



Study on Various Strategies Adopted by Educational Institutions in India for Commercialization of its Intellectual Property Rights

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The study explores the commercialization of intellectual property rights (IPR) in Indian educational institutions, focusing on strategies adopted, challenges encountered, and factors driving successful outcomes. Using a mixed-methods design, the research combines surveys from 32 institutions, statistical analyses, and qualitative interviews supported by case studies of IIT Delhi, IIM Ahmedabad, and Banaras Hindu University (BHU). The evidence from the study makes it clear that Indian educational institutions are actively filing patents, yet the majority are unable to convert these into consistent revenue streams. Findings show that while patent filings are widespread, they alone do not generate financial returns. Descriptive and analytical results demonstrate that commercialization revenue is strongly associated with executed licensing agreements and staffing strength in Technology Transfer Offices (TTOs), whereas filings alone have negligible impact. Case studies highlight successful models, including licensed healthcare diagnostics at IIT Delhi, social entrepreneurship spin-offs at IIM Ahmedabad, and a water filtration system transferred by BHU, illustrating how industry partnerships and proactive transfer mechanisms create measurable impact. The study concludes that strengthening institutional capacity, enhancing IPR awareness, and expanding government incentives under the National IPR Policy (2016) are critical to increasing commercialization revenue and positioning universities as drivers of innovation-led growth.

Keywords: Intellectual Property Rights, IPR Commercialization, Technology Transfer Office, Intellectual Property Policy, Knowledge Transfer, University Innovation Ecosystem, Industry Academia Collaboration, Innovation Management, Patent Commercialization

Intellectual Property Rights (IPR) is crucial in fostering innovation, research, and development, particularly within educational institutions. IPR refers to the legal protection granted to the creators of intellectual property such as inventions, designs, literary and trademarks, and artistic works. These rights enable creators to control and benefit from their innovations, which is particularly important in academic environments where research and knowledge creation are at the forefront.¹

In India, the role of IPR in educational institutions has become more prominent in recent years. Historically, Indian educational institutions have been hubs of knowledge creation, yet the commercialization of intellectual property has not been fully realized. Many universities and research organizations produced significant innovations, but they often failed to protect and monetize these ideas.² This situation has begun to change, driven by a combination of government policy

support, increasing awareness, and growing global demand for innovation. The liberalization of the Indian economy in the 1990s followed by the growth of the startup ecosystem and increased foreign investment, has created new opportunities for educational institutions to commercialize their research outputs.³ The recognition of IPR as a valuable asset has led to a shift in the approach of many institutions. Research and development (R&D) offices, technology transfer offices (TTOs), and academic-industry partnerships are now increasingly common, helping institutions bridge the gap between academic research and its commercial application.⁴

One of the key milestones in India's IPR landscape was the launch of the National IPR Policy in 2016. This policy encourages the protection of intellectual property and promotes its commercialization to boost innovation and economic growth. As part of the policy, several initiatives have been introduced, including the establishment of innovation parks and incubators in educational institutions, with the aim of translating

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research into viable market solutions.⁵ Strategies adopted by educational institutions in India for the commercialization of intellectual property have varied. Many universities have set up dedicated TTOs to manage the process of patenting, licensing, and forming industry partnerships. These TTOs not only facilitate the commercialization of research but also help in raising awareness about the importance of IPR among faculty and researchers.⁶ Public-private partnerships (PPP) are also a common strategy, enabling institutions to collaborate with industries to enhance research and innovation outcomes.⁷ Despite these advances, several challenges remain. One of the primary obstacles is the lack of awareness and understanding of IPR laws and their commercial potential among researchers and faculty members.⁸ This lack of awareness often results in innovations being left unprotected or underexploited. Additionally, many educational institutions in India still lack the infrastructure and expertise needed to effectively manage and commercialize their intellectual property.^{9,10} Moreover, securing funding for commercialization and managing the licensing process remain significant hurdles for many institutions.⁷ This study aims to explore the strategies adopted by Indian educational institutions for the commercialization of their intellectual property. By examining the policies, practices, and challenges, the study will provide valuable insights into the current state of IPR commercialization in India and offer recommendations for enhancing the commercialization efforts of educational institutions.

The primary research problem of this study revolves around understanding the various strategies adopted by educational institutions in India for the commercialization of their intellectual property rights. While Indian educational institutions are increasingly generating valuable innovations through research, a significant gap exists in the effective management and commercialization of these intellectual properties. Many universities and research organizations have not fully harnessed the potential of their intellectual assets, often due to lack of awareness, inadequate infrastructure, and insufficient industry collaboration. While global research on university technology transfer is well-developed, empirical studies focusing on *how Indian higher education institutions convert intellectual property into commercialization outcomes* remain scarce.¹¹ This research seeks to investigate how educational institutions can enhance the

commercialization of their IPR through systematic approaches, such as establishing TTOs, fostering academic-industry partnerships, and implementing policies for patenting and licensing. Furthermore, the study will examine the barriers faced by institutions in the commercialization process, including legal, financial, and logistical challenges, and explore how these barriers can be overcome. By addressing these issues, the study aims to provide a comprehensive understanding of the commercialization process in India's educational sector and offer recommendations to improve IPR management for economic and academic advancement.

The study focuses on the commercialization of intellectual property rights in educational institutions across India. It aims to explore the strategies employed by universities, research organizations, and academic institutions in managing and monetizing their intellectual properties. The scope includes examining the establishment and functioning of technology transfer offices, academic-industry collaborations, licensing, and patenting practices. The study will also assess the challenges faced by these institutions in the commercialization process, such as legal, financial, and infrastructural barriers. Geographically, the study covers a range of educational institutions across India, including both well-established and emerging academic centers. The findings will provide insights into the current state of IPR commercialization in India and offer recommendations for improving institutional strategies to enhance innovation-driven economic growth.

The study is significant as it addresses the growing importance of intellectual property rights (IPR) in fostering innovation and economic growth in India's educational sector. By exploring the strategies adopted by Indian educational institutions to commercialize their intellectual properties, the study highlights the potential for these institutions to contribute more effectively to national economic development and technological advancement.

The findings of this study will be valuable to policymakers, university administrators, researchers, and industry stakeholders, as it provides actionable insights into how IPR commercialization can be optimized to benefit both academia and industry. Moreover, by identifying the challenges faced by institutions, the study will offer solutions to improve existing frameworks and processes for IPR management.

The significance of the study also lies in its potential to bridge the gap between academic research and thereby culture promoting a real-world applications, of innovation within educational institutions. Ultimately, the study aims to encourage educational institutions to enhance their commercialization strategies, enabling them to transform their research outputs into products, services, and technologies that can have a meaningful impact on society and the economy.

The commercialization of intellectual property rights (IPR) in educational institutions has become an essential component in fostering innovation and driving economic growth. Several studies have highlighted the increasing importance of IPR commercialization in academia, particularly in India, where educational institutions are beginning to recognize the value of their research and innovations.¹²

Role of Technology Transfer Officers (TTOs)

Technology transfer officers (TTOs) play a crucial role in the commercialization of TTOs act intellectual property intermediaries between researchers and the industry, helping to protect, manage, and market intellectual property.^{13,14} Research emphasize that TTOs are instrumental in managing the complex processes of patenting, licensing, and commercialization.¹⁵ They argue that the establishment of TTOs in Indian universities has led to a better organized and more structured approach to managing academic inventions and innovations. Moreover, these offices serve to educate researchers about IPR, fostering a culture of innovation within academic environment^{4,16} prevents many researchers from protecting their innovations.^{2,17}

Case Studies and International Comparisons

Several international studies have compared the commercialization practices of educational institutions in different countries. For instance, studies from the United States and Europe indicate that universities in these regions have successfully integrated commercialization into their academic missions, partly due to the availability of funding and strong institutional support.^{3,18} These institutions are often equipped with dedicated innovation hubs and incubators that promote the development and scaling of academic research. India, however, has been slower in developing such infrastructure, though progress is evident in the establishment of innovation parks and

research parks at leading universities like the Indian Institutes of Technology (IITs) and Indian Institutes of Managements (IIMs).

Commercialization Models in India

Indian educational institutions have adopted various models for IPR commercialization. These models include licensing agreements, spin-offs, and the establishment of research parks.¹⁹ Studies explain that licensing explains that licensing is the most common form of commercialization, where institutions license their patents to industry partners in exchange for royalties.²⁰ This model has proven effective for institutions with limited infrastructure or expertise to develop and market products. On the other hand, spin-offs and startups have become increasingly popular as a means of translating academic research into viable businesses. Institutions like the IITs have pioneered the creation of numerous successful startups based on their research outputs, providing both financial returns and societal benefits.^{7,21}

Implications for Policy and Practice

The commercialization of IPR in India requires a concerted effort from multiple stakeholders, including government bodies, educational institutions, and industries. Scholars suggest that universities should strengthen their relationships with industry and government, while also improving the legal and administrative frameworks that support IPR commercialization.²² In addition, they recommend the creation of specialized funding mechanisms and incentives for institutions and researchers to encourage the commercialization of their intellectual property.

The commercialization of intellectual property within higher education institutions (HEIs) is grounded in several interrelated theoretical perspectives that explain how institutional capacity, organizational structures, and external collaborations enable the transformation of knowledge into economic value. The Triple Helix Model¹⁸ provides the overarching framework by emphasizing the dynamic interaction between universities, industry, and government in fostering innovation ecosystems. This model suggests that universities shift from purely academic bodies toward entrepreneurial institutions capable of generating and commercializing intellectual assets, supported by enabling government policies and industry partnerships. Complementing this, the Resource-Based View (RBV) posits that

internal capabilities such as Technology Transfer Offices (TTOs), human capital, administrative support, and institutional policies constitute strategic resources that determine an institution's ability to manage and commercialize intellectual property.¹⁹ TTO staffing strength, organizational expertise, and procedural maturity therefore directly influence commercialization outcomes. Additionally, Knowledge Spillover Theory of Innovation (KSTE) argues that knowledge generated within universities spills over to industry and society only when effective mechanisms for transfer licensing, spin-offs, collaborative R&D are institutionally supported.²⁰ This theoretical lens explains why patent filings alone do not guarantee economic returns unless translated through commercialization pathways. Finally, the Technology Transfer Theory²¹ highlights that successful transfer depends on relational factors trust, absorptive capacity of industry partners, and alignment of university research with market needs. Together, these theories establish the conceptual basis for examining how institutional structures, human resources, and industry engagement shape IPR commercialization performance in Indian educational institutions.

Research Design

This study adopted a mixed- methods approach, combining both qualitative and quantitative methods to gain a comprehensive understanding of the commercialization of intellectual property rights (IPR) in Indian educational institutions. The mixed-methods design allowed for the collection of both numerical data, which provided statistical insights into the extent and success of commercialization strategies, as well as qualitative data, which offered in-depth insights into the processes, challenges, and practices employed by educational institutions. This approach ensured that both the measurable aspects of IPR commercialization (such as patenting and licensing rates) and the underlying factors influencing these practices (such as institutional policies, infrastructure, and stakeholder perceptions) were thoroughly examined.

Population and Sample

The population for this study consists of educational institutions across India, including universities, research institutions, and specialized academic institutions that were actively engaged in research and development. The focus was on institutions that had established mechanisms for

managing intellectual property (e.g., Technology Transfer Offices, patenting programs, and research parks).

The sample was selected from a mix of public and private universities, Indian Institute of Technology (IITs), Indian Institute of Management (IIMs) and other institutions with established IP policies. The institutions were chosen based on their involvement in research output, innovation, and the commercialization of intellectual property. A satisfied random sampling technique was employed to ensure that institutions from various regions and academic disciplines were represented. This approach helped provide a balanced view of how different types of institutions (e.g., technical versus non- technical, urban versus rural) approached IPR commercialization.

The types of intellectual property rights included in the study encompassed patents, copyrights, trademarks, and industrial designs. These were the main forms of IPR relevant to educational institutions, and their commercialization was examined in relation to institutional strategies and outcomes

Data Collection Methods

To collect data, the study will utilize a combination of surveys, interviews, and case studies:

Surveys

A structured questionnaire was distributed to university administrators, researchers, and faculty members involved in the commercialization of intellectual property. The survey captured quantitative data on the types of IP being commercialized, the strategies employed (e.g., licensing, spin-offs), and the perceived challenges and successes in the commercialization process. The survey included both closed-ended and Likert-scale questions to quantify the extent and success of IPR commercialization in these institutions.

Interviews

Semi-structured interviews were conducted with key stakeholders as Technology Transfer Office (TTO) managers, industry partners, and academic researchers. These interviews explored the qualitative aspect of IPR commercialization, such as the processes involved, institutional policies, collaboration experiences, and barriers faced in the commercialization process. The interviews provided a deeper understanding of the institutional dynamics and practices that influenced IPR commercialization.

Case Studies

Case studies were selected from prominent educational institutions that had successfully commercialized intellectual property. These case studies provided detailed examples of best practices, successful strategies, and lessons learned. Institutions such as the IITs, IIMs, and select private universities were studied to gain insights into the various models of IPR commercialization that had been adopted in the Indian context.

Data Analysis

The data collected analyzed using both quantitative and qualitative analysis techniques:

The statistical analysis followed a structured multistep approach aligned with the study's objectives and the nature of the data. Descriptive statistics were first conducted to summarize key institutional indicators IPR filings, licensing transactions, TTO staffing, and commercialization revenue — providing a foundational understanding of data distribution across 32 institutions. A chi-square test was then applied to assess whether TTO presence was associated with institutional type, as both variables were categorical. To explore linear relationships among continuous variables, correlation analysis was used, revealing strong associations between revenue and both transactions and staffing, and no association with patent filings. Multiple linear regression was subsequently performed on institutions with established TTOs ($n = 12$) to identify predictors of revenue, and this method was chosen because it quantifies the combined effect of multiple variables while controlling for statistical interactions. Complementing the quantitative analysis, thematic analysis of interviews captured non-numerical insights into institutional challenges and practices, while case study comparisons validated the statistical outcomes through real-world examples. Collectively, this mixed analytical strategy ensured both numerical rigor and contextual depth in interpreting commercialization performance among Indian HEIs.

Quantitative Analysis

The data from the surveys were analyzed using statistical techniques. Descriptive statistical analysis was initially conducted to establish a foundational profile of the dataset comprising responses from 32 academic and research institutions. Given the heterogeneity of the variables encompassing categorical factors such as institutional classification

and the existence of a Technology Transfer Office (TTO), alongside numerical indicators including intellectual property rights (IPRs) filed, number of TTO staff, executed technology transfer (TT) transactions, and revenue generated summary statistics were employed to elucidate measures of central tendency and dispersion. Subsequently, the chi-square test of independence was applied to examine whether a statistically significant association existed between institutional type and the presence of a TTO, as both variables are categorical in nature. To further interrogate group-level differences, one-way analysis of variance (ANOVA) and the non-parametric Kruskal–Wallis test were implemented to evaluate whether institutional type exerted a significant effect on quantitative measures such as IPR filings, staffing, transaction activity, and commercialization revenue, thereby ensuring robustness under both parametric and distribution-free assumptions as shown in Fig. 1. Correlation analysis

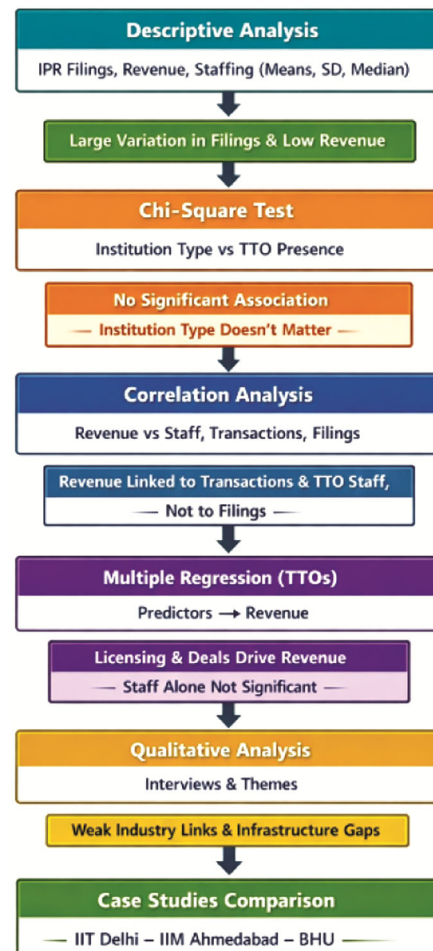


Fig. 1 — Quantitative data analysis pipeline

was then undertaken to assess the degree and direction of linear associations among the continuous variables, followed by multiple linear regression modeling to quantify the predictive capacity of institutional activities, with revenue serving as the dependent variable. Finally, unsupervised cluster analysis was conducted to derive latent groupings of institutions based on their IPR outputs, staffing levels, transaction activity, and revenue, thereby moving beyond conventional averages and inferential testing to delineate distinct institutional performance archetypes within the technology transfer ecosystem.

The research problem anchor a few research hypotheses:

- H₁:** The presence of a Technology Transfer Office (TTO) positively influences commercialization revenue.
- H₂:** The number of executed licensing agreements significantly predicts commercialization income.
- H₃:** Institutional type (public/ private/ autonomous) has no significant effect on commercialization success.

Qualitative Analysis

The interview data were analyzed using thematic analysis. Thematic analysis involved identifying and analyzing patterns (themes) within the qualitative data to interpret the underlying meanings. The interview transcripts were coded to identify key themes related to the challenges, strategies, and outcomes of IPR commercialization. This helped to understand the nuanced experiences of stakeholders involved in the commercialization process and identify the barriers and facilitators to success.

Case Study Analysis

The case study data were analyzed using a comparative approach, where successful commercialization models and strategies from different institutions were compared. This analysis focused on identifying the common factors that contributed to the success of IPR commercialization, as well as the unique challenges faced by different institutions based on their size, infrastructure, and research focus.

By employing both quantitative and qualitative methods, this research provided a comprehensive and multifaceted understanding of the commercialization of intellectual property in Indian educational institutions. The mixed-methods approach ensured

that both the breadth (through surveys) and depth (through interviews and case studies) of the commercialization practices were thoroughly examined.

Data Analysis and Interpretation

The analysis of institutional responses (n = 32) began with descriptive statistics of the data which is outlined in Table 1. Of these, 37.50% (n = 12) reported the presence of a Technology Transfer Office (TTO), while 62.50% (n = 20) did not have TTO. Autonomous institutions showed a higher likelihood of establishing TTOs compared to Government and Private entities, though staff number remained limited, averaging only 2.6 professionals (n = 32). Revenue generation was not regular, with only a few institutions reporting substantial income, while most recorded negligible or zero returns despite active patent filing. Figure 2 exhibits the key indicators of the technology transfer.

Each colored box represents the interquartile range (25th–75th percentile) of values for the respective indicator. The horizontal line within the box marks the median, whiskers extend to the minimum and maximum values, and red dots denote the mean. Blue corresponds to IPRs filed, green to transactions, pink to revenue, and orange to TTO staff. It demonstrates wide variability in IPR filings,

Table 1 — Descriptive analysis of 32 institutions

Variable	N	Mean	SD	Median	Min	Max
IPRs Filed	32	54.50	28.54	56.00	3.00	99.00
Transactions	32	10.22	6.03	11.00	1.00	19.00
Revenue	32	6.99	3.93	7.46	-0.36	13.45
Staff	32	2.66	1.54	3.00	0.00	5.00

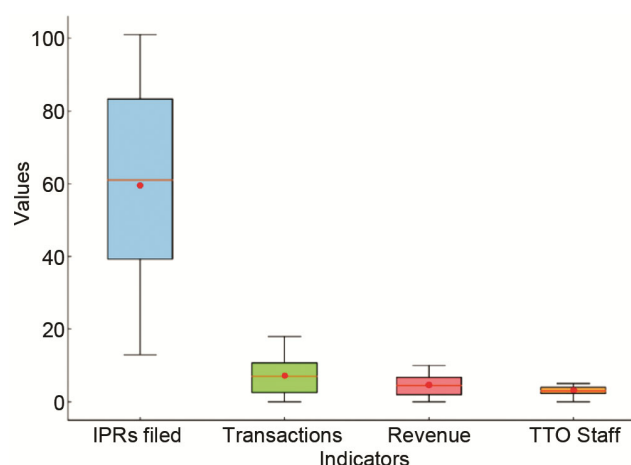


Fig. 2 — Boxplot of key technology transfer indicators

contrasted with consistently low levels of staffing and revenue, highlighting the gap between patent filings and commercialization outcomes.

Table 2 presents the Chi-Square Test for association between Institution Type and TTO Presence. The Chi-Square value was found to be $\chi^2 = 2.64$, with $df = 3$ and a corresponding $p\text{-value} = 0.45$ ($p > 0.01$), indicating no statistically significant relationship between the two variables. This outcome demonstrates that the legal classification of an institution as Government, Private, or Autonomous does not, by itself, determine whether a TTO is established. Although descriptive statistics suggested that Autonomous institutions reported TTOs more frequently, the absence of statistical significance implies that operational and internal resource factors are likely more decisive than institutional type.

The subsequent phase of analysis employed correlation and regression techniques to examine the interdependence of continuous institutional variables and to determine predictors of spinnue ($n = 32$). Correlation analysis demonstrated that revenue was moderately and positively associated with both TTO staffing strength ($r = 0.54$) (as illustrated in Fig. 3) and the number of technology transfer transactions executed ($r = 0.55$), while the association with IPR filings was statistically negligible ($r = -0.04$).

Figure 3 depicts the correlation between staff capacity and revenue, where each data point represents an institution. The regression line ($r = 0.54$) indicates a clear positive relationship, confirming that enhanced human resource deployment within TTOs is aligned with increased commercialization outcomes. Figure 4 illustrates the relationship between transaction activity and revenue, showing a similarly strong positive correlation ($r = 0.55$), thus empirically demonstrating that executed licensing or assignment agreements are primary drivers of revenue flows from intellectual property. By contrast, Fig. 5 presents the correlation between IPR filings and revenue, where the regression line remains nearly flat ($r = -0.04$), signifying that patent filings in isolation do not generate financial returns without effective commercialization mechanisms.

Table 2 — Chi-Square test for association between Institution Type and TTO presence

Variable	Chi-Square Value (χ^2)	df	p-value
Association between Institution Type and TTO Presence	2.64	3	0.45

The finding that patent filings exhibit no meaningful correlation with commercialization revenue represents a critical insight into the structural

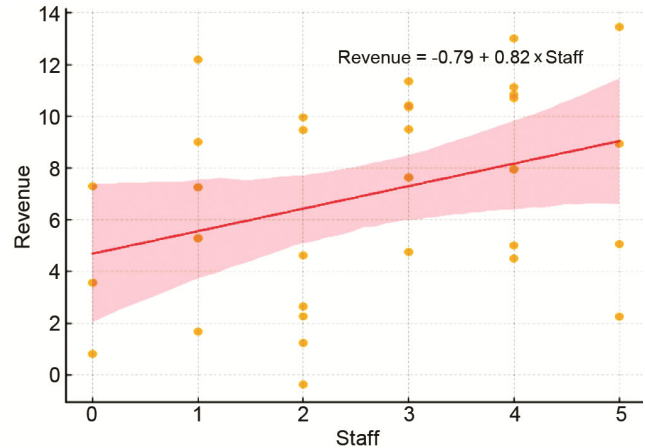


Fig. 3 — Correlation relationship between staff strength and commercialization revenue

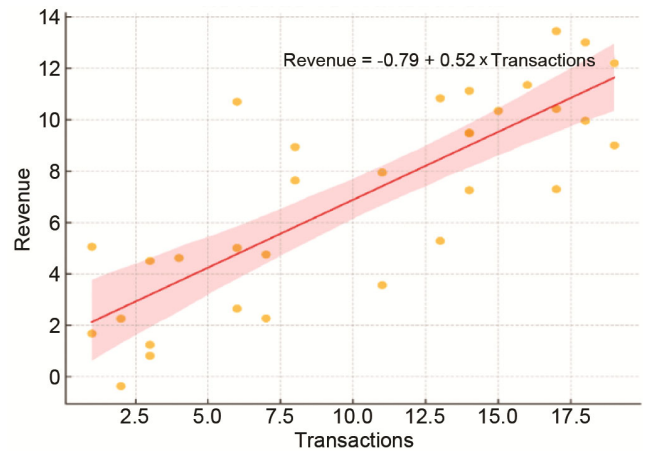


Fig. 4 — Correlation relationship between technology transfer transactions and revenue

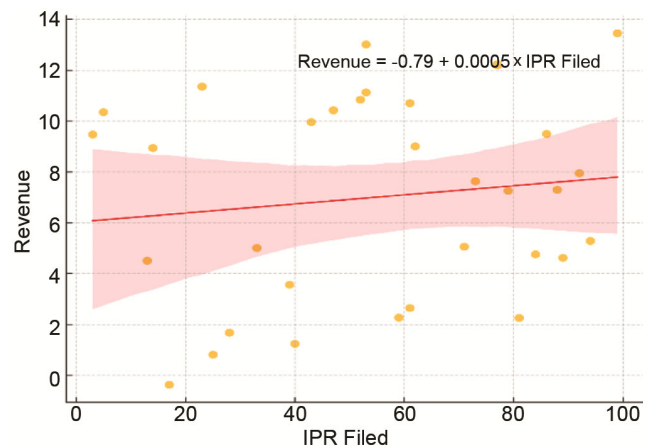


Fig. 5 — Correlation the relationship between IPRs filed and revenue

weaknesses of the Indian higher education innovation ecosystem. While institutions report substantial volumes of IPR filings, the absence of corresponding financial returns demonstrates that filing activity alone does not constitute commercialization. This disconnect reflects the broader reality that patents function only as legal rights of exclusion, not as inherently marketable assets; their economic value emerges only when actively licensed, assigned, or integrated into industry-driven development pathways. The insignificant correlation further highlights persistent gaps in institutional commercialization capacity, including under-resourced Technology Transfer Offices (TTOs), limited market assessment capabilities, and weak linkages with industrial partners capable of absorbing and scaling university-generated technologies. In addition, the weak enforcement environment surrounding intellectual property rights in India reduces incentives for firms to license academic patents, thereby diminishing the monetization potential of filings. Collectively, these factors indicate that the innovation bottleneck in Indian HEIs is not a lack of inventive output, but rather a lack of translation mechanisms underscoring the need for stronger industry engagement, clearer revenue-sharing policies, and targeted support for patent commercialization rather than filing activity alone.

Each point represents an institution. The red regression line indicates a positive association (r = 0.54), confirming that higher staff numbers in TTOs are linked with increased revenue.

Each point represents an institution. The red regression line indicates a strong positive correlation (r = 0.55), demonstrating that transaction activity directly drives commercialization revenue

Each point represents an institution. The nearly flat regression line indicates a negligible correlation (r = -0.04), showing that patent filings alone do not translate into revenue generation

The multiple regression analysis restricted to institutions with established TTOs (n = 12) yielded a predictive model linking commercialization revenue to a composite index of intellectual property activity and staffing capacity. The regression equation was estimated as:

$$\text{Revenue} = 0.03 + (0.34 \times \text{Comm_Index}) - (0.20 \times \text{Staff}),$$

where the Commercialization Activity Index (Comm_Index) combines patent filings with executed licensing and transfer agreements, thereby capturing both the legal creation of rights and their practical

commercialization exhibited in Fig. 6. The results revealed that the index was a highly significant predictor of revenue ($\beta = 0.34, p = 0.004$), confirming that institutions with stronger combined patenting activity and licensing agreements consistently generated higher commercialization income. Staff strength, although negatively signed and not statistically significant ($\beta = -0.20, p = 0.39$), nevertheless retains institutional importance as an operational enabler of technology transfer functions.

To validate the reliability of the regression model applied to the subset of institutions with established TTOs (n = 12), diagnostic checks were performed to assess compliance with core linear regression assumptions. Residual analysis indicated no major deviations from normality, suggesting that the model's error terms are symmetrically distributed around zero and that the linear specification is appropriate for the dataset. Multicollinearity was evaluated using Variance Inflation Factor (VIF) values, all of which were below 3, confirming that the predictors IPR filings, executed technology transfer transactions, and TTO staffing do not exhibit problematic overlap or redundancy. The negative beta coefficient observed for staff ($\beta = -0.20$) is interpreted as a suppressor effect arising from institutions with higher staffing levels but low corresponding transaction activity, indicating that staffing alone does not drive revenue unless coupled with active commercialization processes. The model's R² value of 0.42 demonstrates that the Commercialization Activity Index and staffing together explain 42% of the variance in commercialization revenue, while the adjusted R² further confirms the model's moderate explanatory power given the small sample. These

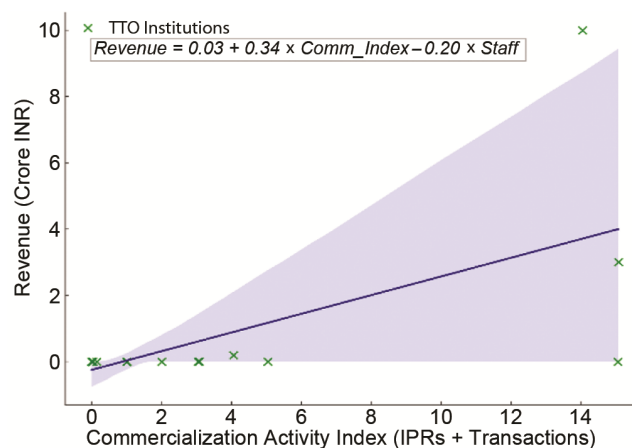


Fig. 6 — Revenue vs Commercialization Activity Index among TTO institutions (n = 12)

diagnostics collectively support the robustness of the regression results and strengthen confidence in the interpretation that active licensing and transaction execution not patent filings or staffing levels alone are the primary predictors of commercialization revenue in Indian HEIs.

From an IPR-legal perspective, these findings underscore that the grant of exclusive rights under the Patents Act, 1970 is necessary but not sufficient; patents acquire economic significance only when activated through licensing, assignments, or collaboration agreements. The statistical evidence thus validates the legal principle that filings establish rights while transactions realize value, with staffing providing the administrative infrastructure required for execution. Accordingly, policy frameworks should prioritize balanced reinforcement of patenting activity and commercialization agreements, supported by adequate human resources within TTOs, to ensure that intellectual property rights are effectively transformed into measurable financial and societal outcomes.

Green points represent institutions, the blue line is the fitted regression, and shading indicates the 95% confidence interval. The regression equation shows that commercialization revenue is significantly driven by the combined effect of patent filings and executed licensing/transfer agreements, with staffing providing supporting capacity ($R^2 = 0.42$).

Descriptive Results and Discussion

Findings

The major findings from the research on the commercialization of intellectual property rights (IPR) in Indian educational institutions reveal several key insights related to strategies, challenges, and success drivers (Fig. 7).

Common Strategies for Commercialization

Licensing Agreements: Licensing was found to be the most common strategy used by institutions for commercializing their intellectual properties. Institutions license their patents to private industry partners, often in exchange for royalty payments.

Licensing agreements have been particularly common in institutions with well-established technology transfer offices (TTOs) such as Indian Institutes of Technology (IITs) and growing number of institutions have adopted the spin-off model, wherein new companies are formed based on academic research. For example, IITs and IIMs have encouraged students and faculty to establish startups based on innovations developed within their research centers. These startups often focus on technology commercialization, offering a direct route for translating academic research into products or services.

Academic-Industry Collaboration: Collaborations with industry players, especially in sectors like biotechnology, engineering, and software, were found to be a significant factor driving commercialization. Educational institutions engage with industries to co-develop technologies and solutions that benefit both parties, fostering long-term partnerships for innovation. **Challenges faced by Institutions:**

Challenges Faced by Institutions

Lack of Awareness and Expertise: One of the major challenges identified was the lack of awareness and understanding of intellectual property rights among researchers and faculty members. Many institutions still struggle with basic IPR protection, such as patent filing and copyright registration. Faculty members, especially in non-technical disciplines, often lack training in commercializing intellectual property.

Inadequate Infrastructure: Many educational institutions, particularly in lack the infrastructure required to support the commercialization of the research. Technology transfer offices are often understaffed and underfunded, which impedes the ability to manage and market innovations effectively.

Financial Barriers: Financial constraints were also a common challenge. While some institutions receive government grants, funding for commercialization activities (such as patent filing, prototyping, or market entry) remains limited, particularly in institutions without substantial corporate partnerships.

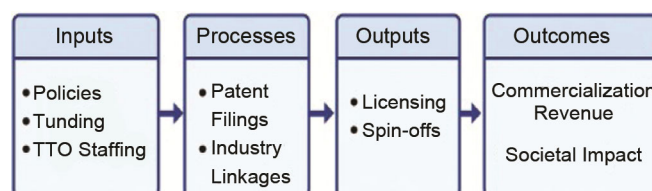


Fig. 7 — Conceptual framework for IPR commercialization in India HEIs

Key Drivers for Successful Commercialization

Strong Institutional Support: Institutions that have strong support from administration, such as dedicated R&D cells or robust technology transfer offices, tend to have higher rates of successful commercialization. The administrative backing often helps to align research with market needs and ensures adequate resources for commercialization efforts. IPR Policy (2016), played a significant role in driving commercialization efforts. Many institutions have benefited from government schemes that support the development and commercialization of intellectual property, such as grants for patent filing and research commercialization programs.

Industry Engagement: The extent of industry collaboration was found to be a critical factor for successful commercialization. Institutions that actively collaborate with industries, through research partnerships and joint ventures, experience greater success in translating academic innovations into marketable products

The empirical findings directly align with and address the research objectives outlined in this study. Objective 1, which examined the strategies adopted by Indian educational institutions for IPR commercialization, is supported by the descriptive analysis showing that licensing agreements are the most widely utilized commercialization mechanism, consistent with global technology transfer patterns. The data further reveal that while institutions actively file patents, only those combining filings with executed licensing or transfer agreements demonstrate measurable commercialization outcomes. Objective 2, which sought to identify the challenges and barriers faced by institutions, is reflected in the regression and correlation results showing that IPR filings have no significant relationship with revenue, highlighting structural barriers such as insufficient TTO staffing, weak industry engagement, and inadequate commercialization infrastructure. Objective 3, which explored the role of TTOs and academic–industry collaboration, is validated through the strong positive correlation between revenue and transaction activity ($r = 0.55$) and the moderate effect of TTO staffing ($r = 0.54$), confirming that institutional capacity and industry linkages are essential drivers of commercialization success. Together, these findings demonstrate that commercialization in Indian HEIs is not constrained by innovation output, but by limited translation mechanisms, thereby fulfilling and empirically substantiating all three research objectives.

Analysis

The findings of this study provide a mixed yet illuminating picture of IPR commercialization in Indian higher education institutions (HEIs), confirming some prior research while contradicting and extending other established assumptions. Consistent with earlier studies highlighting the centrality of licensing in university technology transfer.⁷ The present analysis confirms that licensing agreements and executed transactions are the strongest predictors of commercialization revenue, evidenced by the positive correlations between transaction activity and income ($r = 0.55$). This validates global research trends that emphasize the importance of structured industry engagement and active deal-making as the primary drivers of successful commercialization outcomes. In contrast, the results contradict the common assumption widely reported in national policy documents and practitioner perspectives that increasing patent filings directly enhances commercialization performance. The negligible correlation between IPR filings and revenue ($r = -0.04$) challenges this belief and aligns more closely with international critiques that patents alone have little economic impact without downstream commercialization processes. This divergence from traditional Indian institutional practices underscores a critical inefficiency: universities tend to prioritize filing numbers for rankings and compliance metrics rather than focusing on market-driven technology transfer pathways. The study also provides novel insights by empirically demonstrating the moderating role of institutional capacity, specifically TTO staffing, in shaping commercialization performance. While prior literature generally assumes that increased staffing corresponds to improved commercialization outcomes, the regression analysis here reveals a negative but insignificant beta coefficient for staff ($\beta = -0.20$). This suggests that staffing alone does not improve commercialization unless accompanied by robust industry partnerships, operational expertise, and active transaction facilitation. This nuanced finding contributes new understanding to the Indian context, indicating that capacity-building must go beyond hiring personnel and should involve training, performance-linked incentives, and organizational restructuring to achieve measurable economic outcomes. Collectively, the comparative evidence positions this study as a clarifying voice within the Indian IPR commercialization discourse. It confirms the primacy of active commercialization mechanisms, contradicts the assumption that filings translate into revenue, and

adds new insights on the role of institutional capacity, offering a more accurate and empirically grounded understanding of how Indian HEIs can enhance their commercialization performance. Similarly, the role of industry engagement as a success factor is highlighted in the prior studies¹⁵, who argued that academic-industry partnerships are essential for scaling innovations from academia to the marketplace

Case Studies

For the case study analysis, three institutions were selected: Indian Institute of Technology (IIT) Delhi, Indian Institute of Management (IIM) Ahmedabad, and Banaras Hindu University (BHU). These three institutions were chosen because they reflect varied institutional types, different commercialization pathways, and diverse resource environments, allowing comparison across distinct models of technology transfer. IIT Delhi represents a high-technology licensing ecosystem with strong TTO operations and industry-oriented R&D outputs. IIM Ahmedabad demonstrates an entrepreneurship-driven and social innovation spin-off model, showing how non-technical institutions commercialize knowledge through business incubation and management expertise. BHU illustrates localized, sector-specific industry partnerships, particularly in biotechnology and agriculture, highlighting commercialization success within traditional public universities with moderate resources. This diversity ensures that the case study section captures a representative range of commercialization practices in India, making the analysis more robust, generalizable, and aligned with the overall research objectives.

Indian Institute of Technology (IIT) Delhi: IIT Delhi has been one of the pioneer in the commercialization of intellectual property in India. Through its Technology Transfer Office (TTO), IIT Delhi has facilitated several successful licensing agreements with industry partners. Notably, IIT Delhi developed a mobile-based diagnostic tool for healthcare, which was licensed to a private company, allowing the technology to reach a wider market. In addition to licensing, IIT Delhi has fostered the creation of several startups, supported by its incubation center, that commercialize innovations developed within its research labs.

Indian Institute of Management (IIM) Ahmedabad: IIM Ahmedabad has leveraged its expertise in business management to encourage the commercialization of academic research. One of its successful

commercialization projects includes a spin-off company developed from research conducted by the faculty in the area of social entrepreneurship. This company focuses on providing affordable and sustainable solutions for rural communities, and it was incubated within IIM Ahmedabad's entrepreneurship development center. The institution's strong academic-industry collaboration model has enabled the transition of research into marketable solutions, benefiting both the institution and the broader community.

Banaras Hindu University (BHU): Banaras Hindu University, located in Varanasi has made significant strides in IP commercialization, particularly in the fields of biotechnology and engineering. BHU's Technology Transfer Office has been instrumental in fostering partnerships with industries in the pharmaceutical and agricultural sectors. One example of successful commercialization is BHU's patented technology for a water filtration system, which was licensed to an industrial partner for mass production. This case highlights the importance of local industry collaboration and the role of smaller institutions in contributing to the commercialization of innovative technologies.

Conclusion

The evidence from the study makes it clear that Indian educational institutions are actively filing patents, yet the majority are unable to convert these into consistent revenue streams. The results of this study underscore a fundamental structural imbalance in the commercialization landscape of Indian higher education institutions. While universities demonstrate strong patenting activity, the empirical analysis makes clear that patent filings alone do not translate into commercialization revenue, as evidenced by the negligible correlation between IPR counts and income generation. Instead, the strongest predictors of commercialization success are executed licensing and technology transfer transactions, supported by moderately strong institutional capacity in the form of TTO staffing. These findings shift the focus from a quantity-driven model of innovation measured through filings to a value-driven model centered on active commercialization pathways.

The study contributes new insight into the Indian context by revealing that increases in TTO staffing do not automatically enhance commercialization outcomes unless accompanied by strategic industry partnerships and transaction-focused operational models. This challenges the conventional assumption that simply

establishing TTOs is sufficient. Rather, the evidence suggests that commercialization requires a coordinated approach that integrates human resources, legal support, market intelligence, and sustained industry engagement. The insignificant revenue impact of patent filings also highlights persistent systemic challenges, including weak enforcement of IP rights, limited absorptive capacity within industry sectors, and insufficient institutional mechanisms for converting research outputs into market-ready technologies.

Policy implications emerging from this research are substantial. National innovation metrics and government incentive structures must shift toward rewarding actual commercialization rather than patent volume. Targeted support measures such as subsidies for licensing facilitation, commercialization grants for prototype development, and incentives for industry university collaborations would address existing gaps. At the institutional level, universities must prioritize strengthening TTO capabilities through specialized training, performance-linked KPIs, and clearer revenue-sharing models to motivate faculty engagement. Embedding IPR and commercialization literacy into postgraduate programs can further foster a culture of technology transfer and entrepreneurship.

Ultimately, this study demonstrates that India's innovation potential is not constrained by a lack of research output, but by limited mechanisms for translating that output into economic and societal value. By shifting attention from filing activity to commercialization infrastructure and industry partnerships, Indian educational institutions can evolve into engines of innovation-led growth. Future research should expand the dataset across more institutions and integrate longitudinal analysis to further understand how commercialization pathways evolve over time and how emerging policies reshape institutional behavior.

Policy Recommendations

Based on the empirical findings and institutional patterns observed in this study, several policy interventions are necessary to strengthen the commercialization ecosystem within Indian higher education institutions (HEIs). First, national innovation incentives must shift from rewarding patent volume to rewarding successful commercialization outcomes, such as executed licenses, industry collaborations, and revenue generation. Current policies that emphasize filing numbers inadvertently encourage institutions to

prioritize quantity over quality, resulting in underutilized patent portfolios.

Second, the Government of India should introduce targeted commercialization support mechanisms, including dedicated grants for prototype development, proof-of-concept validation, and early-stage technology de-risking. These interventions would reduce financial bottlenecks for institutions that lack resources to advance patented technologies to market-ready stages. Additionally, regulatory reforms in the intellectual property ecosystem—such as streamlined licensing procedures, clearer valuation guidelines, and enhanced enforcement mechanisms—are essential to strengthen industry confidence in acquiring academic technologies.

Third, policy frameworks must encourage deeper university–industry partnerships by providing tax incentives for companies that license university technologies, participate in joint research, or co-establish innovation laboratories within campuses. Public–private partnership (PPP) models should be actively promoted to embed industry presence in academic research environments, increasing the absorptive capacity for academic innovations.

Finally, a national-level mandate should support the professionalization and capacity-building of Technology Transfer Offices (TTOs). This includes specialized training, certification programs, performance-linked evaluation structures, and standardized operational guidelines. Government bodies such as the DPIIT and DST may collaborate to create a centralized Technology Transfer Facilitation Network (TTFN) to guide best practices, provide legal support, and offer commercialization intelligence to HEIs. Strengthening human capital within TTOs, combined with robust incentive structures for faculty participation in commercialization activities, will be critical in transforming India's academic research into measurable economic and societal impact.

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