cumulative start-up portfolio	>500	567
Patents filed	419	431
Annual incubation milestone	First 100+ year	Second consecutive 100+ year
Major innovation areas	Deep-tech and emerging technologies	AI, quantum, semiconductor, aerospace, robotics, climate-tech and others
Portfolio valuation	—	₹74,100 crore

Source: IIT Madras and Government of India institutional reporting [15].

The case demonstrates the importance of moving beyond isolated entrepreneurship programmes towards an institutional pipeline. IIT Madras's experience illustrates how student and faculty ideas can receive support at

successive stages, beginning with ideation and pre-incubation and extending towards incubation, intellectual-property protection, funding and commercialisation.

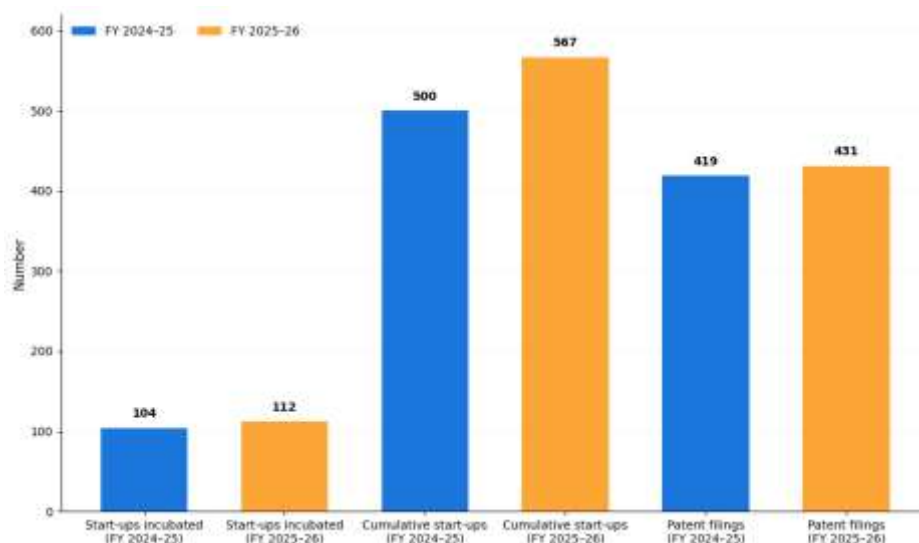


Figure 2. Comparative Entrepreneurship and Innovation Indicators of IIT Madras across FY 2024–25 and FY 2025–26.

5.1 Pre-Incubation and Student Entrepreneurship

Nirmaan, the pre-incubator at IIT Madras, provides an example of early-stage entrepreneurial support. By April 2026, the programme reported **334 active teams, 451 teams trained, 76 startups registered with the Ministry of Corporate Affairs, and 66 intellectual-property filings** [16]. Such a structure is significant because many student ideas fail to progress not because of lack of creativity but because students lack technical mentoring, business validation, market understanding and access to institutional resources.

The pre-incubation model can therefore be represented as:

Student Idea → Team Formation → Technical Validation → Business Feasibility → Prototype → IP/Market Validation → Incubation

This approach aligns with NEP-2020's emphasis on experiential and problem-based learning because entrepreneurial activity becomes an extension of academic learning rather than a completely separate activity.

5.2 Research-to-Start-up Translation

The IIT Madras case also demonstrates the potential relationship between research and entrepreneurship. The filing of 431 patents during FY 2025–26 alongside the incubation of 112 start-ups illustrates the coexistence of knowledge generation and entrepreneurial translation [15].

The importance of this relationship is particularly evident in deep-tech sectors. Research-intensive enterprises generally require substantial technical development before achieving commercial readiness. University-based research infrastructure can therefore reduce the distance between scientific discovery and entrepreneurial application.

5.3 Industry and Investment Linkages

An institutional entrepreneurial ecosystem becomes stronger when academic research is connected with industry, investors and markets. IIT Madras's Research Park and incubation ecosystem provide mechanisms for these interactions. Recent institutional developments also include a deep-tech investment initiative designed to provide capital to technology-intensive ventures in areas such as space, semiconductors, artificial intelligence, quantum technologies, manufacturing and health technology [17].

Such mechanisms address an important weakness of university entrepreneurship: **the funding gap between prototype development and commercial scaling.**

5.4 Case Study Implications for NEP-2020

The IIT Madras experience provides five institutional lessons relevant to NEP-2020.

NEP-2020 Objective	IIT Madras Institutional Mechanism	Observable Outcome
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Multidisciplinary learning	Cross-disciplinary innovation ecosystem	Technology-based ventures
Research and innovation	R&D and IP ecosystem	431 patent filings in FY 2025–26
Entrepreneurship	IITM Incubation Cell	112 start-ups incubated in FY 2025–26
Experiential learning	Centre for Innovation and Nirmaan	Student innovation and pre-incubation
Industry linkage	Research Park and external partnerships	Funding, mentoring and commercialisation
Technology development	Deep-tech incubation	Ventures in AI, quantum, aerospace, semiconductor and other fields

The case does not establish that NEP-2020 alone caused IIT Madras's entrepreneurial outcomes. IIT Madras had a mature research and innovation ecosystem before NEP-2020. Rather, the case demonstrates the type of institutional architecture that is consistent with the policy's objectives and illustrates how the policy principles can operate when supported by strong infrastructure, research capacity and external networks.

6. CHALLENGES AND STRATEGIC MEASURES FOR EFFECTIVE IMPLEMENTATION OF NEP-2020

Despite the strong entrepreneurial orientation of NEP-2020, implementation across India's higher-education system remains uneven. The country's institutions differ substantially in financial resources, infrastructure, faculty expertise, research intensity, industry connectivity and geographical location. Consequently, a uniform entrepreneurial model cannot be expected to produce identical outcomes across institutions.

6.1 Infrastructure and Resource Constraints

Entrepreneurship and innovation require laboratories, prototyping facilities, computing infrastructure, testing facilities, intellectual-property support and incubation spaces. Institutions with limited resources may find it difficult to establish such facilities independently.

A major policy requirement is therefore to create shared innovation infrastructure through regional clusters. Multiple universities can collectively access advanced laboratories, testing facilities, maker spaces, technology-transfer offices and incubation services.

6.2 Faculty Preparedness

Entrepreneurship-oriented education requires faculty members to adopt pedagogical approaches different from conventional lecture-based teaching. Faculty need exposure to design thinking, project-based learning, innovation management, industry practices, intellectual property and start-up development.

Table 6. Major Implementation Challenges and Strategic Responses

Challenge	Institutional Consequence	Strategic Measure
Limited funding	Weak innovation infrastructure	Dedicated innovation and seed-grant funds
Faculty skill gaps	Low-quality entrepreneurial mentoring	Faculty development and industry immersion
Weak industry links	Limited market validation	Formal industry partnership cells
Inadequate incubation	Ideas fail to reach commercialisation	Institutional pre-incubators and incubators
Limited IP expertise	Research remains under-commercialised	Technology-transfer and IPR cells
Regional disparities	Unequal entrepreneurial opportunities	Regional innovation clusters
Risk-averse culture	Low student participation	Recognition and incentives for innovation
Theory-oriented assessment	Limited practical capability	Project and problem-based evaluation
Funding gap after prototyping	Difficulty scaling ventures	Investor networks and seed funding
Digital inequality	Unequal access to innovation resources	Shared digital infrastructure

6.3 Financing the Innovation Pipeline

A recurring problem in university entrepreneurship is the transition from an idea to a commercially viable enterprise. Initial student grants may support prototype development, but subsequent stages require substantially larger resources.

The funding chain should therefore be structured as:

Institutional Grant → Prototype Funding → Seed Capital → Angel/VC Funding → Industry Investment → Scale-up Capital

Institutions should develop formal relationships with banks, angel investors, venture-capital funds, government funding programmes, corporate venture units and deep-tech investors

6.4 Strengthening Intellectual-Property and Technology-Transfer Mechanisms

Universities frequently generate research outputs that do not progress towards commercialisation. A stronger technology-transfer system should provide researchers with assistance in patent evaluation, prior-art analysis, licensing, industry identification, technology valuation and start-up formation.

An institutional technology-transfer office should consequently monitor the complete pathway:

Research Output → IP Assessment → Protection → Industry Matching → Prototype → Licensing/Start-up → Commercialisation

This is particularly important for engineering, biotechnology, artificial intelligence, advanced materials, electronics and other research-intensive fields.

6.5 Regional and Institutional Inequality

A major challenge is the concentration of entrepreneurial infrastructure in leading metropolitan institutions. If NEP-2020's innovation objectives are to have nationwide impact, state universities, colleges and institutions located outside major technology clusters must also receive appropriate support.

Regional innovation hubs can address this problem by connecting several institutions with:

shared laboratories;

common incubators;

industry mentors;

patent support;

investor networks;

digital entrepreneurship platforms; and

regional innovation funds.

Such a model can distribute entrepreneurial capacity more broadly rather than concentrating it within a limited number of elite institutions.

6.6 Measuring Outcomes Rather Than Activities

The establishment of an innovation council, entrepreneurship cell or incubation centre should not itself be considered evidence of entrepreneurial success. Institutions should evaluate outcomes through measurable indicators.

Table 7. Proposed NEP-2020 Entrepreneurship Performance Dashboard

Indicator	Suggested Measurement
Student innovation participation	% of students participating annually
Entrepreneurship education	% of programmes with entrepreneurship components
Experiential learning	% of students undertaking industry/project-based learning
Prototypes	Number developed annually
IP generation	Patents, copyrights and other IP filings
Incubation	Number of ventures admitted
Start-up creation	Number of student/faculty/alumni ventures
Funding	External capital raised
Commercialisation	Technologies licensed/commercialised
Employment	Direct and indirect jobs generated
Industry engagement	Joint projects and sponsored research
Social impact	Ventures addressing societal challenges
Inclusion	Participation across gender and socioeconomic groups
Sustainability	Green and climate-oriented innovations

This outcome-oriented approach would enable universities to identify whether entrepreneurial education is producing measurable changes in innovation capability and enterprise creation.

6.7 Building a University-Wide Entrepreneurial Culture

Entrepreneurship should not remain confined to management departments or specialised innovation cells. Engineering, science, humanities, commerce, social sciences, agriculture, medicine and vocational programmes can all contribute to entrepreneurial development.

A university-wide entrepreneurial culture should include:

Curriculum + Research + Innovation + Industry + Incubation + IP + Funding + Mentoring

When these components operate independently, the entrepreneurial pipeline becomes fragmented. When they operate collectively, students can move progressively from academic learning towards innovation and enterprise creation.

6.8 Strategic Implementation Model

A scalable institutional implementation model can therefore be developed in four phases:

Phase I – Foundation: curriculum reform, faculty development, innovation awareness and entrepreneurship orientation.

Phase II – Capability: laboratories, experiential learning, innovation challenges, IPR training and industry projects.

Phase III – Commercialisation: pre-incubation, incubation, prototype funding, mentoring and market validation.

Phase IV – Scaling: investment, industry partnerships, technology licensing, exports, employment generation and international collaboration.

The success of NEP-2020's entrepreneurial objectives should ultimately be measured through the strength of this complete institutional pipeline rather than through isolated initiatives.

7. CONCLUSION

NEP-2020 provides a comprehensive foundation for integrating entrepreneurship and innovation into Indian higher education. Its emphasis on multidisciplinary education, experiential learning, research, incubation, digital capabilities and industry collaboration can strengthen entrepreneurial competencies and innovation capacity. The IIT Madras case demonstrates how these principles can operate through an integrated ecosystem connecting students, research, intellectual property, incubation, industry and investment. However, nationwide outcomes depend on funding, faculty preparedness, infrastructure, regional equity and effective technology-transfer mechanisms. NEP-2020 can therefore serve as a powerful enabling framework, but sustained entrepreneurial transformation requires institutions to convert its provisions into measurable capabilities, innovation outputs, commercially viable ventures and socially valuable solutions

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