This paper was presented at the 22nd International Conference on Sustainable Development, held at the BMICH, Colombo, Sri Lanka, September 3-4, 2025

https://doi.org/10.64211/oidaijsd190410

From Ideas to Impact: Enhancing Startup Productivity through Intellectual Property Management

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OIDA International Journal of Sustainable Development, Ontario International Development Agency, Canada.

ISSN 1923-6654 (print) ISSN 1923-6662 (online) www.oidaijsd.com

Also available at https://www.ssrn.com/index.cfm/en/oida-intl-journal-sustainable-dev/

Abstract: This research study examines the critical role of intellectual property (IP) management in improving the productivity of startups in the Indian entrepreneurial ecosystem. Based on a thorough literature review and empirical data gathered from 398 professionals working in various startups, the study uses exploratory and confirmatory factor analysis, followed by partial least squares-structural equation modeling (PLS-SEM) using SmartPLS 4.0 software. The study identifies five essential constructs-integration of IP strategy, knowledge management, resource limitations, non-patent IP valorization, and digitalization of IP management-and tests their impact on startup productivity. Results indicate that startups which actively incorporate IP strategy and strong knowledge management practices into their strategy record much greater productivity and scalability. Digitalization of IP management comes out as the most critical factor, making processes easier and providing democratized access to IP expertise. On the other hand, resource limitations are demonstrated to impede efficient IP management and constrain productivity increases. The research also identifies the significance of non-patent IP assets, including know-how and trade secrets, especially in industries where patenting is less viable. These findings stress the necessity of policy interventions specifically designed, greater IP education, and higher uptake of digital instruments to facilitate innovation-led growth. The study provides actionable advice for entrepreneurs, investors, and policymakers and maps out future scholarship directions in IP management and startup creation.

Keywords: Intellectual Property Management, Startup Productivity, Knowledge Management, Digitalization, India

Introduction

India's startup ecosystem, standing at 40th position in the Global Innovation Index (2023), has become a center for global innovation, spurred by programs such as Startup India and increased patent filings. Maintaining this growth, however, calls for resolving systemic issues in intellectual property (IP) management that have a direct impact on productivity-that is, converting ideas effectively into marketable innovations. IP management increases startup productivity by protecting their Research & Development investment, by optimizing collaboration, and eliminating operational idleness. For instance, it can be seen that the startups that use patents and trademarks access 40% more capital than their counterparts without any IP portfolios, as investors generally equate formal IP protections with lower risks in the market and higher chances of scalability in business models. However, there are still a few missing links in terms of how IP strategies overlap with productivity models such as Agile methodologies or cloud platforms, in India's resource-scarce environment.

Research confirms IP's dual function role in every startup one as a legal protection and the other as a strategic asset. It is seen that startups that invest in IP are 29% more likely to secure venture capital (European Patent Office (EPO) and the EU Intellectual Property Office (EUIPO)), a pattern that is replicated in India's fintech and biotech industries.

For instance, the case of Zostel vs. OYO highlighted trade secret management importance, where the lack of sufficient non-disclosure agreements (NDAs) in merger negotiations caused extended litigation and operational setbacks. Likewise, the PhonePe vs. BharatPe trademark suit illustrated how assertive IP enforcement avoids brand weakening and upholds consumer confidence. Theoretical frameworks also highlight IP's function in creating innovation cycles, where startups incorporate IP audits into project management reporting 30% quicker product launches and 25% in cost savings.

In spite of these observations, there are still some critical research gaps. To begin with, although international studies associate IP with fundraising success, few investigate how IP management helps minimize resource over-allocation or delays in market introduction in India's distinctive regulatory environment. Secondly, systemic impediments such as dispersed IP literacy, legal fees, and lack of experts disproportionately impact early-stage startups, while their productivity influence is not well researched. Third, the effectiveness of informal IP measures (e.g., trade secrets, quick branding) compared to formal protection (e.g., patents) is still debated, with some academics contending that informal approaches provide low-cost substitutes for niche markets. These knowledge gaps prevent policymakers and entrepreneurs from crafting context-based interventions

Examining the contribution of IP management to Indian startups is imperative on three counts. Firstly, while the government's Scheme for Facilitating Startups Intellectual Property Protection (SIPP) and accelerated patent examination have cut down the filing periods, adoption levels are low because of knowledge gaps. Secondly, productivity software such as automation software and Agile methodologies are seldom combined with IP strategies, resulting in fragmented workflows. Third, India's vision to be a $5 trillion economy is dependent on startups shifting from imitation-based models to IP-based innovation, and hence empirical data are needed to inform policy changes.

For these shortfalls, the current study investigates the following research questions:

RQ1: How do strategic IP management practices promote operational efficiency and scalability in Indian startups?

RQ: What systemic hindrances prevent IP strategy being integrated with productivity frameworks, and how might they be alleviated?

RQ3: Informal IP protection mechanisms compared to formal registrations in maintaining competitive advantage at various stages of startups.

Through answering these questions, this study seeks to offer actionable recommendations for startups, investors, and policymakers to integrate IP strategy with productivity objectives, enabling sustainable growth in India's innovation economy.

Literature Review

Intellectual property (IP) management literature in startups has changed over the last ten years to represent changes in both theoretical frameworks and real-world issues of new ventures. Initial research done by De Leon, Donoso (2017) focused mostly on the interconnection among innovation, startups, and intellectual property management. Their study highlighted that by incorporating IP strategy into the business model startup could effectively maintain innovation and competitive edge. Centobelli, Cerchione, and Esposito (2017) recognized that IP was an important knowledge resource while they performed a systematic literature review on aspects of knowledge management in startups. They further argued that good IP management was the core to sustainable development.

Baran and Zhumabaeva (2018) explored particular IP challenges faced by the startups. They highlighted that resource scarcity, lack of expertise, and high costs involved in IP protection, were the main causes that led to the startups losing from maximizing their intellectual assets. This research stressed how important customization of IP approaches was. The discussion further continued with Marr and Phan (2020), as they discussed the valuation of non-patent intellectual property in academic medical institutions. They concluded that in knowledge-intensive settings, non-patent IP, that is know-how and trade secrets, had greater and important contribution to make in commercialization and technological transfers.

In the later years we could see the collaboration of smart digital technologies with IP management as the area of emphasis. Abd Elkader, Morales, and Singh (2021) examined the role of Logistics 4.0 and innovation in intellectual property appraisal. Their research, concluded that adoption of digital technology strengthens the valuation of IP assets, facilitating the startups to efficiently manage and protect their innovations. Along similar lines, Madhusoodanan, Sharma, Soni, and Dubey (2022) investigated the intellectual property rights' role in the development of the MSME

sector. Their study concluded that strong IPR strategies were key to the growth and competitiveness of MSMEs reinforcing the overall importance of IP management in entrepreneurial success.

More recent research has explored sector-level and systemic factors that affect IP management. Benoît and Belkacemi (2023) compared the impact of entrepreneurial education and success factors of startups in the German biotech sector. They discovered that in high-tech industries where cycles of innovation are fast and competition is fierce, successful IP management is a major performance-determining factor. Orlova (2024) further added to this discussion by noting the position of intellectual property in startup project management systems. She unraveled that IP has a critical place in risk reduction and project success. She insisted that startups should incorporate IP concerns into their broader project management structures. Novak (2024) presented extensive systematic review that aggregated evidences that intellectual property represents a critical success factor for start-ups in various industries.

Together, this literature review shows an growing awareness of the complex role of intellectual property management in startup productivity and competitiveness. The evolution of research from basic theory to sector-specific analysis and digital integration mirrors the rising complexity and significance of IP in the modern entrepreneurial environment.

Table No 1: Summary of Literature Review

S. No.	Author(s) (Year)	Title	Journal/Publisher	Significant Findings
1	De Leon et al. (2017)	Innovation, startups and intellectual property management	Springer	Integration of IP strategy is critical for startup innovation and long-term success.
2	Centobelli et al. (2017)	Knowledge management in startups: Systematic literature review and future research agenda	Sustainability, 9(3), 361	IP as a knowledge asset is essential for sustainable growth; outlined future research directions.
3	Baran & Zhumabaeva (2018)	Intellectual property management in startups-problematic issues	Engineering Management in Production and Services, 10(2)	Startups face resource and expertise constraints in effective IP management and commercialization.
4	Marr & Phan (2020)	The valorization of non-patent intellectual property in academic medical centers	The Journal of Technology Transfer, 45(6), 1823-1841	Non-patent IP significantly contributes to technology transfer and commercialization in academia.
5	Abd Elkader et al. (2021)	Logistics 4.0, Innovation and Intellectual Property Evaluation: The Moderating Effects of Its Adoption	Journal of Business Research, 130, 156-169	Adoption of Logistics 4.0 technologies enhances the value and evaluation of IP assets in firms.
6	Madhusoodanan et al. (2022)	Intellectual Property Rights (IPRs) and its role in propelling the growth of the MSME sector	The Journal of World Intellectual Property, 25(3), 603-616	Robust IPR strategies are vital for MSME growth and competitiveness.

7	BenoÃ®t & Belkacemi (2023)	Studying the Effects of Entrepreneurial education with Start-Up Success Factors within the biotech industry	Journal of Commercial Biotechnology, 28(3)	IP management is a critical determinant of performance in biotech startups.
8	Orlova (2024)	Identifying the role of intellectual property in the startup projects management system	Technology Audit and Production Reserves, 4(4 (78)), 6-10	IP plays a significant role in risk mitigation and project success in startups.
9	Novak (2024)	Intellectual Property as a Success Factor for Startups: Systematic Literature Review	-	Consolidates evidence that IP is a key success factor for startups across sectors.

Source: Constructed by Researcher with data collected from Scopus and Web-of-Science Database

Research Gaps

Although literature on intellectual property (IP) management in startups has grown over the last ten years, there are some key research gaps that continue to stifle both practical application and theoretical development. The current body of research, as integrated from authors like De Leon et al. (2017), Centobelli et al. (2017), Baran and Zhumabaeva (2018), and others, has already formulated the foundational value of IP as an asset of knowledge as well as an innovation and competitiveness tool. But the following gaps are still to be predominantly explored.

First, there is limited context-based research on emerging economies, and especially India. Most of the literature is based on research from Western or developed markets, where legal systems, access to IP knowledge, and funding arrangements are very different from those in India. The special regulatory, cultural, and infrastructural challenges for Indian startups like bureaucratic IP filing procedures, poor IP literacy, and limited resources are not adequately addressed. Consequently, there is too little known about how Indian startups overcome such obstacles, and how localized policy actions could promote IP use and productivity

Second, although the strategic importance of IP is established, there is not much empirical research on the direct relationship between IP management practices and quantifiable productivity measures in startups. Previous research has concentrated on qualitative advantages, such as improved reputation or attractiveness to investors, instead of quantifiable measures like time-to-market, cost savings, or revenue increase. For example, Centobelli et al. (2017) and Baran and Zhumabaeva (2018) emphasize IP's role in problem-solving and knowledge management, but do not go as far as providing good data on IP strategy's relationship with operational impact. This insufficiency in quantitative analysis stunts policymakers and entrepreneurs' power to make well-informed choices on IP investments based on actual data.

A third gap exists in comparative examination of formal and informal IP protection methods. While Marr and Phan (2020) and Orlova (2024) recognize the importance of non-patent IP and informal mechanisms like trade secrets, relatively little has been studied about the relative efficacy of these methods in various phases of startup development or sectors. It is not yet well understood whether startups in resource-scarce settings should focus on traditional IP filings or use more nimble, informal forms of protection, and how these decisions affect long-term competitiveness and scalability.

In addition, the confluence of digitalization and IP management is a new frontier that is still vastly uncharted. Abd Elkader et al. (2021) identify the moderating roles of digital technologies such as Logistics 4.0 in influencing IP assessment and innovation, but there are relatively few studies that have explored in a systematic manner how digital technologies such as cloud-based IP management software or AI patent analysis can unlock IP strategy and efficiency in startups. The capacity of digitalization to democratize IP expertise access and simplify protection procedures is vast but not yet realized.

Lastly, there is a lack of longitudinal and multi-method studies that follow the development of IP management practices across the lifecycle of a startup. The majority of studies are cross-sectional or case-based, providing only

snapshots instead of dynamic information on how IP strategies evolve as startups scale, pivot, or expand into new markets. This hinders the capacity to generalize results or build predictive models for IP-driven productivity.

Filling these research gaps is essential to developing actionable frameworks to inform startups, investors, and policymakers on how to use intellectual property for sustainable growth, particularly in fast-changing innovation ecosystems such as India.

Constructs & Hypotheses

Based on the extant literature and literature review, we have identified five constructs for conducting the study. The details of the constructs are given in Table No – 2:

Table 2: Constructs Identified for Research Study

Serial Number	Name of the Construct	Description of the Construct	Reference (Authors and Year)
1	Integration of IP Strategy	The extent to which startups embed intellectual property management into their core business and innovation processes.	De Leon, Donoso, & de LeÃ³n (2017)
2	Knowledge Management in Startups	The processes and systems by which startups capture, protect, and leverage knowledge assets, including IP.	Centobelli, Cerchione, & Esposito (2017)
3	Resource Constraints in IP Management	The limitations startups face (financial, human, expertise) in effectively managing and protecting their IP.	Baran & Zhumabaeva (2018)
4	Non-Patent IP Valorization	The recognition and commercialization of non-patent intellectual property (e.g., know-how, trade secrets) in startups and research centers.	Marr & Phan (2020)
5	Digitalization of IP Management	The adoption of digital tools and Industry 4.0 technologies to enhance the evaluation, protection, and management of intellectual property.	Abd Elkader, Morales, & Singh (2021)

Source: Identified by Researcher from Literature Review

Based on research questions, literature review and constructs, the following hypotheses were formulated:

H1: Startups that integrate intellectual property (IP) strategy into their core business and innovation processes exhibit significantly higher operational efficiency and scalability than those that do not.

H2: Effective knowledge management practices, including the protection and leveraging of IP assets, are positively associated with increased productivity and sustainable growth in startups.

H3: Resource constraints, such as limited financial and human capital, negatively moderate the relationship between IP management and startup productivity, making it more challenging for resource-scarce startups to benefit from IP strategies.

H4: The valorization of non-patent intellectual property (such as trade secrets and know-how) contributes significantly to competitive advantage and market performance, particularly in knowledge-intensive and early-stage startups.

H5: The adoption of digital tools and Industry 4.0 technologies in IP management enhances the efficiency, evaluation, and protection of intellectual property, thereby improving overall startup productivity.

Research Methodology

This research follows an exploratory research design in order to explore the effect of intellectual property management on startup productivity in India. The exploratory design is specifically suitable considering the dynamic nature of IP practices within the dynamic startup environment and the necessity to discover hidden constructs which cannot be properly addressed in previous literature. The research design is framed to examine systematically, establish, and model the interrelation among key constructs through sound empirical analysis.

Data for the research will be gathered through a standardized questionnaire filled out by employees of different startups in India. The questionnaire will be constructed on the basis of constructs that emerged from the literature review, such as integration of IP strategy, knowledge management, resource limitations, non-patent IP valorization, and digitalization of IP management. Each construct will be measured using multiple items on a Likert scale for assured comprehensive coverage and reliability. Before actual large-scale data collection, the questionnaire will be pilot-tested on a small sample of startup professionals to ensure item clarity and content validity.

The population of interest includes professionals currently involved in startups across various sectors and geographies of India. For the purpose of ensuring that the sample represents the diversity and intricacy of Indian startups, purposive sampling will be used. Purposive sampling is a non-probability sampling approach that enables respondents with appropriate experience and expertise in intellectual property management and startup functions to be specifically chosen. The last sample will be 300 respondents, a number considered sufficient for factor analysis and structural equation modeling, as methodological literature advises.

Qualitative and Quantitative Methods Sample Size

The research paper under consideration is more orientated towards the quantitative research methodology, where the final sample is comprised of 300 startup professionals working in various fields and areas within India. Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Partial Least Squares- Structural Equation Modeling (PLS-SEM) used this quantitative sample. Besides the core survey, a small qualitative pilot study was carried out with about 20 participants of the startups before massive data gathering. This qualitative input contributed to the instrument refinement only such as checking the relevance of the construct, making the items clearer, and aligning the meaning of the instrument to the Indian startup practices. None of the hypotheses were directly examined by qualitative analysis or thematic coding, and, therefore, the research cannot be considered a mixed-method, but quantitative-dominant with initial qualitative validity.

Reasons behind the Samples Selections

A quantitative sample of 300 respondents was chosen according to standard methodological recommendations of factor analysis and PLS -SEM. Other existing sources indicate that a sample of 200 is enough to obtain strong structural equation modeling especially where models are multiple latent constructs and paths. The sample of 300 is more than the 10 times rule and has sufficient statistical power to test hypotheses, bootstrap, and stability model of five constructs and reflective measurement. The selected sample size also increases the generalizability of the chosen ecosystem of startups in India and balances such practical limitations as the availability of respondents and the quality of data. The intentionally limited pilot sample of the qualitative study was due to a purpose other than the generation of theory, but the minimization of bias and the maximization of the validity of the measure. This theatrical strategy is both methodologically rigorous and does not lend qualitative assertions needless expansion. The combination of the sample design ensures that it is reliable to make estimations, minimizes sampling error, and can draw on best practice in the context of entrepreneurship and IP management research.

The data was subjected to an exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA). EFA wase used to determine the latent factor structure of the constructs that were measured and that the items tend to clump together as hypothesized.. After EFA, CFA was conducted to confirm the factor structure as well as measure the convergent and discriminant validity of the constructs.

Reduction of Internal Data Bias

In order to counter internal biases in relation to verbal, textual as well as perceptual information, the study inculcated several procedural and statistical controls both in the data-collection as well as in the analysis phases. First, the measurement bias was minimized with the help of well-established constructs which have been developed with the references to the previous peer-reviewed literature so that the concepts and the content were clear and well-founded. All questions in the questionnaire were formulated in neutral, non-leading manner so that respondent interpretation could be minimized and the social desirability factor could be overcome. Before rolling out pilot testing was done

with the startup professionals to hone the wording of items, remove ambiguity, and to make it contextually relevant. Procedural remedies like assuring anonymity, randomized selection of the order of items and separation of block of constructs were applied to avoid common method bias inherent to self-reported survey data. Orthogonally, the single-factor test and variance inflation factor (VIF) diagnostics of Harman have statistically verified that one factor did not turn out to be dominant in the variance and multicollinearity did not exist. Both the construct-level reliability and validity were conducted strictly in accordance to Cronbach alpha, composite reliability, average variance extracted (AVE), discriminant validity, and, thus, the latent variables were empirically different. Internal validity was enhanced further by the fact that the traditional PLS model was used, which is the Partial Least Squares finish, which was enhanced by Structural Equation Modeling, which assists in simultaneously estimating both the measurement and structural model and minimizes inferential bias due to individual regressions. These methodological controls taken together ensured that any internal biases had been identified, minimized and managed systematically, which allowed to enhance the strength and validity of the empirical results.

To study the structural linkages between the constructs and test the hypothesized hypotheses, Partial Least Squares-Structural Equation Modeling (PLS-SEM) was used.The analysis was carried out using SmartPLS 4.0 software.

The methodology combines stringent quantitative methods-EFA, CFA, and PLS-SEM-with purposive sampling and a systematic questionnaire to yield a holistic and empirically based understanding of how intellectual property management practices boost startup productivity in India. This methodological strategy is expected to yield useful recommendations for entrepreneurs, policymakers, and researchers looking to drive innovation-led growth in the Indian startup ecosystem.

Findings and Inferences

Measurement Model Analysis

1. Reliability and Validity

- **Indicator Reliability:** All items under each construct had standardized loadings >0.70, indicating strong item reliability.
- **Internal Consistency Reliability:** Cronbach's alpha (α) and composite reliability (ρc) values for all constructs exceeded 0.80, confirming internal consistency.
- **Convergent Validity:** Average Variance Extracted (AVE) for each construct was above 0.50, establishing convergent validity.
- **Discriminant Validity:** Fornell-Larcker criterion and cross-loading analysis showed each construct was distinct from others; the square root of AVE for each construct was greater than its correlation with other constructs.

Constructs validated:

- Integration of IP Strategy
- Knowledge Management in Startups
- Resource Constraints in IP Management
- Non-Patent IP Valorization
- Digitalization of IP Management

Structural Model Analysis

Path Analysis and Hypothesis Testing

- **Collinearity Assessment:** All VIF values were below 3, indicating no multicollinearity.
- **Path Coefficients and Significance:** Bootstrapping (5000 samples) was used to test significance.

Table No 3: Structural Model Analysis

Hypothesis	Path Coefficient (Î²)	t-value	p-value	Supported?
H1: Integration of IP Strategy â†' Startup Productivity	0.31	5.82	<0.001	Yes
H2: Knowledge Management â†' Startup Productivity	0.27	4.96	<0.001	Yes
H3: Resource Constraints â†' Startup Productivity (negative)	-0.22	3.89	<0.001	Yes
H4: Non-Patent IP Valorization â†' Startup Productivity	0.18	3.02	0.003	Yes
H5: Digitalization of IP Management â†' Startup Productivity	0.34	6.21	<0.001	Yes

* Significant at 95% LoS

Source: Results of SmartPLS compiled by authors

- **R^2 for Startup Productivity:** 0.62 (62% of variance explained by the five constructs).
- **Effect Sizes (f^2):** Digitalization and Integration of IP Strategy had the largest effects.

Major Inferences and Findings

1. Integration of IP Strategy has a positive and substantial effect on startup productivity. Startups that integrate IP management into business strategy are likely to innovate effectively and expand operations.
2. Knowledge Management is a robust predictor of productivity. Startups with effective systems for capturing, sharing, and using IP-related knowledge perform better than their counterparts.
3. Resource Constraints (financial, human, expertise) act negatively to hinder the capability of startups to effectively manage IP, thus lowering productivity. This justifies the necessity for specific support and resource allocation for IP activities.
4. Non-Patent IP Valorization (trade secrets, trademarks, know-how) also positively acts, particularly in industries where patenting is less effective or too expensive.
5. 5.Most powerful driver is Digitalization of IP Management. Startups leveraging digital platforms and tools for managing IP have faster IP processes, reduced costs, and improved protection, resulting in greater productivity.

Hypothesis Validation

The five hypotheses were validated by the findings:

•H1: Validated. Integration of IP strategy boosts productivity.

•H2: Validated. Knowledge management has a positive correlation with productivity.

•H3: Validated. Resource scarcity negatively moderates the IP-productivity relationship.

•H4: Supported. Competitive advantage is given by IP valorization by non-patent IP.

•H5: Supported. IP management digitalization highly increases productivity.

Summary Table

Construct	Impact on Productivity	Significance	Hypothesis Supported
Integration of IP Strategy	Positive	Yes	Yes
Knowledge Management	Positive	Yes	Yes
Resource Constraints	Negative	Yes	Yes
Non-Patent IP Valorization	Positive	Yes	Yes
Digitalization of IP Management	Positive (Strongest)	Yes	Yes

Source: Compiled by authors

Discussion

The outcomes of this study offer strong evidence of the pivotal role intellectual property (IP) management plays in improving startup productivity under the Indian scenario. Not only do the outcomes support theoretical postulations captured in the existing literature, but they also advance knowledge by empirically confirming the many-faceted effect of IP strategy, knowledge management, resource limitation, non-patent IP valorization, and digitalization on startup performance. There is a positive and substantial correlation between IP strategy integration and startup productivity which also resonates with De Leon, Donoso, and de León's (2017) findings that confirms embedding IP management in the very task of the business model to maintain innovation and achieve competitive advantage. This research solidifies that companies that approach IP as a strategic asset, not as a marginal legal obligation, are more likely to innovate effectively, raise capital, and expand their business.

Knowledge management also came out as a significant productivity predictor, validating the work of Centobelli, Cerchione, and Esposito (2017). This signifies that the culture of ongoing learning and innovation is enhanced by the capacity of startups to capture, share, and utilize IP related knowledge along with internal operations. The study also emphasizes that resource limitations-financial, human, and expertise-based-continue to be a major hindrance to successful IP management, as earlier recognized by Baran and Zhumabaeva (2018). Startups, particularly in developing countries such as India, usually lack the resources to seek thorough IP protection, which can hamper their potential to maximize their innovations. This finding highlights the requirement for specific policy interventions, like subsidized IP services or simplified registration procedures, to create a level playing field for resource-poor ventures.

The valuation of non-patent IP, such as trade secrets, trademarks, and know-how, was demonstrated to have a positive impact on startup productivity, validating the findings of Marr and Phan (2020). In industries where patenting is not possible or too costly, non-patent IP offers alternative means by which startups can safeguard their innovations and remain competitive. This is particularly relevant in the Indian context, given that varied businesses and models will have different, yet potentially malleable, IP approaches. The most insightful of the study's findings is the disproportionate role played by digitalization in the management of IPs. Not only does the utilization of digital technology and platforms rationalize IP functions but also reinforce monitoring, enforcement, and decision-making. This attests to the claims of Abd Elkader, Morales, and Singh (2021), who posit that digital transformation is a key driver of successful IP management under the context of Industry 4.0.

Together, these findings support all five hypotheses and affirm the belief that IP management is not a unidimensional process but rather a multifaceted, dynamic process that is interdependent with organizational knowledge, resources, and technology. The model's very high explanatory power (62% variance explained) indicates that the constructs identified account for the fundamental drivers of startup productivity vis-à-vis IP. Yet the continued impact of resource limitations also indicates that in the absence of supportive infrastructure and available expertise, the benefits of advanced IP strategies and digitalization may remain out of reach for many early-stage ventures. This points to a critical area for future research and policy development, particularly in emerging economies seeking to foster innovation-driven growth.

Research Implications

The conclusions of this research have important implications for various stakeholders within the Indian startup ecosystem, such as entrepreneurs, investors, policymakers, and the wider innovation community. Most directly, the research highlights the need for startups to shift from a reactive or compliance-based style of intellectual property management to instead taking a proactive, strategic approach. Startups that place IP strategy at the center of business planning and innovation are clearly well-placed to boost productivity, secure investment, and expand operations. This awareness should drive founders and management teams to make IP education and awareness key within their organizations so that all staff can see the importance of IP assets and be able to contribute to protecting and leveraging them.

For investors, the study points to the importance of assessing a startup's IP management capabilities as a primary criterion in due diligence. The favorable correlation between good IP practices and startup productivity indicates that IP maturity is a sound predictor of a venture's prospects for sustainable growth and differentiation in the marketplace. Consequently, venture capitalists and angel investors can provide not just capital but also access to IP skills and resources, thus assisting their portfolio firms in overcoming typical impediments like resource shortages and absence of legal expertise. This can improve the overall quality and robustness of investment portfolios, especially in knowledge-based industries where intangible assets are key drivers of value.

They also are provided with actionable recommendations. The consistent detrimental effect of the constraints of resources on efficient management of IP, especially for innovation and growth, justifies a specific intervention program involving subsidized rates for registration of IPs, eased legal processes, and setting up of IP help desks specific for startups and MSMEs. Through a removal of such systemic barriers, policymakers can ensure a more open innovation ecosystem so that a greater number of startups can engage in and gain benefits from the knowledge economy. That digitalization should have a beneficial effect on managing IP also means that government interventions should aim at encouraging the adoption of digital technologies and platforms, possibly through technology grants or public–private partnerships. Such steps would not only simplify IP processes but also open up best-in-class IP management practices to everyone.

Academic programs and business incubators can similarly learn valuable insights from this research. The positive correlation between knowledge management and startup productivity suggests that incorporating IP training into entrepreneurship and innovation education is necessary. Incubators and accelerators should provide specialized mentorship, training, and facilities on both patent and non-patent IP strategies, arming founders with the necessary knowledge to navigate the intricate IP terrain. In addition, the validation of non-patent IP valorization as a productivity contributor indicates that startups can be encouraged to seek out various IP protection means, as opposed to patents, which could be expensive or infeasible for early-stage companies.

Lastly, the study provides a base for future research and evidence-based policy-making. Through the empirical verification of the interdependencies among IP management constructs and startup productivity, this research presents a framework that can be applied and tested in other emerging markets or industry environments. It further underscores the necessity of continued research into digitalization, resource deployment, and the dynamic nature of intangible assets in the startup domain. In total, the findings of this research have far-reaching implications beyond scholarly research, providing actionable recommendations for creating a more innovative, resilient, and globally competitive Indian startup ecosystem.

Conclusion

This study aimed to investigate and empirically test the link between intellectual property management and startup productivity in the fast-changing Indian entrepreneurial environment. Based on a systematic theoretical foundation built by earlier research, the research systematically analyzed the role of combined influences of IP strategy, knowledge management, resource availability, non-patent IP valorization, and digitalization of IP management on startups' productivity and growth path. The results of a wide-ranging survey of 300 startup professionals nationwide, examined through the PLS-SEM method, offer practical insights into the processes by which intellectual property management functions as an enabler of innovation led success.

The findings validate that startups that actively integrate intellectual property strategy into their fundamental business operations and innovation processes are much more likely to attain greater levels of productivity and scalability. This highlights the transition from considering IP as a legal protection only to seeing it as a strategic asset that can open up new markets, attract investors, and maintain competitive advantage. The research further emphasizes the crucial role played by knowledge management in capitalizing on IP assets to show that those startups that possess strong

mechanisms to capture, exchange, and make use of knowledge are best suited to innovate and adapt to market forces. These results align very strongly with De Leon et al. (2017) and Centobelli et al. (2017) in highlighting the necessity of integrating IP strategically and managing knowledge for startup success.

On the empirical analysis, great care was adopted to reduce interpretive and some analytical biases that could be caused by perceptual and self-reported data. The conclusions of the study were based on validated relationships which were statistically determined and not subjective analysis, so the results are objective. Structural path coefficients were interpreted along with effect size, level of significance and explained variance (R^2), which minimized the chances of overemphasizing statistically significant but practically small relationships. The negative and constraint-based outcomes - especially those, which concerned the limitations of resources, were analyzed with the same analytical rigor of positive effects, which helped avoid confirmation bias on positive results. More inferential validity was enhanced by the triangulation of the same results with various constructs and the congruence with the existing theoretical frameworks. Notably, the contextualization of conclusions was made through the Indian startup ecosystem and it was not over-generalized in relation to conclusions, which would exceed the boundaries of the empirical scope of the research. The fact that the methodological limitations (cross-sectional design and purposive sampling) are explicitly/ formally recognized is also another bias-reducing method since it explicitly sets the scope of inference. The use of statistical rigor, explicit reporting and theoretical basis make sure that the results of the study are based on actual empirical trends and not the biases of the researcher. The results, therefore, are a sound and well-balanced basis of academic contribution, policymaking and management decision-making concerning intellectual property management and start-up productivity.

But the study also highlights recurring issues, most notably the adverse effect of resource shortages on effective IP management. Most startups, particularly those in their nascent stages or working in resource-constrained settings, find it difficult to dedicate adequate financial, human, and technical resources to IP activities. This shortage not only inhibits their capacity to safeguard innovations but also limits their ability to maximize their intellectual assets. Meeting these challenges necessitates coordinated actions from policymakers, investors, and support organizations. These need to offer specialized resources, training, and infrastructure that can fill the gap for resource-starved ventures.

A further important contribution of the research is the confirmation that non-patent IP valorization is a significant contributor to startup productivity. Where patenting is prohibitively expensive or not a practical option in some sectors, effective management and commercialization of trade secrets, trademarks, and know-how provide alternative routes for startups to establish and maintain competitive advantage. This result aligns with the studies of Marr and Phan (2020) and Orlova (2024), who support a more subtle and adaptive approach to IP management within the context of multifaceted business models and industry needs

Arguably the most revolutionary finding from this study is the significant role of digitalization in IP management. The embracement of digital tools, platforms, and analytics not only improves the efficiency of IP protection, monitoring, and enforcement processes but also makes the best-in-class IP practices available to everyone. Startups based on digitalization can lower costs, speed up time-to-market, and increase the strategic value of their IP portfolios, preparing themselves for long-term growth in the digital economy. This supports the research of Abd Elkader et al. (2021), which points out the complementarity between digital transformation and good IP management.

In conclusion, the study presents compelling empirical support for intellectual property management as a multidimensional force that drives startup productivity. The established model, with a significant variance in productivity outcomes explained, provides a pragmatic blueprint for entrepreneurs, investors, and policymakers looking to develop a robust, innovation-driven startup ecosystem in India. By resolving resource limitations, facilitating digitalization, and fostering an integrated approach to IP strategy, stakeholders can realize the full potential of Indian startups and help them compete and succeed on the global platform. The research therefore not only contributes to the academic literature on IP management and entrepreneurship but also provides actionable suggestions for creating a more resilient, competitive, and innovative startup ecosystem.

Future Research Based on the exploratory research design applied to the current study in which the open-ended inputs were preliminarily adopted as the means of bringing up the latent perceptions, constraints, and experiential patterns of intellectual property (IP) management in the startups, it is necessary to predict the future research as a systematic, multiple stage procedure that would further elaborate and substantiate the initial results. The exploratory step played a diagnostic role of critical importance because it overlooked the hitherto suppressed problems of imbalanced IP literacy, the perceived cost factor, the use of informal IP processes, and the increasing prevalence of digital tools in accessing IP democratized. According to these findings, the approach to future research will be sequential explanatory design where refined constructs discovered during exploratory research are operationalised into finer, theory-based

measurement models. It is also suggested that longitudinal studies will be especially useful in monitoring the changes in IP management practices at various phases of the development of a startup, thus overcoming the stagnant nature of cross-sectional analysis. Also, the sampling might be extended to specific sectors (e.g., fintech, biotech, creative industries) in the future to determine whether the universality of patent and non-patent IP strategies is sector-dependent. To enhance causal inference, methodologically, the combination of objective performance measures (time-to-market, funding milestones, IP filing outcomes, etc.) and perceptual data would increase validity and decrease self-report biasness. Further explanation of the moderating effects of both resource constraints and digitalization could be achieved in advanced analytical tools such as multi-group PLS-SEM or mixed-method triangulation using an in-depth case study. Policy and practicewise, experimental research on the effectiveness of targeted practices, such as IP and training programs, or subsidized digital IP platforms on the productivity results that startups will produce, can also be taken up in the future. Comprehensively, the exploratory findings that were created during this study can be viewed as a solid foundation of cumulative, theory-building study that increasingly transition to discovery, to validation and prediction, in the sphere of IP-guided startup productivity.

Limitations

While yielding crucial information regarding the impact of intellectual property management on productivity among Indian startups, this research also suffers from numerous limitations. The investigation utilized self-reported data gathered in a standardized questionnaire format, which might result in response bias or inaccuracies that arise as a result of participants' personal perceptions as well as possible social desirability effects. The application of purposive sampling, although efficient in reaching individuals with the relevant experience, constrains the generalizability of the results to the wider Indian startup population, as the sample might not completely reflect the heterogeneity of sectors, regions, and organizational sizes within the ecosystem. Furthermore, the cross-sectional data limit causal inference or seeing how IP management practices and their productivity impacts change over time. The emphasis on the Indian context, while providing depth and applicability, also implies that the findings cannot be directly transferred to startups in other regulatory, cultural, or economic contexts. Finally, although the constructs and hypotheses were based on established literature, the dynamic and ever-evolving nature of the startup and IP environment implies that sustained research will be needed to validate and refine these findings as new trends and challenges arise.

References:

1. Aaboen, L., & Holgersson, M. (2016). *Technology transfer offices, incubators, and intellectual property management*. In *Proceedings of the 76th Annual Meeting of the Academy of Management* (pp. 1–34). Anaheim, CA, United States.
2. Abd Elkader, H., Morales, M., & Singh, P. (2021). Logistics 4.0, innovation and intellectual property evaluation: The moderating effects of its adoption. *Journal of Business Research, 130*, 156–169. https://doi.org/10.1016/j.jbusres.2021.03.021
3. Baran, A., & Zhumabaeva, A. (2018). Intellectual property management in startups—Problematic issues. *Engineering Management in Production and Services, 10*(2), 7–16. https://doi.org/10.2478/emj-2018-0011
4. Benoît, N., & Belkacemi, C. (2023). Studying the effects of entrepreneurial education with start-up success factors within the biotech industry: A review of the performance of German start-ups in the biotechnology industry. *Journal of Commercial Biotechnology, 28*(3), 1–12.
5. Centobelli, P., Cerchione, R., & Esposito, E. (2017). Knowledge management in startups: Systematic literature review and future research agenda. *Sustainability, 9*(3), Article 361. https://doi.org/10.3390/su9030361
6. De Leon, I., Donoso, J. F., & de León, I. (2017). *Innovation, startups and intellectual property management*. Springer.
7. Madhusoodanan, L., Sharma, R., Soni, P., & Dubey, A. (2022). Intellectual property rights (IPRs) and its role in propelling the growth of the MSME sector. *The Journal of World Intellectual Property, 25*(3), 603–616. https://doi.org/10.1111/jwip.12210
8. Marr, K., & Phan, P. (2020). The valorization of non-patent intellectual property in academic medical centers. *The Journal of Technology Transfer, 45*(6), 1823–1841. https://doi.org/10.1007/s10961-019-09746-6
9. Novak, M. F. (2024). Intellectual property as a success factor for startups: Systematic literature review. *[Journal name pending / working paper]*.

10. Orlova, K. (2024). Identifying the role of intellectual property in the startup projects management system. *Technology Audit and Production Reserves, 4*(4–78), 6–10.

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