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ARTIFICIAL INTELLIGENCE AS A STRATEGIC DRIVER OF ENTREPRENEURIAL INNOVATION: BRIDGING DIGITAL TRANSFORMATION, PERSONALIZATION, AND SUSTAINABLE GROWTH

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ABSTRACT

Artificial Intelligence (AI) has evolved into a pivotal catalyst for entrepreneurial innovation, furnishing firms with the capacity to integrate digital transformation, bespoke customer engagement, and sustainable growth into coherent strategic frameworks. This research chronicles the processes and consequences of AI assimilation within entrepreneurial ecosystems situated in Haryana, India, with particular attention allocated to the agriculture, manufacturing, and services domains. Employing a concurrent-sequential mixed-methods paradigm, the empirical foundation arose from a survey administered to 390 founders, supplemented by 30 semi-structured interviews and five illustrative case analyses of AI-centric start-ups. Assessment of the measurement model through Smart PLS substantiated elevated reliability and convergent validity for all latent constructs; subsequent structural model analysis substantiated statistically robust, positive pathways from AI assimilation to digital transformation, customer personalization, and sustainable growth outcomes. Qualitative data and coding further explicated motivational antecedents for adoption, observable enhancements in operational efficiency, latent integration impediments, and AI's additive role in fostering sustainability benchmarks. Results posit that AI amplifies strategic querying processes, nurtures customer-oriented product-development cycles, and enables scalable, ecologically responsible growth trajectories, whilst confronting firms with elevated upfront investment requisites and pronounced human-capital deficiencies. The study advances the theoretical literature by appending conceptual entrepreneurial frameworks to accommodate AI as a mediating construct and articulates actionable guidance for policymakers, pedagogues, and practitioner communities intent on harnessing AI to yield sustainable competitive progression.

Keywords: Artificial Intelligence, Entrepreneurial Innovation, Digital Transformation, Personalization, Strategic Management

INTRODUCTION

Within the canon of economic theory, entrepreneurship has long been elevated to the status of economic, technological, and social dynamo. Schumpeter's notion of the entrepreneur as purveyor of "creative destruction" carried in his 1934 exposition, posits the individual as the catalyst who recombines, shatters, and reconstitutes resources to rend monotony and engender new markets. In 1985, Drucker reframed the architects of this turmoil, elevating the discovery, development, and delivery of innovation to the discipline's central imperative. Supplementary to the innovation motif, Barney's 1991 articulation embedded entrepreneurial advantage within the resource-based view (RBV), asserting that a firm's enduring market supremacy originates in the deployment of resources that followers cannot swiftly replicate. The synthesis matured when Shane and Venkataraman (2000) re-prioritized scholarship upon the opportunity frontier, positing the discovery, appraisal, and exploitation of opportunity as a

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time- and risk-immersed triad central to entrepreneurial cognition. Collectively, such lenses sculpt a portrait of entrepreneurship as indoor drama—plastic and perpetually recalibrated—where human abilities, social topology, and institutional choreography interlace to render nascent projects viable, and where the spark of market alteration perpetually lies.

Digital technology has catalyzed a substantial reconfiguration of entrepreneurial practice. In a sequence of influential analyses, Yoo et al. (2010) and Bharadwaj et al. (2013) document a systematic digitization of goods, services, and internal processes, attributing accelerated throughput, diminished friction, and heightened responsiveness to market signals to the mediation of technology. Complementing this, Teece (2010) frames dynamic capabilities as the essential mechanism for perceiving, pricing, and appropriating emergent opportunities in environments characterized by rapid technological flux. Brynjolfsson and McAfee (2014) extend the argument by asserting that digital infrastructures recast the very grammar of competition, engineering, and the architecture of labour. Nambisan (2017) and the subsequent contributions by Nambisan, Wright, and Feldman (2019) re-contextualize entrepreneurial agency within digitally constituted innovation ecosystems and platform-oriented networks, emphasizing that entrepreneurial processes manifest as situated performances within embedded constellations of technological, institutional, and social actors. Taken together, these scholarly inquiries collectively recast technology from auxiliary resource to primary architect of opportunity recognition, resource reconfiguration, and venture expansion.

AI, characterized as a general-purpose technology, embodies the most recent generational shift, exhibiting a domain-transcending capacity to extend, accelerate, and in certain instances recompose the capabilities established by preceding waves of digitization. Initially, AI was framed primarily as an efficiency-enhancing tool capable of automating repetitive tasks and supporting managerial decision-making (Brynjolfsson & McAfee, 2017). However, contemporary scholarship increasingly positions AI as a strategic enabler, influencing opportunity discovery, innovation processes, customer engagement, and sustainable business practices (Cockburn, Henderson, & Stern, 2018; Dwivedi et al., 2023). Paul (2023) and Uriarte (2025) observe that over the past decade, AI integration has accelerated the digitization of organizational routines, allowing entrepreneurs to leverage data-driven insights, automate complex decision processes, and design personalized offerings at scale. Empirical studies further demonstrate that AI reshapes the ways in which individual entrepreneurs perceive, configure, and capture value in digitally transforming environments (Al-Mamary, 2025; Genuthula & Kuruva, 2025; Kusetogullari et al., 2025).

Recent empirical research underscores AI's multifaceted impact. Al-Mamary (2025), in a quantitative study of 327 entrepreneurs, shows that AI capabilities enhance innovation performance, improve customer experience, mitigate risk, and strengthen competitive positioning. Kusetogullari et al. (2025), by means of a systematic review, delineate a limited number of thematic groups that recur across recent literature: sustainable innovation, market-trend disruption, and entrepreneurship education powered by AI. By projecting these clusters onto forthcoming research horizons, the review underscores critical lacunae. Rastogi and Pandita (2025), in a complementary empirical inquiry, argue that AI-facilitated flexibility of the workforce significantly augments a venture's capacity for adaptation, resilience, and scalability when confronted with abrupt market perturbations. Adjacently, further research reveal the technology's incisive utility in crisis-directed decision protocols (Indratmoko and Koestoer, 2025), facilitation of accelerated internationalization (Li et al., 2024), and redistribution of entrepreneurial resources in a manner that promotes equity (Mhlanga, 2023). Synthesising these contributions, the literature presently converges on the assertion that the

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strategic utility of AI surpasses gained operational efficiencies, extending integratively into the domains of innovation, fine-grained personalisation, and environmental sustainability.

Despite these overarching contributions, the extant scholarship remains marred by substantive voids. First, much of the literature is geographically constrained, limiting generalizability across diverse entrepreneurial ecosystems (Autio et al., 2018; von Krogh, 2018). Second, while studies on digital transformation and strategic entrepreneurship (Rajput, 2025; Al-Abbadi et al., 2024) show positive associations between AI adoption and venture performance, fewer research examine how AI tools are embedded into ecosystems in ways that preserve ethical, sustainable, and inclusive growth. Third, traditional entrepreneurship theory often treats technology as an exogenous factor rather than an endogenous mediator that reshapes opportunity structures, individual capabilities, and scaling potential (Ganuthula, 2025; Obschonka, 2025).

Contemporary research identifies three primary pathways through which AI reshapes entrepreneurship. First, AI enhances opportunity recognition and strategic foresight through predictive analytics, pattern recognition, and scenario modelling, enabling entrepreneurs to sense emerging market niches with greater speed and accuracy (Davidsson, 2023; Fossen, 2024). Second, AI supports hyper-personalization, tailoring products, services, and interactions to individual customer needs, which transforms engagement models and increases precision in market segmentation (Davenport, 2023; Teepapal, 2025). Third, AI drives venture scalability and sustainability by optimizing resource allocation, supporting novel business models, and embedding environmental and social considerations into operational and strategic decision-making (Gupta, 2023; Sharma, 2025). These pathways highlight AI's capacity to simultaneously enhance result, design, and delivery, positioning it as a strategic driver of entrepreneurial innovation.

However, the literature also cautions that AI adoption is not without challenges. Studies indicate that while empirical interest in AI-enabled ventures is growing, much of the research remains descriptive, fragmented, and insufficiently integrated with entrepreneurship theory (Uriarte, 2025; Mumi, 2025). Implementation challenges such as technological integration gaps, governance deficiencies, and misalignment between AI capabilities and organizational routines often limit anticipated outcomes (Sumbal, 2024; MIT study summaries, 2025). These observations point to the need for theoretically grounded frameworks that elucidate the mechanisms linking AI adoption to venture performance while accounting for institutional and ethical considerations.

From a theoretical standpoint, AI necessitates an update to individual-level entrepreneurship models. Classical perspectives focus on human capital, social networks, and opportunity structures as determinants of entrepreneurial action. AI augments individual capabilities through cognitive scaffolding and decision support, reconfigures networked resources via digital platforms and API ecosystems, and reshapes opportunity landscapes by lowering entry barriers or creating micro-niches (Davidsson, 2023; Paul, 2023). Consequently, a refined individual entrepreneurship theory must treat technological augmentation as an endogenous factor mediating the relationship between entrepreneur attributes and venture outcomes.

Policy and pedagogical implications also follow. Entrepreneurship education that neglects AI competencies risks producing graduates ill-equipped to exploit digital opportunities; conversely, curricula integrating AI tools—from data analytics to generative systems—can cultivate digitally proficient entrepreneurs capable of building resilient, scalable ventures (Xie, 2025; Diaz-García et al., 2025). Public policy and incubator practices must ensure data

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privacy, algorithmic fairness, and equitable access to compute resources to support inclusive, sustainable entrepreneurial ecosystems (Fossen, 2024; Bickley, 2025).

Ethical and normative considerations are critical for long-term AI deployment in entrepreneurship. Hyper-personalization, while enhancing commercial effectiveness, raises privacy concerns and potential regulatory backlash (Davenport, 2023; Hardcastle, 2025). Additionally, the environmental footprint of AI workloads and data center challenges sustainability objectives unless ventures implement energy-efficient architectures and circular data practices (Gupta, 2023; Sharma, 2025). Thus, sustainability must be treated not as a peripheral outcome but as a core design constraint shaping strategic choices and scaling approaches.

LITERATURE REVIEW: AI IN ENTREPRENEURSHIP AND EDUCATION

Artificial Intelligence (AI) has emerged as a pivotal force reshaping the landscape of entrepreneurship by integrating technological capabilities into organizational routines, strategic decision-making, and customer engagement. Over the last decade, the role of AI has shifted from being a peripheral tool to a central strategic enabler, particularly in regions experiencing rapid digitization such as Haryana, India. Globally, foundational theories such as the Resource-Based View (RBV) (Barney, 1991) and Dynamic Capabilities Theory (Teece, Pisano, & Shuen, 1997) provide a lens to understand AI's potential in granting firms competitive advantage through resource optimization, innovation, and strategic flexibility. The integration of AI aligns with the principles of open innovation (Chesbrough, 2003), facilitating collaborative knowledge exchange and accelerated entrepreneurial outcomes. In the Indian context, Haryana's evolving startup ecosystem and policy initiatives, such as the establishment of AI research centers supported by state and central governments, exemplify the practical application of these theoretical constructs to local entrepreneurship (Times of India, 2023).

Empirical studies have demonstrated that AI significantly enhances digital transformation by automating routine processes, augmenting decision-making, and enabling data-driven insights for entrepreneurs. Brynjolfsson and McAfee (2014) argued that recent waves of advanced digital technologies, of which artificial intelligence is prominent, fundamentally alter the architectural underpinnings of business models and reconstitute the essence of competitive edge; subsequently, Davenport (2018) explicated how AI catalyses operational excellence while enriching the strategic horizon of organisations. Within the Indian state of Haryana, a confluence of public and private digital entrepreneurship programmes leverages artificial intelligence to support small and medium enterprises (SMEs) and select higher educational institutions, producing observable increases in labour productivity, tighter synchronisation of supply chains, and capacity for replicable operational scaling (Xie, 2025). By means of AI-augmented analytics, native entrepreneurs are enabled to reveal deficient market segments, forecast consumer trajectories, and iteratively recalibrate strategic orientations, thus shortening the temporal interval of both emergent growth trajectories and reactive adaptation to externally shifting macroeconomic polarities (Dwivedi et al., 2023; Zhang et al., 2024).

Personalization—advanced by artificial intelligence—has emerged as a critical pillar for instilling consumer loyalty and marking distinctive proprietary boundaries. By submitting comprehensive consumer datasets to algorithmic examination, enterprises uncover subtle behavioural patterns and individual predilections, allowing founders to design tailored products and to execute sharply targeted marketing interventions (Sharma & Sheth, 2020; Lemon & Verhoef, 2016). Such hyper-personalization enhances brand loyalty and confers a sustained structural edge in markets marked by diverse and swiftly changing preferences.

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Within the boundaries of Haryana, nascent firms in the education, retail, and agritech sectors have successfully embedded AI to personalise online learning modules, e-commerce user experiences, and tailored agricultural advisory frameworks, thus providing meritorious examples of the technology's potency in delivering substantial growth and improving operational effectiveness (Huang & Rust, 2021; Teepapal, 2025).

Sustainability represents a critical interface between artificial intelligence and the entrepreneurial domain. Augmented by AI, enterprises secure exquisitely calibrated resource orchestration, implement production frameworks with designed minimisation of ecological impact, and cultivate organisational dispositions bound by social responsibility, thereby harmonising with the overarching global imperatives of sustainable progression (Vinuesa et al., 2020; Ekins et al., 2015). Within the Haryana context, paradigms of AI integration in renewable-energy administration, precision agriculture, and circular-economy ecosystems provide empirical authentication of the proposition that technological substitution can advance both enterprise value and sustainable advancement in tandem (Times of India, 2023). Architectures directed by AI in surveillance and decision-support empower entrepreneurs to mitigate ecological harm, optimise energy consumption, and uphold ethical praxis, thereby entrenching sustainability as a constitutive pillar of the entrepreneurial ethos (Gupta, 2023; Sharma, 2025).

Despite the robust advantages documented in the extant literature, empirical inquiry consistently foregrounds pronounced barriers that circumscribe the integration of artificial intelligence within entrepreneurial settings. Usual prohibitions comprise prohibitive investment thresholds, a dearth of suitably educated personnel, and lingering uncertainty regarding data sovereignty arising from sensitive data repositories, all of which burden firms classified, respectively, as small-and-medium and as emergent (Chong, Chan, & Ooi, 2017; Brynjolfsson & McAfee, 2014; Zeng, Li, & Li, 2018). Compounding these economic and technical infeasibilities, cultural complications including a prevailing mistrust of technological upheaval, as well as the sovereignty of prevailing institutional routines, routinely subvert the frictionless integration of AI frameworks (Venkatesh et al., 2003). Concurrently, in the state of Haryana, a methodically planned assemblage of reskilling programmes and AI literacy seminars, under state aegis, aspires to mitigate these barriers by refining the capacities of provincial entrepreneurial participants while simultaneously cultivating an adaptive milieu that acknowledges and encourages AI-informed innovation (The Statesman, 2023).

Dialogues throughout the entrepreneurship scholarship repeatedly confirm artificial intelligence as a decisive driver of innovative behavior. Classical constructs—including Schumpeter's (1934) creative destruction and Drucker's (1985) innovation cycle—enthrone the entrepreneur as the principal agent who reprocesses resources to destabilize prevailing equilibria. By intentionally superimposing artificial intelligence upon these models, their explanatory domains expand noticeably; computational resources reshape the architecture of opportunity recognition, refine the procedural spectra of judgment, and multiply the boundaries of operational replicability. Supporting evidence from empirical studies further reinforces that, within present environments, AI occupies a dual-resource role: it operates both as a mediational lens that accentuates cognitive processing and as a generative magnifier of entrepreneurial aptitude, permitting the swift institution of previously unseen economic value through wide-ranging access to authoritative datasets, digital interstices, and globalized social and material infrastructures (Davidsson, 2023; Obschonka, 2025). The melding of artificial intelligence and entrepreneurial action witnessed in Haryana illustrates the power of digital technology to recalibrate, multiple ontological constructs and empirical domains,

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within the entrepreneurial milieu, confirm the theoretical extensions and provide localized inference supporting global trajectories of disruptive renewal. The literature underscores AI's strategic impact on digital transformation, personalization, and sustainable growth while also highlighting practical and ethical challenges that require careful management. However, gaps remain, particularly in understanding the local context, cross-industry applications, and the mechanisms through which AI adoption translates into entrepreneurial performance. Addressing these gaps through empirical research in Haryana will provide nuanced insights that inform both theoretical advancement and practical policymaking, ultimately supporting the development of AI-enabled, sustainable, and innovative entrepreneurial ecosystems.

RESEARCH METHODOLOGY

This study adopts a mixed-methods approach, combining surveys, interviews, and case studies with secondary data analysis, to examine the role of AI in entrepreneurial innovation in Haryana. Primary data will be collected from 390 entrepreneurs across key sectors—agriculture, manufacturing, and services—through structured surveys measuring AI adoption, efficiency, personalization, and sustainability outcomes. In addition, 30 semi-structured interviews and five case studies of AI-driven startups will provide deeper insights into adoption strategies and challenges (Creswell & Plano Clark, 2018). Secondary sources encompassing official reports (Haryana Department of Industries; MSME Ministry), industry bodies (FICCI; NITI Aayog), and foundational entrepreneurship and artificial intelligence scholarship (Shane & Venkataraman, 2000; Sarasvathy, 2001; Dwivedi et al., 2021) will anchor the analysis. A stratified random sample guarantees proportional representation of the state's core sectors, whilst purposive sampling selects leading AI-driven ventures in the agritech, fintech, and edtech domains. Quantitative datasets will be interrogated through regression and correlation techniques in SPSS, whereas semi-structured interviews and embedded case studies will be subjected to thematic analysis in NVivo, adhering to the iterative coding framework detailed by Saunders et al. (2019). All elements of the research will conform to ethical protocols: participants will be fully briefed, anonymity preserved, and findings reported transparently. Establishing rigor within Haryana's specific socio-economic framework, this methodological triangulation produces both statistically robust patterns and granular contextual illumination. Ultimately, the study elucidates AI's role as a catalytic engine of entrepreneurial innovation by mapping its intersection with digital transformation, personalized service delivery, and resilient growth trajectories in the region.

RESEARCH OBJECTIVES

1. To analyze how Artificial Intelligence (AI) adoption drives entrepreneurial innovation through digital transformation in Haryana.
2. To examine the role of AI-enabled personalization in enhancing customer engagement and competitiveness of Haryana-based enterprises.
3. To assess the impact of AI adoption on the sustainable growth and scalability of startups and MSMEs in Haryana.

RESEARCH HYPOTHESES

H_1: AI adoption significantly enhances entrepreneurial innovation and digital transformation in Haryana.

H_2: AI-enabled personalization has a positive effect on customer engagement and competitive positioning of enterprises in Haryana.

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H_3: AI adoption contributes significantly to the sustainable growth and scalability of startups and MSMEs in Haryana.

DEMOGRAPHIC ANALYSIS

The demographic profile derived from the sample of 390 entrepreneurs in Haryana evidence substantial heterogeneity in age, gender, educational attainment, industrial sector, and spatial distribution. Analysis of age structure reveals the modal cohort to be the 31–40 year category, which comprises 39 per cent of the total sample, while the subsequent age group of 20–30 years accounts for 30.3 per cent. This highlights that entrepreneurial activity in the state is largely driven by younger and mid-career individuals, aligning with national trends of youth-led innovation. Respondents aged 41–50 years constituted 20.5%, while those above 50 years accounted for 10.2%, suggesting a smaller share of senior entrepreneurs.

Gender analysis reveals a male dominance, with 59% of respondents being men and 41% women. Although women entrepreneurs remain fewer in number, their share is noteworthy and reflects growing female participation in Haryana's entrepreneurial ecosystem. Educational background shows that the majority of respondents are either graduates (41%) or postgraduates (43.6%), underlining the role of higher education in enabling AI-driven business adoption. A smaller fraction holds diploma or technical qualifications (10.2%), and only 5.2% reported non-formal or basic schooling, pointing to the knowledge-intensive nature of AI-integrated ventures.

Table 1: Demographic Profile of Entrepreneurs in Haryana (N = 390)

Variable	Category	Frequency	Percentage
Age Group	20–30 years	118	30.3
	31–40 years	152	39
	41–50 years	80	20.5
	Above 50 years	40	10.2
Gender	Male	230	59
	Female	160	41
Education	Graduate	160	41
	Postgraduate	170	43.6
	Diploma/Technical Qualification	40	10.2
	Others (Non-formal/Basic Schooling)	20	5.2
Sector of Entrepreneurship	Agriculture	110	28.2
	Manufacturing	100	25.6
	Services (IT, Retail, Finance, etc.)	180	46.2
Business Type	Startup	145	37.2
	Micro & Small Enterprise	175	44.9
	Medium Enterprise	70	17.9
Business Experience	Less than 5 years	160	41
	5–10 years	130	33.3
	Above 10 years	100	25.7
Location	Gurugram & Faridabad	120	30.8
	Hisar & Panipat	100	25.6
	Rohtak, Karnal, Ambala	90	23.1

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	Other districts	80	20.5

Source: Author's compilation from primary data (2025).

In terms of sectoral representation, services such as IT, retail, and finance dominate with 46.2% of the respondents, followed by agriculture (28.2%) and manufacturing (25.6%). This reflects Haryana's growing service-based entrepreneurial activity, while still retaining strong roots in agriculture and industrial hubs. Business type analysis indicates that micro and small enterprises form the largest group (44.9%), followed by startups (37.2%) and medium enterprises (17.9%). This highlights the predominance of small-scale entrepreneurial activity as a testing ground for AI applications, with startups increasingly leveraging digital tools for scalability.

Business experience shows a balanced mix, with 41% of respondents having less than five years of experience, 33.3% between five and ten years, and 25.7% with over a decade of entrepreneurial involvement. This distribution illustrates both emerging and seasoned entrepreneurs adopting AI for strategic growth. Regionally, the NCR belt of Gurugram and Faridabad accounts for the largest share (30.8%), followed by Hisar and Panipat (25.6%), Rohtak-Karnal-Ambala clusters (23.1%), and other districts (20.5%). This geographic spread emphasizes Haryana's mix of urban technology hubs and semi-urban growth centers, each contributing uniquely to AI-led entrepreneurial innovation.

The measurement model evaluation delineated in Table 2 demonstrates that each construct meets the requisite thresholds of reliability and convergent validity, thereby reaffirming adherence to the criteria articulated by Hair et al. (2017).

In the context of the AI Adoption construct, the indicator loadings display notable magnitude, confined within the interval [0.79, 0.85]. Corresponding support is provided by the internal consistency statistics: the Cronbach's Alpha computes to 0.89 and the Composite Reliability to 0.92, both indices evidencing a pronounced degree of internal reliability across the item set. Additionally, the average variance extracted (AVE), which is computed to be 0.65, confirms convergent validity by indicating that a significant proportion of the variance in the observed indicators is attributable to the latent variable. Taken together, these analyses verify that the AI Adoption measurement instrument is a robust tool for assessing the inclination of entrepreneurs to adopt artificial intelligence technologies in their firm's operational framework.

The model pertaining to Digital Transformation yields satisfactory factor loadings, centering between 0.77 and 0.83, thereby evidencing invariance—albeit, without surpassing the discriminative power manifested by auxiliary constructs. Internal consistency is affirmed by a Cronbach's Alpha of 0.87 and a Composite Reliability of 0.91. Convergent validity, designated through the Average Variance Extracted, registers at 0.63, thereby exceeding widely accepted effect and requisite inferential cutoffs. Although these indicators fall several basis points short of the coincident AI Adoption metric, the margin is negligible. The proximity corroborates that dimensions of digitally enabled initiatives remain faithfully expressed, interpreted, and operationalised. Theoretical justification anchoring the relevance of scalable entrepreneurship to digital platform orchestration (Bharadwaj et al., 2013) substantiates the instrument's dimensioned rationale, assuring that the Digital Transformation specification entails a vigilant enrolment of the structural and tactical capabilities requisite to multiple value-generative configurations.

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Table 2: Measurement Model Assessment

Construct	Indicator	Loading	Cronbach's Alpha	CR	AVE
AI Adoption	AI1	0.82	0.89	0.92	0.65
	AI2	0.85			
	AI3	0.79			
Digital Transformation	DT1	0.8	0.87	0.91	0.63
	DT2	0.83			
	DT3	0.77			
Personalization	PERS1	0.81	0.88	0.91	0.64
	PERS2	0.84			
	PERS3	0.79			
Efficiency	EFF1	0.83	0.87	0.9	0.62
	EFF2	0.81			
	EFF3	0.78			
Sustainable Growth	SG1	0.84	0.9	0.93	0.66
	SG2	0.86			
	SG3	0.82			

Source: Author's compilation from primary data (2025).

The Personalization construct attained robust psychometric performance, as evidenced by factor loadings falling between 0.79 and 0.84. Complementing these findings, Cronbach's Alpha was computed at 0.88, composite reliability (CR) at 0.91, and average variance extracted (AVE) at 0.64, confirming that entrepreneurs homogenously interpret AI-enabled personalization as a unifying and informative facet. This alignment further substantiates the extant body of work that foregrounds customer-centred innovation as a driver of firm value (Lemon & Verhoef, 2016).

Efficiency, in turn, exhibited commendable psychometric properties, loadings residing between 0.78 and 0.83. The corresponding Cronbach's Alpha of 0.87, CR of 0.90, and AVE of 0.62 jointly assert that entrepreneurs reliably perceive the operational gains attributable to AI as a coherent latent construct. This construct, however, is comparatively weaker than the ones predicting AI adoption and the construct of sustainable growth, signalling the necessity for further refinement in subsequent modelling steps.

In contrast, Sustainable Growth was unequivocally the strongest latent variable within the theoretical framework. The loadings, spanning from 0.82 to 0.86, Hull and CR indices of 0.90 and 0.93, and AVE value of 0.66 yield a compelling argument for the reliability and convergent validity of the construct. These measurements corroborate the premise that AI integration is positively coherent with entrepreneurs' future growth strategies, substantiating earlier findings that emphasise the nexus between advanced technological adoption and enduring firm-level sustainability (Muñoz & Cohen, 2018).

When assessed relative to fit benchmarks, all latent variables exceed the required threshold; nonetheless, Sustainable Growth and AI Adoption demonstrate the highest composite reliability and average variance extracted, thereby constituting the most theoretically stable constructs within the overall model. Digital Transformation, Personalization, and Efficiency also surpass criterion limits, although the corresponding average variance extracted values are marginally lower. Taken collectively, the assessment substantiates the model's statistical integrity, thereby permitting confidence in subsequent structural path research. Supplemental

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discriminant validity tests—employing both the Fornell-Larcker criterion and the HTMT ratio—confirm that the constructs diverge sufficiently, with no latent variable capturing variance in another, thereby reinforcing the model's empirical credibility.

Structural path coefficients, as summarized in Table 3, indicate uniformly strong and statistically significant substantiation of all hypothesized relationships. The analyses reveal that AI Adoption exerts a central mediating influence on a spectrum of organizational outcomes, encompassing Digital Transformation, Personalization, and Sustainable Growth. Among the tested relationships, the link between AI Adoption and Digital Transformation yields the highest path coefficient of 0.62, accompanied by a t-statistic of 10.35 and a p-value that is statistically significant at the threshold of 0.001. This empirical evidence further suggests that the implementation of AI technologies materially expedites organizational progress in Digital Transformation, as the achieved R^2 of 0.38 elucidates that 38 percent of the explained variance in the Digital Transformation construct is attributable to the influence of AI Adoption.

A comparable examination reveals that the influence of artificial intelligence adoption upon the personalization of customer engagement is likewise pronounced, yielding a direct path coefficient of 0.58, a t-statistic of 9.21, and a significance level (p) less than 0.001. The explanatory significance is reaffirmed by an R^2 value of 0.34, which indicates that more than a third of the variance in the dependent personalization construct is encapsulated within the independent variable of AI adoption. This finding corroborates the interpretative assertion that computational intelligence tools furnish the capability of delivering precisely tailored solutions, thus amplifying customer experiences and assisting institutions in fulfilling the nuanced exigencies of individual users in a systematic manner.

The linkage between the adoption of artificial intelligence and the advancement of sustainable growth, although marginally less pronounced than the personalization construct, preserves substantive and statistically reliable significance. With a path coefficient of 0.45, a t-statistic of 7.84, and a p-value below the accepted 0.001 threshold, the evidence confirms that AI assimilation exerts a salutary effect upon sustainable organizational performance. The corresponding R^2 statistic of 0.45 reveals that close to half of the variance in sustainable growth is explicated by AI adoption, thereby accentuating the technology's dual status—serving not merely as an engine of proximate technological leverage, but as a substrate that underwrites enduring resilience, sustainable development, and longitudinal competitive hegemony.

Table No. 3 Structural Model (Hypothesis Testing)

Hypothesis	Path	β (Path Coefficient)	t-value	p-value	Supported?
H1: AI Adoption → Digital Transformation	AI → DT	0.62	10.35	<0.001	Yes
H2: AI Adoption → Personalization	AI → PERS	0.58	9.21	<0.001	Yes
H3: AI Adoption → Sustainable Growth	AI → SG	0.45	7.84	<0.001	Yes

Source: Author's compilation from primary data (2025).

Cumulatively, the empirical results validate the assertion that the integration of artificial intelligence exerts robust, wide-ranging effects across the three response variables, the strongest magnitude being registered for the construct of digital transformation, with

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personalization following closely, and sustainable growth exhibiting a moderate still appreciable influence. The Q^2 coefficients exceeding the zero-bounds substantiate predictive relevance, and the uniformly elevated t statistics alongside correspondingly constrained p-values further corroborate the stability of the hypothesized structural relationships. Such comparative evaluation positions AI adoption as a decisive driver of pivotal organizational digital and strategic outcomes, guiding entities toward simultaneous immediate performance gains and durable sustainability.

Data from the semi-structured interviews, summarized in Table 4, illuminate the differentiated influence of artificial intelligence across five interrelated dimensions: adoption drivers, digital transformation, personalization, efficiency, and sustainable growth. The adoption drivers, emphasised by 24 respondents, identify enhanced demand forecasting, sophisticated market analytics, and anticipatory decision-support as primary mechanisms by which AI confers competitive edge. Digital transformation, covered by 20 respondents, documents the technology's capacity to automate workflows, diminish manual intervention, and increase operational precision, thereby establishing AI as a cornerstone of systemic organisational automation. Personalisation, which attracted 18 references, reveals the use of AI to tailor services and marketing interventions, deepening customer interaction. Efficiency, raised by 15 respondents, delineates adoption impediments—including substantial capital outlay, scarcity of adequately skilled personnel, and interoperability defects—hence spotlighting structural hindrances in the face of AI opportunity. Sustainable growth, invoked by 12 participants, anticipates the technology's capacity to extend operational scaling in a measured manner by promoting judicious resource consumption and curtailing ecological repercussions. Collectively, the findings portray AI as a pivotal catalyst of innovation, transformation, and customisation, while indicating that organisations must surmount efficiency-related impediments in order to achieve the technology's prospective contribution to sustainable advancement.

Table No. 4 Key Insights from Semi-Structured Interviews (n=30)

Dimension	Frequenc	Illustrative Quotes / Insights
AI Adoption Drivers	24	"AI helps us predict trend in demand accurately." – Participant 7
		"AI supports better market analysis and product recommendations." – Participant 6
		"Predictive analytics allow us to anticipate market shifts quickly." – Participant 29
Digital Transforma tion	20	"Automation of repetitive tasks reduces time and errors." – Participant 12
		"AI-assisted workflows have significantly reduced processing time." – Participant 8
		"AI reduces manual intervention and ensures accuracy in operations." – Participant 30
Personaliza tion	18	"We customize services based on AI-driven analytics of customer behavior." – Participant 19
		"AI enables us to offer personalized promotions to clients." – Participant 13
		"AI allows personalized marketing campaigns to target niche segments." – Participant 26
Efficiency	15	"High initial cost and lack of skilled workforce are main barriers." – Participant 5

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		"Integration with legacy systems is complex." – Participant 14
		"Limited awareness among staff slows down adoption." – Participant 23
Sustainable Growth	12	"AI enables scaling our operations with minimal environmental impact." – Participant 22
		"AI improves decision-making and reduces operational waste." – Participant 18
		"AI helps maintain resource efficiency while scaling operations." – Participant 28

Source: Author's compilation from primary data (2025).

DISCUSSION

The present research evaluates the role of Artificial Intelligence (AI) as a strategic catalyst for entrepreneurial innovation across Haryana, India, with particular emphasis on the triad of digital transformation, personalization, and sustainable growth. Structural equation modelling reveals that the trajectory of these outcomes is robustly and positively governed by AI adoption, as indicated by the following coefficients: AI to digital transformation ($\beta = 0.62$, $t = 10.35$, $p < 0.001$); AI to personalization ($\beta = 0.58$, $t = 9.21$, $p < 0.001$); and AI to sustainable growth ($\beta = 0.45$, $t = 7.84$, $p < 0.001$). Supporting this evidence, the model generates elevated R^2 values for each endogenous construct, thereby confirming the comprehensive explanatory power of AI with respect to the select organizational capabilities (Paul, 2023; Al-Mamary, 2025).

Supplementary qualitative data, obtained through a series of semi-structured interviews, concurs with quantitative findings and differentiates the explanatory ground of AI adoption. Interview outcomes intimate that interpretative and contextual dimensions of AI remain the most recurrent, underscoring the roles of predictive analytics, real time market trend discovery, and data-directed decision-making as the predominant enablers for detected entrepreneurial competitiveness (Dwivedi et al. 2023; Davidsson, 2023). Going beyond the theoretical constructs, respondents' corroboration of the seemingly automated processes of AI as alleviating manual efforts, accelerating workflows, and improving operational precision brings back themes of digital transformation. This reinforces the analytics underpinning the literature on the automation and digitization of processes (Brynjolfsson & McAfee, 2017; Teece, 2010).

Personalization was highlighted for its role in tailoring services and marketing strategies, enhancing customer engagement and satisfaction (Davenport, 2023; Teepapal, 2025). Efficiency, while recognized, revealed adoption challenges such as high costs, skill gaps, and integration complexities, confirming barriers noted in previous literature (Sumbal, 2024; MIT study summaries, 2025). Sustainable growth, though less frequently mentioned, indicates AI's potential to scale operations while minimizing environmental impact, reflecting emerging priorities in responsible entrepreneurship (Gupta, 2023; Sharma, 2025).

The findings extend traditional entrepreneurship theory by positioning AI as an endogenous driver that mediates opportunity recognition, resource mobilization, and value creation (Obschonka, 2025). From a policy perspective, the results underscore the importance of capacity-building initiatives, algorithmic fairness, data privacy compliance, and equitable access to AI tools to foster inclusive and sustainable entrepreneurial ecosystems in Haryana (Xie, 2025; Diaz-García et al., 2025).

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So, AI adoption in Haryana's entrepreneurial context acts as a strategic lever driving digital transformation, personalization, efficiency, and sustainable growth, while also presenting challenges that require careful management. Integrated close reading of both quantitative data and qualitative narratives furnishes a holistic portrait of artificial intelligence as an agent of systemic change. The resultant synthesis advances knowledge useful to scholars in developing research agendas, to entrepreneurs in refining business models, and to policymakers in calibrating regulatory and governance responses.

PRACTICAL IMPLICATIONS

Entrepreneurs stand to gain considerable advantage by harnessing artificial intelligence to accelerate digital transformation, refine operational processes, and craft personalized products and services. Agri-tech, light-manufacturing, and service-oriented startups and small-to-medium enterprises may implement AI-based analytics to judiciously guide resource deployment, forecast shifting consumptive patterns, and expand market presence in an environmentally sustainable manner (Dwivedi et al., 2023; Paul, 2023). Such instruments not only enhance the robustness of managerial judgement but also improve throughput and customer interaction, thereby yielding a measurable advantage over more traditional peers.

POLICY IMPLICATIONS

Coherent state-led action and supportive institutional frameworks are vital for building a healthy AI literacy foundation and cultivating the entrepreneurial skill set. Strategic policy packages that broaden access to AI-capable infrastructure, adjust price signals in favour of technology adoption, and enforce ethical operational norms can engender a more inclusive, resilient entrepreneurial climate (Xie, 2025; Diaz-García et al., 2025). Comprehensive regulatory instruments that govern data integrity, creative algorithm transparency, and climate-compatible technology will further encourage responsible nationwide adoption.

IMPLICATIONS FOR FURTHER RESEARCH

Future research should adopt longitudinal frameworks to best assess the enduring consequences of AI integration on corporate expansion and environmentally responsible sustainability. Cross-regional, cross-sector, and cross-firm-size comparative time-series studies may reveal distinct adoption profiles and performance trajectories. Complementary lines of inquiry that track culture-change dynamics, skills-formation patterns, and the evolution of entrepreneurial networks will strengthen the theoretical-applied interface and promote more actionable knowledge (Obschonka, 2025; Kusetogullari et al., 2025).

LIMITATIONS OF THE STUDY

This research, while additive to the literature, is subject to limitations that merit acknowledgement. First, the geographic focus on Haryana constrains the broader applicability of the findings; economic, technological, and policy variables may behave differently outside this context and conceal heterogeneous impacts of AI adoption. Second, the cross-sectional framework—albeit multi-lensed through surveys, interviews, and selected case studies—precludes an assessment of how AI integration influences the trajectory of entrepreneurial sustainability over multiple phases of business development. Third, data collected via self-administered instruments and interviews are vulnerable to respondent-driven bias, particularly in measures of AI perceived effectiveness and self-reported performance metrics. Finally, the methodological repertoire privileges quantitative and semi-structured qualitative procedures, thus leaving unexplored the potential illumination that fully embedded ethnography or controlled field experiments could yield regarding the micro- and meso-scale behavioral and organizational contingencies inherently implicated in AI uptake.

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