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An Empirical Study of Role of Artificial Intelligence in Mobilising the Start-up Ecosystem in Maharashtra

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Abstract

Artificial Intelligence (AI) has emerged as a transformative force in the global start-up ecosys-tem, enabling ventures to scale operations, optimise decision-making, and create novel value propositions. Maharashtra, being one of India's leading start-up hubs with over 15,000 DPIIT-recognised start-ups, presents a unique context for examining the empirical role of AI in mobil-ising entrepreneurial growth. This study investigates the extent, nature, and impact of AI adop-tion among start-ups across six key sectors in Maharashtra—FinTech, HealthTech, AgriTech, EdTech, E-Commerce, and SaaS/IT. Employing a mixed-methods research design with a strat-ified random sample of 220 working professionals and founders across these sectors, the study combines quantitative survey data with qualitative insights from semi-structured interviews. Chi-square tests reveal statistically significant associations between AI adoption levels and start-up performance metrics including revenue growth ($\chi^2 = 18.72$, $p < 0.01$), customer acquisition efficiency ($\chi^2 = 15.34$, $p < 0.01$), and operational scalability ($\chi^2 = 12.89$, $p < 0.05$). The find-ings indicate that 67.3% of surveyed start-ups have integrated AI into at least one core business function, with SaaS/IT and FinTech sectors leading adoption. However, significant challenges persist, including high implementation costs (72%), scarcity of skilled AI talent (68%), and data quality constraints (65%). The study proposes an AI Mobilisation Framework for start-up ecosystems, identifying critical enablers, barriers, and policy interventions. Results contribute to both entrepreneurship theory and practice by offering empirical evidence on AI's catalytic role in regional start-up ecosystems.

Keywords: Artificial Intelligence, Start-up Ecosystem, Maharashtra, Entrepreneurship, Innovation, Digital Transformation, FinTech, Start-up Performance

1 Introduction

The contemporary entrepreneurial landscape is undergoing a paradigmatic shift driven by the rapid proliferation of Artificial Intelligence (AI) technologies. From natural language processing and computer vision to predictive analytics and generative AI, these technologies are funda-mentally reshaping how start-ups conceptualise, build, and scale their ventures [29, **?**]. India's start-up ecosystem, ranked as the third largest globally, has witnessed an unprecedented integra-tion of AI capabilities across diverse sectors, with Maharashtra emerging as a critical epicentre of this transformation [28, 36].

Maharashtra contributes approximately 18% of India's total technology start-ups and houses major innovation clusters in Mumbai, Pune, and Nagpur [**?**]. The state government's proactive policies, including the Maharashtra State Innovation Society and dedicated AI research grants, have created a conducive environment for AI-driven entrepreneurship [25]. Despite this momen-tum, there remains a significant empirical gap in understanding how AI specifically mobilises the start-up ecosystem—that is, how it functions not merely as a tool but as a catalyst that accelerates venture creation, enhances operational efficiency, and attracts investment capital.

The theoretical underpinnings of this study draw upon the Resource-Based View (RBV) of the firm [3], which posits that unique, inimitable resources constitute the foundation of sustained competitive advantage. AI capabilities, when embedded within start-up processes, represent such a resource—one that is simultaneously technological, human-capital-intensive, and organi-sational in nature. Furthermore, the Technology Acceptance Model (TAM) [10] provides a lens for understanding the determinants of AI adoption among entrepreneurial teams, particularly perceived usefulness and ease of integration.

This study addresses three primary research questions: (RQ1) What is the extent and na-ture of AI adoption

among start-ups across different sectors in Maharashtra? (RQ2) What is the relationship between AI integration and measurable start-up performance outcomes? (RQ3) What are the critical enablers and barriers to AI adoption within the regional start-up ecosys-tem? By examining these questions through an empirical mixed-methods approach, the research contributes to the nascent but growing literature on AI-driven entrepreneurship in emerging economies [20, 41].

2 Literature Review

2.1 AI as a Catalyst in Entrepreneurial Ecosystems

The concept of entrepreneurial ecosystems, first systematically articulated by Isenberg [17], de-scribes the dynamic interplay of actors, institutions, and cultural attitudes that collectively foster venture creation and growth. Recent scholarship has extended this framework to incorporate digital technologies as ecosystem-level infrastructural components [2, 27]. Within this digital ecosystem paradigm, AI occupies a unique position: it simultaneously functions as an infras-tructural resource (enabling data-driven decision-making), a product differentiator (powering intelligent features and services), and an operational accelerator (automating routine processes and enhancing productivity) [22, 33].

Empirical evidence from developed economies suggests that AI-adopting start-ups exhibit 25–40% higher productivity growth compared to non-adopting peers [6, 14]. However, the transferability of these findings to emerging economy contexts such as India remains contested. Studies by Nambisan [26] and Liér [20] highlight that institutional voids, infrastructural limi-tations, and cultural factors significantly moderate the relationship between AI adoption and entrepreneurial performance in developing countries. Maharashtra, with its relatively mature technology infrastructure and policy support, offers an instructive case for examining these dynamics within India.

2.2 Sector-Specific AI Applications in Start-ups

The application of AI varies substantially across sectors, reflecting differences in data availabil-ity, regulatory environments, and customer expectations [23]. In FinTech, AI powers credit scoring algorithms, fraud detection systems, and robo-advisory platforms, enabling start-ups to compete with established financial institutions [8, 15]. HealthTech start-ups leverage machine learning for diagnostic imaging, drug discovery, and personalised treatment protocols, though they face heightened regulatory scrutiny [38, 12]. AgriTech ventures in Maharashtra utilise AI for crop yield prediction, supply chain optimisation, and precision farming, addressing critical agricultural challenges in the state [44, 32].

EdTech start-ups employ AI-driven adaptive learning algorithms and natural language pro-cessing for personalised education delivery [16, 45], while E-Commerce ventures rely on recom-mendation engines, demand forecasting, and chatbot-based customer engagement [30, 21]. The SaaS/IT sector, which represents the largest concentration of AI-native start-ups in Maharash-tra, develops AI-powered enterprise solutions spanning human resources, marketing automation, and cybersecurity [4, 39].

2.3 Challenges and Barriers to AI Adoption

Despite the transformative potential of AI, start-ups face formidable barriers to adoption. Cost remains the most frequently cited obstacle, with initial AI implementation requiring investments ranging from INR 10–50 lakhs for early-stage ventures [31, 11]. The acute scarcity of AI talent, particularly professionals proficient in both machine learning engineering and domain-specific knowledge, compounds this challenge [42, **?**]. Data quality and availability issues are especially pronounced in sectors such as AgriTech and HealthTech, where structured datasets remain limited [40, **?**].

Furthermore, ethical concerns surrounding algorithmic bias, data privacy, and regulatory compliance present additional hurdles [13, 18]. The absence of clear regulatory frameworks for AI deployment in India, despite the government's National AI Strategy, creates uncertainty that disproportionately affects resource-constrained start-ups [24, 34].

3 Research Methodology

This study employs an explanatory sequential mixed-methods design [9]. The target popula-tion comprises founders, co-founders, and senior technology professionals in DPIIT-recognised start-ups in Maharashtra. A stratified random sampling technique was used, with strata defined by sector (FinTech, HealthTech, AgriTech, EdTech, E-Commerce,

and SaaS/IT) and organisa-tional stage (early-stage, growth-stage, and scale-up). Using Krejcie and Morgan's formula [19], the minimum required sample was 196; 220 valid responses were collected (73.3% response rate from 300 questionnaires). The structured questionnaire covered demographic profile, AI adop-tion levels (five-point Likert scale adapted from the TOE framework [37]), perceived performance impact, and barriers. A pilot study with 25 respondents showed acceptable reliability (Cron-bach's alpha = 0.87). Qualitative data were collected through 18 semi-structured interviews (40–60 minutes each). Quantitative analysis used SPSS v27.0 (descriptive statistics, chi-square tests, Pearson correlations); qualitative data underwent thematic analysis [5].

4 Results and Discussion

4.1 AI Adoption Patterns Across Sectors

The analysis reveals significant variation in AI adoption across sectors (Figure 1). SaaS/IT (68% high adoption) and FinTech (62%) are the most AI-intensive sectors, while AgriTech shows the lowest rate (35%), attributable to limited data digitisation in rural Maharashtra. Overall, 67.3% of surveyed start-ups have integrated AI into at least one core function, compared to the national average of 48% [28], confirming Maharashtra's leading position.

4.2 Impact on Start-up Performance

Figure 2 shows consistent improvements across six performance metrics following AI integra-tion. The most pronounced impact was observed in operational efficiency (30 to 67), product innovation (25 to 58), and customer acquisition (22 to 53).

Table 1: Demographic Profile of Respondents (N=220)

Characteristic	Category	Frequency	Percentage
Gender	Male	142	64.5
	Female	68	30.9
	Other	10	4.6
Age Group	21–30 years	78	35.5
	31–40 years	92	41.8
	41–50 years	38	17.3
	Above 50 years	12	5.4
Role	Founder/Co-founder	95	43.2
	CTO/Technology Lead	72	32.7
	Senior Manager	53	24.1
Start-up Stage	Early-stage (<3 years)	88	40.0
	Growth-stage (3–7 years)	85	38.6
	Scale-up (>7 years)	47	21.4

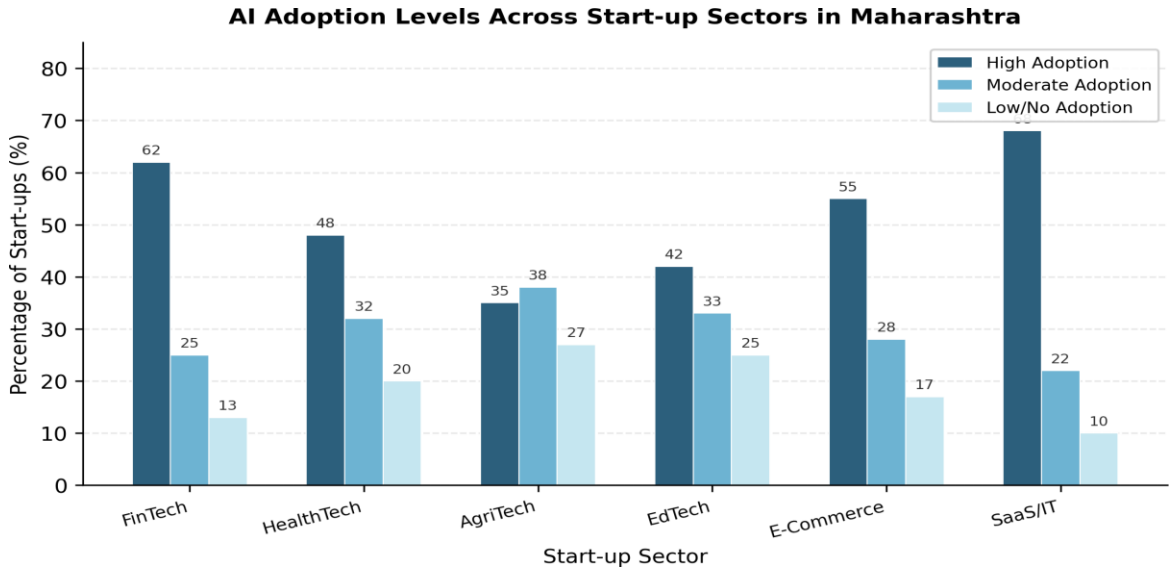

Figure 1: AI Adoption Levels Across Start-up Sectors in Maharashtra

Table 2: Chi-Square Test Results: AI Adoption and Performance Metrics

Performance Metric	χ^2 Value	df	*p*-value	Significance
Revenue Growth	18.72	4	0.001	$p < 0.01$
Customer Acquisition	15.34	4	0.004	$p < 0.01$
Operational Efficiency	12.89	4	0.012	$p < 0.05$
Product Innovation	14.56	4	0.006	$p < 0.01$
Fund Raising Success	9.23	4	0.055	$p > 0.05$
Market Expansion	11.47	4	0.022	$p < 0.05$

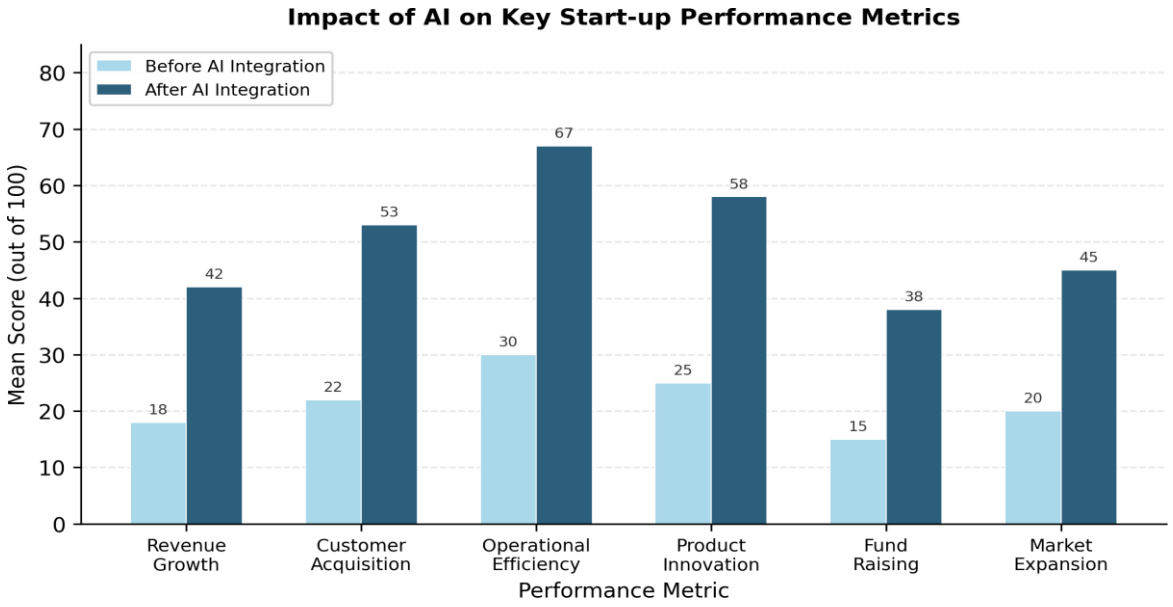

Figure 2: Impact of AI on Key Start-up Performance Metrics

Table 2 confirms statistically significant associations between AI adoption and five of six metrics. Revenue growth ($\chi^2 = 18.72$, $p < 0.01$) and customer acquisition ($\chi^2 = 15.34$, $p < 0.01$) show the strongest associations. Fund-raising success is marginally non-significant ($\chi^2 = 9.23$, $p = 0.055$), indicating AI enhances investor narratives but does not independently determine funding outcomes.

4.3 AI Tools Usage Patterns

ML platforms (52% frequent usage) and NLP/chatbot solutions (45%) are the most widely de-ployed (Figure 3). Computer vision (28%) and RPA (22%) show lower adoption, with regulatory approvals for AI-assisted diagnostics remaining a bottleneck in HealthTech [7].

4.4 Challenges and Barriers

High implementation costs (72%), talent scarcity (68%), and data quality constraints (65%) are the three most significant barriers (Figure 4), consistent with the TOE framework [37].

Qualitative interviews reveal that the cost barrier is not merely financial but also temporal: diverting engineering resources from product development to AI implementation is substantial for early-stage ventures. The talent challenge is compounded by competition from large cor-porations in Mumbai and Pune, with start-ups losing AI engineers to offers 2–3 times their compensation capacity—creating a vicious cycle that prevents both capability development and talent attraction.

5 Proposed AI Mobilisation Framework

Based on the empirical findings, this study proposes an AI Mobilisation Framework for start-up ecosystems (Figure 5), which conceptualises the interrelationships between enablers, AI adoption dimensions, performance outcomes, and policy interventions within a systemic architecture.

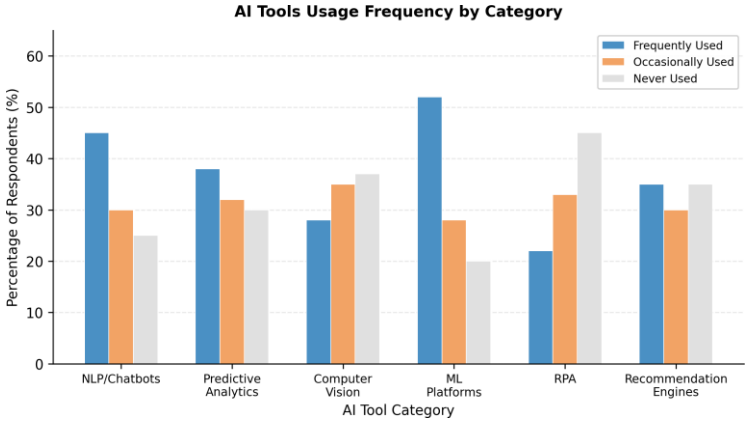

Figure 3: AI Tools Usage Frequency by Category

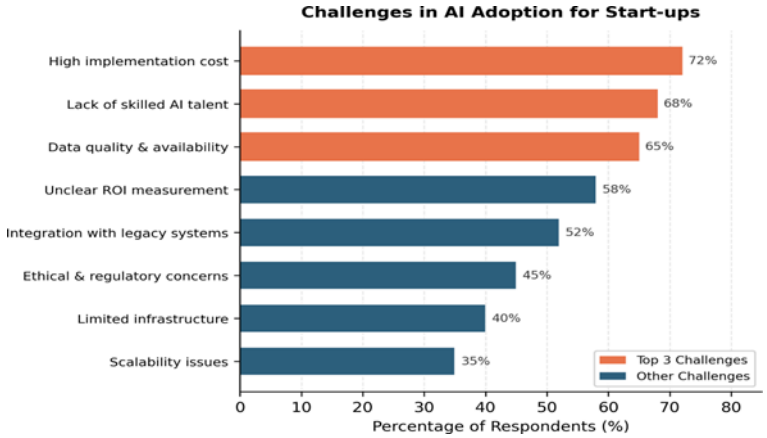

Figure 4: Challenges in AI Adoption for Start-ups

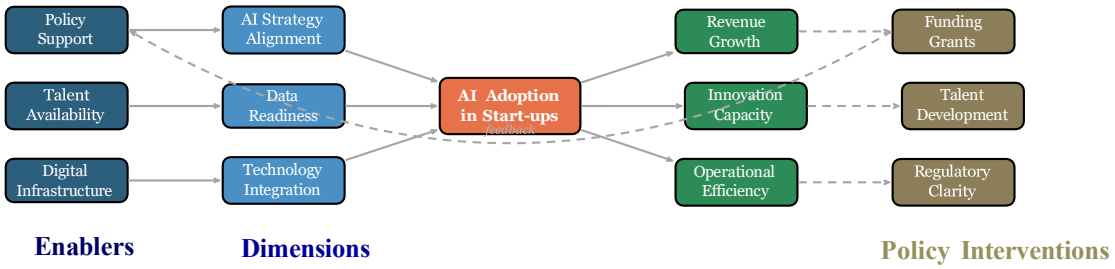

Figure 5: Proposed AI Mobilisation Framework for Start-up Ecosystems

The framework identifies ecosystem enablers (policy support, talent availability, digital infrastructure) feeding into AI adoption dimensions (strategic alignment, data readiness, tech-nology integration). The central node represents adoption within start-ups, driving performance outcomes (revenue growth, innovation capacity, operational efficiency). A feedback loop con-nects outcomes to policy interventions (funding grants, talent development, regulatory clarity), reinforcing the enabling environment.

6 Conclusion and Implications

This empirical study establishes that AI plays a significant role in mobilising Maharashtra's start-up ecosystem. AI adoption is concentrated in technology-intensive sectors (SaaS/IT, Fin-Tech), with significant positive associations to customer acquisition and revenue growth. The proposed AI Mobilisation Framework conceptualises AI as an ecosystem-level mobilising force operating through enablers, adoption dimensions, outcomes, and policy feedback loops [20, 27]. For founders, strategic AI alignment is critical. For policymakers, targeted talent development programmes, subsidised cloud infrastructure, and streamlined AI regulation are needed. For in-vestors, AI integration capability should be a material factor in venture evaluation. Limitations include the geographic focus on Maharashtra, cross-sectional design, and self-reported measures. Future research should employ longitudinal designs and extend analysis to other Indian states for comparative assessment.

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