

Review Paper

From Digital Literacy to Responsible AI-Driven Entrepreneurship: Institutional Readiness and Policy Implications for Higher Education

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Abstract

Purpose: This paper develops a theory-informed conceptual framework for responsible AI entrepreneurship ecosystems in higher education. It addresses the limited integration of AI capabilities, entrepreneurship, institutional readiness, and governance in existing scholarship, particularly amid increasing AI adoption by higher education institutions (HEIs).

Methodology: The study adopts a conceptual research approach grounded in institutional, human capital, and entrepreneurial ecosystem theories. Relevant literature on AI, entrepreneurship, higher education, governance, and innovation ecosystems is synthesised to construct an integrated conceptual framework.

Results: The framework conceptualises responsible AI entrepreneurship as the intersection of AI capability, entrepreneurial innovation, ethical responsibility, and institutional governance. It identifies four interrelated dimensions: AI capability, entrepreneurial innovation, ethical and governance capability, and institutional readiness, and explains how leadership, pedagogy, technological infrastructure, governance systems, and ecosystem collaboration shape universities' capacity to foster sustainable AI-driven innovation. Particular attention is given to challenges facing developing economies.

Novelty and Contribution: The study advances higher education scholarship by integrating AI capability development, institutional readiness, entrepreneurship, and ecosystem thinking into a unified conceptual model, providing a foundation for future empirical research on responsible AI entrepreneurship ecosystems.

Practical and Social Implications: The framework offers guidance for policymakers and university leaders seeking to strengthen AI governance, institutional readiness, and ecosystem collaboration. It supports the development of ethical, inclusive, and innovation-oriented higher education systems capable of preparing graduates and entrepreneurs for AI-driven economies.

Keywords: Responsible AI entrepreneurship; AI capability; Institutional readiness; Higher education transformation; Entrepreneurial ecosystems

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1 Introduction

Artificial intelligence (AI) is fundamentally reshaping how societies learn, work, and innovate. Across higher education and entrepreneurship, AI technologies are altering not only the tools used but also the processes through which knowledge is produced, processed and applied. The rapid development of machine learning and generative AI has accelerated the emergence of digitally mediated innovation ecosystems (Dwivedi et al., 2023; Yarram & Parimi, 2024). Within higher education institutions (HEIs), these developments transform curriculum design, pedagogy, and governance, prompting them to reconsider their roles in knowledge economies (Zawacki-Richter et al., 2019). Simultaneously, labour markets face structural shifts as AI automates routine tasks while increasing demand for advanced cognitive and entrepreneurial capabilities (OECD, 2023; da Silva, 2024). Consequently, HEIs face intensifying pressure to prepare graduates for responsible engagement within AI-driven economies.

The connection between AI and entrepreneurship strengthens the strategic importance of HEIs as innovation actors. AI-driven entrepreneurship differs from earlier digital forms by incorporating intelligent systems and algorithmic decision-making into venture development (Nambisan et al., 2019; Usman et al., 2024). Consequently, they are expected to operate as entrepreneurial ecosystems that facilitate both interdisciplinary collaboration and industry engagement (Cunningham et al., 2022). In this context, AI innovation ecosystems are interconnected networks of HEIs, governments, and industries that collectively support entrepreneurial capability and knowledge transfer (Autio et al., 2018; Saha et al., 2022), thereby expanding higher education to play a role in broader forms of innovation leadership.

These developments reflect a critical shift from conventional digital literacy toward broader AI capability. Traditional frameworks focused on operational technology use and communication (Ng, 2012). However, AI-intensive environments require more sophisticated capabilities, including ethical reasoning, algorithmic awareness, and data governance (Long & Magerko, 2020; Brusseau, 2023). Beyond technical proficiency, AI capability extends to responsible engagement in complex entrepreneurial contexts. Recent scholars argue that graduates require integrated competencies that combine technological fluency with ethical judgement and adaptability to navigate evolving digital economies (Luckin et al., 2022; Sohaee et al., 2023).

Alongside these opportunities, accelerated AI adoption creates significant concerns regarding ethics and social responsibility. Issues such as algorithmic bias, privacy, and unequal access have intensified debates on the societal implications of AI (Floridi & Cows, 2019; Lainjo, 2020). In response, responsible AI, defined by transparency, fairness, and alignment with human values, has become a paramount concern (Jobin et al., 2019). HEIs are then called upon to produce graduates who can seriously engage with AI while contributing to sustainable innovation. Thus, responsible AI entrepreneurship is an educational priority linking technological capability with institutional transformation.

Nonetheless, despite AI's potential, many HEIs' systems remain grounded in literacy paradigms that fail to address the complexities of AI-driven innovation. Educational models often prioritise technical skills and basic digital competence while neglecting AI governance and ethical reasoning (Selwyn, 2022). Consequently, curricula remain insufficiently equipped for environments where AI shapes economic decision-making and organisational processes.

A significant challenge is the limited integration of responsible AI within entrepreneurship education (EE). While HEIs' entrepreneurship programmes promote innovation, they often overlook data governance and algorithmic accountability (Ratten, 2020; Nwaimo et al., 2023). Similarly, George (2023) and Yadav (2024) concluded that AI initiatives frequently focus on technical skills at the expense of their ethical dimensions, disconnecting the development of sophisticated technological abilities by students without the critical awareness necessary to navigate the governance implications of AI-driven ventures. Additionally, institutional readiness for this transformation remains uneven. Many HEIs struggle with fragmented strategies, limited infrastructure, and insufficient faculty expertise (Gkrimpizi et al., 2023; Crompton & Burke, 2023). Readiness encompasses curriculum redesign, strategic leadership, and ecosystem collaboration. However, structural barriers, including funding limitations and weak policy frameworks, constrain effective AI integration, particularly in developing economies (Mhlanga, 2023; Folorunso et al., 2024), reducing HEIs' capacity to support responsible and sustainable innovation.

Governance concerns further complicate AI integration. Generative AI has raised questions regarding digital inequality, intellectual property and academic integrity (Bearman et al., 2023; Al-Kfairy et al., 2024). While institutional governance often remains reactive, lacking frameworks to guide ethical use across teaching and research, it should

also be noted that without robust systems, technological innovation may advance faster than ethical accountability (Sivasubramaniam et al., 2021; Da Silva & Gani, 2022).

Together, these challenges risk producing graduates who are technologically capable but ethically underprepared, especially in developing economies, where regulatory inconsistencies and institutional vulnerabilities may deepen the risks of unregulated AI adoption (Akinwale & Grobbelaar, 2022; Folorunso et al., 2024), making it imperative for frameworks that integrate AI capability, entrepreneurial competence, and institutional readiness within a coherent policy approach. Conceptually, this study unifies discussions of AI literacy, institutional transformation, and responsible innovation. It extends debates on AI governance by emphasising the conditions necessary for ethical ecosystems, particularly in developing economies where capability gaps remain significant. Therefore, the paper pursues three objectives:

- i. To examine the relationship between digital literacy, AI capability, and entrepreneurship in higher education.
- ii. To conceptualise responsible AI entrepreneurship and develop a framework linking it to institutional readiness and innovation ecosystems.
- iii. To analyse the policy and institutional implications of responsible AI entrepreneurship in higher education, particularly within developing economies.

The study contributes to scholarship on curriculum transformation and graduate ethical AI preparedness. By offering a framework for redesigning educational models, it aligns technological development with ethical innovation. Policy-wise, it highlights the importance of aligning national AI strategies with HEIs reform. For developing economies, the focus on institutional readiness addresses broader discussions concerning inclusive innovation and equitable technological participation.

2 Conceptual Background

From Digital Literacy to AI Capability

Digital literacy is defined as the capacity to access, evaluate, and communicate information via digital technologies (Feerrar, 2019; Tinmaz et al., 2023). Early academic discourse emphasised functional and cognitive skills, such as information retrieval and responsible online participation (Eshet-Alkalai, 2004; Martin & Grudziecki, 2006; Ng, 2012). These competencies became central to higher education as institutions expanded technology-enhanced learning and digitally mediated assessment, linking literacy to graduate employability (Siddiq et al., 2016; van Laar et al., 2017).

However, the rise of AI has fundamentally broadened the scope of digital capability. AI capability necessitates more than tool proficiency; it requires an understanding of data generation, algorithmic operations, and automated decision-making. AI is now deeply embedded in generative tools, learning analytics, and institutional governance (Zawacki-Richter et al., 2019; Crompton & Burke, 2023). Consequently, graduates require a synthesis of data competence, digital fluency, and ethical reasoning to exercise critical judgment when engaging with intelligent systems.

The transition from digital literacy to AI capability is both pedagogical and conceptual. While literacy enables participation, capability empowers learners to interrogate and responsibly apply intelligent systems. This distinction is vital, as AI systems are shaped by data and design choices that can perpetuate misinformation or bias (Bearman et al., 2023; Memarian & Doleck, 2023). Mastery, therefore, requires moving beyond operational competence toward a critical awareness of how these systems influence knowledge production.

Existing digital literacy frameworks are increasingly inadequate for AI-intensive environments, as they often prioritise tool usage while neglecting algorithmic opacity and human–AI interaction. HEIs must reconceptualise graduate capabilities through curricula that integrate literacy, ethical reasoning, and entrepreneurial application. Without such interdisciplinary integration, graduates may remain digitally competent yet ethically underprepared for AI-driven societal contexts.

Responsible AI in Higher Education

The proliferation of AI in HEIs has intensified discourse regarding ethics, governance, and institutional responsibility. Responsible AI encompasses the design and deployment of systems that uphold privacy, fairness, transparency, accountability, and human agency. These concerns are critical as AI increasingly influences pedagogy, assessment, and research analytics (Bearman et al., 2023; Crompton & Burke, 2023). Consequently, AI's implications are actively reshaping student experiences and institutional trust.

Fairness is a primary concern; AI tools trained on biased datasets may reinforce existing inequalities in academic support (Mittelstadt et al., 2016; Jobin et al., 2019). Furthermore, accountability remains a challenge regarding liability for AI-mediated decisions. Explainability and transparency are equally vital, as opaque "black box" algorithms may dictate learning pathways without adequate human oversight (Floridi & Cows, 2019; Memarian & Doleck, 2023).

Effective adoption requires practical governance, such as staff training, robust academic integrity policies, and rigorous data frameworks, rather than abstract ethical statements. While generative AI offers innovative opportunities, it also raises risks regarding plagiarism and cognitive over-reliance (Kasneji et al., 2023). HEIs must therefore treat AI as a fundamental pedagogical and governance challenge requiring sustained institutional reflection (Bearman et al., 2023; Katsamakos et al., 2024).

This responsibility assumes particular significance in entrepreneurship education. Students utilising AI for business modelling or market analysis must engage with the ethical dimensions of innovation. Responsible AI entrepreneurship transcends technological creativity; it demands critical engagement with privacy and social impact to ensure graduates innovate sustainably.

AI Entrepreneurship and Innovation Ecosystems

AI entrepreneurship involves leveraging artificial intelligence to identify opportunities, automate processes, and create novel business models. While similar to digital entrepreneurship, it is distinct due to its heavy reliance on intelligent systems and algorithmic decision-making. Digital technologies have made innovation more open and generative; consequently, entrepreneurial activity is no longer confined to individual firms but emerges through interconnected digital systems and collaborative networks (Nambisan et al., 2019).

These activities are deeply embedded within broader innovation ecosystems. Entrepreneurial ecosystem theory suggests that venture creation is influenced by networks of institutions, policies, and knowledge systems (Stam, 2015; Spigel, 2017). In AI-driven contexts, these involve universities, technology firms, investors, and regulatory agencies. Digital entrepreneurial ecosystems are shaped by the interaction between technological infrastructures and institutional conditions (Autio et al., 2018; Sussan & Acs, 2017). However, scholarship remains conceptually fragmented regarding how these elements intersect, reinforcing the need for integrated approaches to AI entrepreneurship in higher education.

HEIs occupy a strategic position within these ecosystems. Beyond teaching and research, HEIs contribute via talent development, research commercialisation, and startup incubation. The 'entrepreneurial university' literature highlights how institutions stimulate regional development through technology transfer and interdisciplinary collaboration (Etzkowitz & Leydesdorff, 2000; Guerrero et al., 2016). In AI-driven economies, this role is more complex: universities must not only encourage innovation but also ensure that AI-enabled ventures are ethically informed and socially responsible.

Consequently, AI-driven transformation requires integrated capability development. Students need a combination of entrepreneurial competence, AI literacy, and ethical awareness. Capability in AI-intensive economies transcends business planning; it involves critically evaluating AI-generated insights and managing data responsibly. Responsible AI entrepreneurship thus acts as a bridge between higher education and sustainable digital transformation.

Institutional Readiness for AI Transformation

As AI permeates higher education, institutional readiness, defined as the strategic, pedagogical, and governance capacity for effective adoption, becomes paramount. Transformation transcends mere infrastructure, requiring

systemic alignment across leadership, curriculum design, and external partnerships (Benavides et al., 2020; Crompton & Burke, 2023).

Strategic readiness depends on a coherent institutional vision; without leadership commitment and clear policy direction, AI adoption remains fragmented or reactive. Equally significant is pedagogical readiness, which hinges on the faculty's ability to integrate AI in ways that augment, rather than replace, human judgment. Research identifies staff capability and curriculum redesign as the primary drivers of meaningful institutional change (Bearman et al., 2023; Zawacki-Richter et al., 2019).

While technological infrastructure and cybersecurity are essential, governance readiness is critical. AI integration raises complex challenges regarding data privacy, academic integrity, and algorithmic accountability (Floridi & Cowls, 2019; Memarian & Doleck, 2023). Consequently, universities require robust frameworks to oversee AI selection and regulation. Furthermore, ecosystem readiness, the capacity to collaborate with industry and government, is vital for responsible entrepreneurship, providing students with access to real-world ethical innovation networks (Autio et al., 2018; Stam, 2015).

In developing economies, readiness is a multidimensional challenge often constrained by infrastructure gaps and digital inequality. In these contexts, sustainable transformation requires phased capacity-building, inclusive access, and context-sensitive governance.

3 Theoretical Foundations of Responsible AI Entrepreneurship Ecosystems

Institutional Theory

Institutional Theory provides a critical lens for understanding how higher education institutions (HEIs) navigate technological disruption and evolving governance expectations. The theory posits that organisations are shaped by wider institutional environments that define legitimate and socially acceptable behaviour (Scott, 2014). Consequently, HEI responses to AI are determined not only by technological potential but also by policy mandates, professional norms, and public trust regarding responsible innovation.

The proliferation of AI has intensified pressure on universities to modernise curricula and pedagogical practices. HEIs are increasingly expected to function as adaptive entities that prepare graduates for AI-driven economies while maintaining ethical integrity (Benneworth et al., 2018; Selwyn, 2022). Institutional Theory categorises these pressures into three distinct types (DiMaggio & Powell, 1983):

- **Coercive:** Pressures stemming from governments, regulators, and accreditation bodies.
- **Normative:** Expectations emerging from academic and professional communities.
- **Mimetic:** The imitation of perceived leaders or successful peers within the sector.

These pressures are most visible in AI governance. As universities integrate AI into teaching and administration, they must address academic integrity, data privacy, algorithmic bias, and ethical accountability (Floridi & Cowls, 2019; Jobin et al., 2019). AI adoption is thus a governance challenge requiring oversight mechanisms that balance innovation with institutional legitimacy. Organisations maintain this legitimacy by adjusting routines and strategic priorities in response to shifting environments (Scott, 2014).

However, institutional responses remain heterogeneous, shaped by leadership capacity, resource availability, and organisational culture. While some HEIs proactively integrate AI into entrepreneurial activities, others remain reactive due to infrastructural gaps or policy uncertainty (Crompton & Burke, 2023). This unevenness is particularly acute in developing economies, where transformation is often constrained by funding pressures and weak digital infrastructure (Mhlanga, 2023).

From this perspective, institutional readiness transcends technical preparedness; it reflects the strategic vision and adaptability required to align institutional practices with societal expectations. Universities that successfully synchronise strategy, governance, and innovation ecosystems are best positioned to foster sustainable, responsible AI entrepreneurship.

Human Capital Theory

Human Capital Theory provides a robust foundation for understanding why responsible AI entrepreneurship is a priority for higher education. Proponents such as Becker (1964) and Schultz (1961) argue that education and training are strategic investments that enhance individual capabilities, employability, and economic participation. In AI-driven economies, this perspective is increasingly relevant; technological transformation depends on graduates possessing technical expertise alongside cognitive flexibility and entrepreneurial adaptability.

The transition from digital literacy to AI capability reflects a shift in how human capital is valued. Contemporary labour markets demand graduates who can critically engage with intelligent systems, interpret complex data, and apply technological knowledge within innovation-oriented settings (OECD, 2023). Consequently, universities must cultivate advanced competencies, including critical thinking, ethical reasoning, and innovation capacity, that extend beyond operational digital skills. From this theoretical perspective, investments in AI literacy and interdisciplinary learning enhance the long-term value of graduates within knowledge-intensive economies.

AI capability development represents a modern form of human capital formation, encompassing data competence, algorithmic awareness, and responsible technology use (Long & Magerko, 2020). In entrepreneurial contexts, these competencies allow graduates to recognise opportunities and develop AI-enabled ventures. However, responsible entrepreneurship requires more than technical mastery; it demands the ethical awareness necessary to reflect on the societal implications of innovation. Human Capital Theory thus supports the integration of technological knowledge, entrepreneurial competence, and ethical responsibility.

Entrepreneurship education has similarly evolved, moving beyond narrow business management toward fostering an innovation mindset, resilience, and interdisciplinary problem-solving (Lack  us, 2015). These traits are vital in environments shaped by automation and platform-based competition. Universities, therefore, serve as central hubs for preparing students to lead responsible forms of AI-enabled venture creation.

Furthermore, AI-driven labour markets increasingly reward those who combine technical proficiency with 'collaborative intelligence' and adaptive learning (Brynjolfsson & McAfee, 2014; Challoumis, 2024). This reinforces the strategic role of higher education as an investment in national innovation capacity and economic resilience. These issues are particularly acute in developing economies, which often face gaps in digital infrastructure and faculty expertise. In such contexts, investing in AI capability serves broader goals of socio-economic transformation and inclusive digital development. Therefore, human capital theory sustains the argument that responsible AI entrepreneurship ecosystems depend on educational investment and long-term institutional capability-building.

Entrepreneurial Ecosystem Theory

Entrepreneurial ecosystem theory provides a systemic framework for understanding how responsible AI entrepreneurship emerges through the interplay of institutions, technologies, policies, and networks. Rather than attributing success solely to individual talent, the theory posits that activity is shaped by a holistic environment involving universities, industry, government, and cultural norms (Stam, 2015; Spigel, 2017). This perspective is critical because AI-enabled ventures require a convergence of data access, technical expertise, and regulatory support (Autio et al., 2018). Within these systems, universities serve as strategic anchors by facilitating knowledge production and connecting students with broader innovation networks.

HEIs–industry collaboration is a cornerstone of these ecosystems. The convergence of AI and innovation has expanded the university's role in research commercialisation and startup incubation (Etzkowitz & Leydesdorff, 2000). In AI-intensive sectors, such partnerships are essential, as institutions often lack the independent infrastructure or market access required for large-scale innovation. Incubation spaces and digital innovation labs further drive ecosystem-based innovation by fostering technological experimentation and interdisciplinary mentorship (Rippa & Secundo, 2019). According to the theory, these structures strengthen entrepreneurial capability by providing access to the professional networks necessary for scaling innovations. Crucially, the ecosystem perspective highlights that responsible AI entrepreneurship is a systemic process. It is shaped not only by entrepreneurs but also by policymakers, developers, and civil society actors who collectively define ethical standards and governance expectations.

In developing economies, this theory is particularly salient as innovation often depends on partnerships to overcome resource constraints. In these contexts, universities act as central intermediaries within emerging AI ecosystems, supporting inclusive innovation and socially responsible technological development.

Integrating the Theoretical Perspectives

Institutional, human capital, and entrepreneurial ecosystem theory collectively provide a comprehensive framework for understanding responsible AI entrepreneurship. Their integration reveals how institutional change, capability development, and ecosystem collaboration intersect to shape innovation.

- **Institutional Theory** clarifies how HEIs navigate the pressures of AI transformation. It emphasises the necessity of institutional readiness, policy alignment, and ethical oversight to maintain legitimacy and public trust amidst rising societal expectations.
- **Human Capital Theory** focuses on the individual, explaining why investment in AI capability, entrepreneurial competence, and ethical reasoning is vital. It posits that institutional transformation and human capital formation are interdependent, as universities must produce graduates who are both technologically proficient and critically aware.
- **Entrepreneurial Ecosystem Theory** situates universities within wider innovation systems. Unlike the organisational or individual focus of the previous theories, this framework highlights the networks and partnerships that sustain entrepreneurial activity, arguing that responsible innovation depends on collaborative infrastructure and shared ethical governance.

The synergy between these perspectives forms the conceptual bedrock of responsible AI entrepreneurship. Institutional readiness provides the policy foundations; human capital formation equips stakeholders with ethical and technical competencies; and entrepreneurial ecosystems offer the collaborative framework to translate these capabilities into socially meaningful innovation. Ultimately, responsible AI entrepreneurship is a multidimensional phenomenon requiring integrated governance, long-term capability development, and collaborative innovation.

4 Developing a Conceptual Framework for Responsible AI Entrepreneurship Ecosystems

Defining Responsible AI Entrepreneurship

The convergence of artificial intelligence, entrepreneurship, and higher education necessitates an integrated understanding of innovation. Existing discourse often treats digital innovation, technology ventures, and AI transformation as discrete phenomena, frequently neglecting ethical governance and institutional readiness. This paper conceptualises responsible AI entrepreneurship as a multidimensional process through which individuals and institutions develop and govern AI-enabled activities in ways that are innovative, ethically grounded, and institutionally supported.

This conceptualisation resides at the intersection of four interconnected dimensions:

- **AI Capability:** Competencies required to work with intelligent systems and data infrastructures (Long & Magerko, 2020).
- **Entrepreneurial Innovation:** Identifying and scaling opportunities through AI-enabled products and models (Nambisan, 2017).
- **Ethical Responsibility:** Principles of fairness, transparency, and human-centred innovation (Floridi & Cowls, 2019; Jobin et al., 2019).
- **Institutional Governance:** Strategic, pedagogical, and policy structures that legitimise AI innovation within higher education (Scott, 2014).

This approach differs significantly from traditional models. Digital entrepreneurship often overlooks algorithmic governance (Nambisan, 2017; Sussan & Acs, 2017), while technology entrepreneurship may fail to engage with the socio-ethical implications of datafication (Bailetti, 2012). Furthermore, conventional AI frameworks frequently prioritise technical efficiency over educational transformation (Dwivedi et al., 2023).

Responsible AI entrepreneurship transcends technological optimisation by situating innovation within ethical and societal contexts. It recognises that entrepreneurial success is inseparable from fairness, governance legitimacy, and social sustainability. Consequently, this framework views ecosystems as interconnected systems where universities, industry, and policymakers collectively drive AI capability and institutional transformation. It is a socio-technical process dependent on integrated capability development and ecosystem-level coordination.

Core Dimensions of Responsible AI Entrepreneurship Ecosystems

The proposed conceptual framework comprises four interconnected dimensions: AI Capability, Entrepreneurial Innovation, Ethical and Governance Capability, and Institutional Readiness. These dimensions are not isolated components; they interact to influence how universities prepare students and support sustainable, innovation-oriented ecosystems.

i. AI Capability Dimension

This dimension represents the foundational competency layer. As AI becomes embedded in entrepreneurial environments, graduates require capabilities that transcend conventional digital literacy, focusing on three key areas:

- **AI Literacy:** The capacity to understand AI operations, interact with tools, and interpret outputs within social contexts (Long & Magerko, 2020). It involves recognising system limitations and biases rather than mere technical proficiency.
- **Data and Algorithmic Awareness:** Understanding how data are generated, governed, and potentially distorted. Awareness allows individuals to identify the assumptions embedded within predictive analytics (Brynjolfsson & McAfee, 2014).
- **Critical AI Evaluation:** The ability to exercise judgement regarding misinformation and algorithmic discrimination (Kasneci et al., 2023). This is vital in entrepreneurial settings where AI tools influence strategic choices and stakeholder relationships.

ii. Entrepreneurial Innovation Dimension

This dimension focuses on identifying opportunities and developing sustainable ventures. AI-driven entrepreneurship intensifies the need for an innovation mindset, characterised by creativity and strategic problem-solving in response to rapidly changing technological conditions. Venture creation capability is equally critical, involving the practical ability to design business models and mobilise resources within platform-based ecosystems (Nambisan et al., 2019). Furthermore, this dimension prioritises sustainable development, positioning innovation as an ethically informed process that considers social inclusion and stakeholder well-being.

iii. Ethical and Governance Dimension

Addressing the normative foundations of the ecosystem, this dimension centres on responsible AI reasoning. This involves evaluating societal implications and ensuring decisions align with fairness and human-centred innovation (Floridi & Cowls, 2019). Accountability and transparency are vital governance principles; they ensure that AI-mediated outcomes are explainable and that data usage remains open. Finally, governance awareness helps students navigate institutional policies and regulatory frameworks, ensuring that innovation is balanced with ethical oversight and institutional legitimacy (Bearman et al., 2023).

iv. Institutional Readiness Dimension

This dimension reflects the systemic conditions necessary to cultivate these ecosystems. Readiness extends beyond infrastructure to include:

- **Strategic Leadership:** A clear institutional vision and policy direction that aligns AI transformation with educational values.
- **Academic Capability:** Faculty expertise and interdisciplinary research that ensure AI is integrated into curricula with pedagogical depth.
- **Infrastructure and Policy Support:** The provision of secure data systems and quality assurance frameworks that facilitate ethical AI integration.

Collectively, institutional readiness positions universities as strategic actors capable of shaping AI-driven innovation through coordinated governance and collaborative development.

The Role of Higher Education Institutions in AI Ecosystems

Higher education institutions (HEIs) have emerged as pivotal actors within AI-driven innovation ecosystems, functioning as nexuses for knowledge production, talent development, and entrepreneurial activity. While the 'entrepreneurial university' model originally defined the institutional role in technology transfer and startup creation (Etzkowitz & Leydesdorff, 2000), AI-driven economies have expanded this mandate. Universities are now expected to lead AI capability development and facilitate responsible technological transformation.

Today, HEIs operate as innovation hubs within wider ecosystems. By establishing AI laboratories, incubators, and digital innovation programmes, universities provide environments for experimentation and knowledge exchange (Rippa & Secundo, 2019; Schumann et al., 2024). These platforms enable students and researchers to engage with AI in practical settings while fostering essential collaboration between academic, industrial, and policy stakeholders.

AI entrepreneurship education reinforces this institutional role. Preparing students for the AI era necessitates an interdisciplinary approach that integrates technical training with ethical reasoning and an innovation mindset (George, 2023; Saad, 2023). Consequently, the HEI mission has shifted from teaching functional skills toward cultivating critical thinking, governance awareness, and socially responsible innovation capability.

Furthermore, HEIs drive ecosystems through interdisciplinary knowledge production. Because AI innovation depends on the convergence of computer science, ethics, and public policy, HEIs serve as vital nodes in knowledge economies (Dai & Zhu, 2025). Collaboration with industry actors further strengthens these ecosystems, providing technical insights and funding to ensure educational programmes remain aligned with labour market shifts (Autio et al., 2018; Rosienkiewicz et al., 2024).

In developing economies, the ecosystemic role of HEIs is particularly critical. They often act as primary intermediaries linking technological capability with policy and local entrepreneurship (Bramwell et al., 2019). Despite infrastructural constraints, HEIs foster inclusive innovation by supporting local AI talent and facilitating sustainable digital transformation (Ahmad, 2024). In this capacity, HEIs do not merely react to AI; they actively shape the evolution of innovation ecosystems within their broader socio-economic contexts.

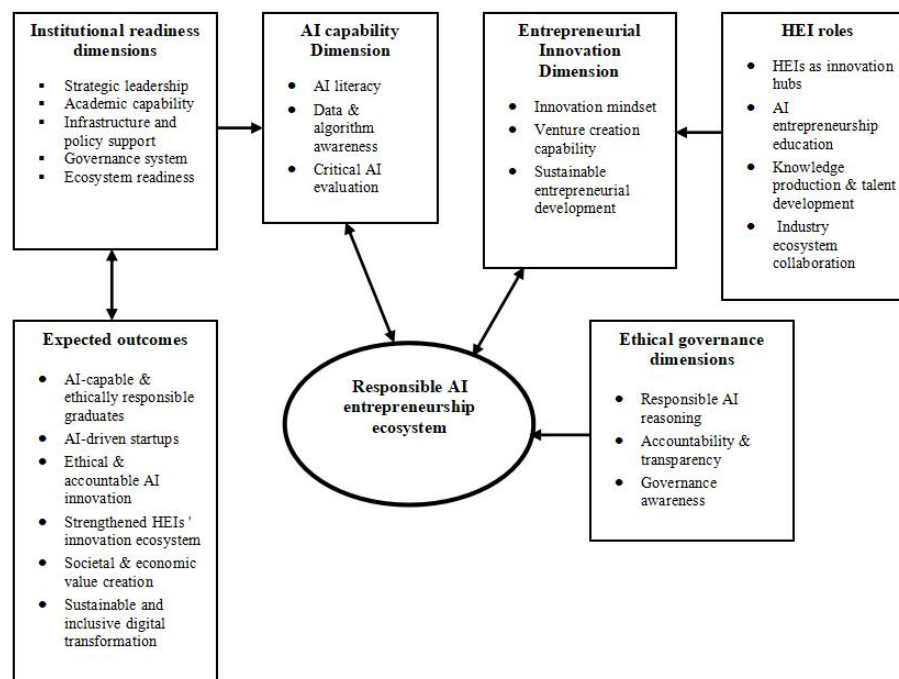


Figure 1 Conceptual frameworks for responsible AI entrepreneurship ecosystems in HEIs

Figure 1 above illustrates how responsible AI entrepreneurship ecosystems in higher education are shaped through the interaction of four interconnected dimensions: AI capability, entrepreneurial innovation, ethical and governance capability, and institutional readiness. AI capability provides the foundational competencies required for engaging with intelligent technologies, while entrepreneurial innovation supports venture creation and innovation-oriented thinking. The ethical and governance dimension ensures that AI-driven activities are guided by accountability, transparency, and responsible innovation principles. These dimensions are strengthened by institutional readiness through strategic leadership, academic capability, infrastructure, and policy support. Collectively, the framework positions universities as central actors within AI-driven innovation ecosystems capable of fostering sustainable and ethically responsible entrepreneurship.

5 Institutional Readiness and Ecosystem Transformation

Strategic and Leadership Readiness

Institutional readiness for responsible AI entrepreneurship begins with strategic clarity. AI transformation is not merely technical adoption; it is an organisational change process requiring long-term vision and adaptive leadership. Successful universities demonstrate coherent strategies that align technological innovation with academic values and societal responsibility (Benavides et al., 2020; Crompton & Burke, 2023). Without such direction, AI adoption becomes fragmented, leading to disconnected experimentation lacking governance coherence (Selwyn, 2022). Leadership commitment is a foundational enabler. Leaders must navigate uncertainty and balance innovation with academic integrity and institutional legitimacy (Abad-Segura et al., 2020). Successful integration depends on institutional flexibility and continuous organisational learning to maintain public trust during rapid technological shifts (Scott, 2014).

Academic and Pedagogical Readiness

Academic readiness refers to the educational capacity to integrate AI capability, entrepreneurial learning, and ethical reasoning. Faculty competence is a primary determinant; staff require familiarity with algorithmic processes to design meaningful learning experiences (Crompton & Burke, 2023). However, uncertainty regarding the ethical implications of AI persists among many educators (Bearman et al., 2023). Curriculum integration must transcend disciplinary boundaries, combining technical literacy with interdisciplinary problem-solving (Luckin et al., 2022). Experiential pedagogies, such as innovation labs and industry-linked projects, allow students to apply AI in practical settings while developing critical awareness (Lack us, 2015). Furthermore, institutions must rethink assessment practices as generative AI challenges conventional assumptions of authorship and originality (Kasneci et al., 2023).

Technological and Governance Readiness

While AI transformation is technology-driven, its success depends on the governance structures guiding its use. Foundational readiness requires digital infrastructures, including cloud computing and secure data architectures (Benavides et al., 2020). However, investment without governance often results in unsustainable initiatives (Abad-Segura et al., 2020). Governance readiness involves establishing policies for algorithmic accountability, data privacy, and ethical oversight (Floridi & Cows, 2019; Jobin et al., 2019). Institutions must strike a balance between encouraging innovation and maintaining safeguards for academic integrity, particularly as generative AI complicates traditional plagiarism policies (Bearman et al., 2023; Tlili et al., 2023).

Ecosystem Readiness

Ecosystem readiness is the capacity of universities to engage with industry, government, and civil society. Innovation rarely emerges in isolation; it develops through collaborative relationships (Spigel, 2017; Stam, 2015). Industry partnerships are vital for accessing real-world applications and funding, as technological advancement often moves faster in the private sector than in academia (Etzkowitz & Leydesdorff, 2000). Innovation hubs and incubators further strengthen this dimension by facilitating interdisciplinary experimentation and mentorship (Rippa & Secundo, 2019).

Coordinated relationships ensure that educational programmes remain aligned with workforce expectations and societal needs (OECD, 2023).

Challenges in Developing Economies

Universities in developing economies face structural barriers that limit their ecosystem participation. Unreliable connectivity, unstable power, and limited computational capacity hinder the integration of AI (Mhlanga, 2023). Additionally, limited financial resources restrict the ability to sustain large-scale faculty development or research initiatives (Akinwale & Grobbelaar, 2022). Governance gaps and policy inconsistency further create uncertainty regarding ethical oversight and data privacy (UNESCO, 2021). Furthermore, digital inequality risks deepening existing socio-economic disparities (Selwyn, 2022). Despite these constraints, universities can act as intermediaries, building context-sensitive AI ecosystems that respond to local priorities through inclusive innovation policies.

6 Policy and HEIs Implications

Implications for Higher Education Institutions

The rise of responsible AI entrepreneurship ecosystems necessitates a shift from fragmented technology adoption to holistic institutional transformation. To remain relevant, universities must rethink their educational models to integrate AI capability, entrepreneurial competence, and ethical reasoning (Crompton & Burke, 2023; Dwivedi et al., 2023).

- **Curriculum Redesign:** Curricula must move beyond narrow discipline-specific silos toward interdisciplinary pathways. This involves embedding AI literacy and governance capability across business, education, and social sciences, rather than confining them to engineering (Luckin et al., 2022).
- **Reimagining Entrepreneurship Education:** Traditional programmes often overlook algorithmic accountability and data governance. Integrating responsible AI principles requires experiential approaches, such as incubators and challenge-based learning, to ensure students can apply AI ethically in venture creation (Ratten, 2020).
- **Readiness Strategies:** Institutions need long-term plans that align leadership vision with governance frameworks. This includes addressing academic integrity, intellectual property, and algorithmic bias across all university activities (Benavides et al., 2020).

Implications for Educators and Academic Leaders

Because faculty are the primary drivers of curriculum delivery, their preparedness is vital. Many educators currently face uncertainty regarding the professional and ethical implications of generative AI (Bearman et al., 2023).

- **Faculty Development:** Continuous professional development is essential. This should focus not only on technical familiarity but also on critical AI evaluation and innovation-oriented teaching.
- **Pedagogical Shift:** As generative AI democratizes content creation, educators should pivot from content transmission toward fostering critical thinking, creativity, and collaborative problem-solving (Kasneci et al., 2023).
- **Leadership Culture:** Academic leaders must foster an organisational culture that supports interdisciplinary collaboration and ethical experimentation. Their commitment determines resource allocation and the legitimacy of institutional adaptation.

Implications for Policymakers and Regulators

Policymakers must create environments that support responsible AI integration while ensuring societal well-being (OECD, 2023).

- **Governance Frameworks:** National standards are needed to provide clarity on fairness, transparency, and human oversight in AI systems (Floridi & Cowls, 2019; UNESCO, 2021).
- **Funding and Infrastructure:** Significant investment is required for digital infrastructure, cybersecurity, and innovation grants. This is particularly urgent for institutions facing resource constraints (Mhlanga, 2023).

- **Sector Alignment:** Policies must align higher education with industrial strategy and national innovation agendas. This facilitates university-industry collaboration and ensures knowledge transfer between academia and the digital economy.

Implications for Developing Economies

In developing economies, AI transformation risks deepening digital inequality if institutional readiness is neglected (Akinwale & Grobbelaar, 2022).

- **Inclusive Capability:** Strategies must prioritise equitable access to AI technologies and context-sensitive curriculum transformation to prevent reinforcing socio-economic disparities.
- **Capacity Building:** Long-term institutional strengthening is required, supported by international partnerships and regional networks to overcome local resource limitations.
- **Context-Sensitive Innovation:** Developing economies should avoid "one-size-fits-all" models. Instead, ecosystems should be aligned with local developmental priorities, such as social equity and workforce inclusion, ensuring that AI entrepreneurship responds to local social realities.

7 Conclusion

Higher education institutions (HEIs) must move beyond teaching operational digital skills to fostering integrated, responsible AI entrepreneurship ecosystems. HEIs are no longer mere providers of qualifications; they are strategic actors in AI-driven innovation systems. This transformation is as much a governance challenge as a technological one, requiring a synchronisation of leadership, pedagogy, and infrastructure to ensure innovation remains ethically grounded and socially sustainable. Conceptually, this paper unifies institutional, human capital, and entrepreneurial ecosystem theories into a single framework. This integration shifts the academic discourse from simple technical adoption toward broader questions of institutional legitimacy and socio-ethical responsibility. From a policy standpoint, the paper advocates for coordinated governance frameworks that prioritise curriculum redesign and faculty upskilling. It specifically highlights the necessity for inclusive innovation and capacity-building in developing economies to ensure equitable digital transformation.

Directions for Future Research

The expansion of AI within HEIs presents a fertile ground for empirical inquiry. Future scholarship should move beyond conceptual debates toward evidence-based research that examines the interaction between institutional readiness, AI capability, and governance systems. Researchers should operationalise the proposed framework's dimensions. Quantitative methods, such as Structural Equation Modelling (SEM) or configurational analysis, could determine how institutional strategies influence entrepreneurial outcomes. Qualitative studies could further explore leadership responses and institutional adaptation. Studies across different regions and institutional cultures are essential. Comparative inquiry can highlight how responsible AI ecosystems emerge in developed versus developing economies, or in public versus private institutions, identifying context-sensitive governance strategies. Future studies should develop multidimensional tools to evaluate institutional preparedness. These models should extend beyond technical infrastructure to assess faculty capability, ethical oversight, and ecosystem collaboration, helping leaders identify strategic gaps.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Declaration of Use of Generative AI

In line with principles of ethical publishing and research integrity, the authors declare that generative AI tools were used only for editorial support, including language refinement, grammar correction, and formatting assistance. All intellectual content, conceptual development, analysis, and final manuscript decisions remain the sole responsibility of the authors.

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