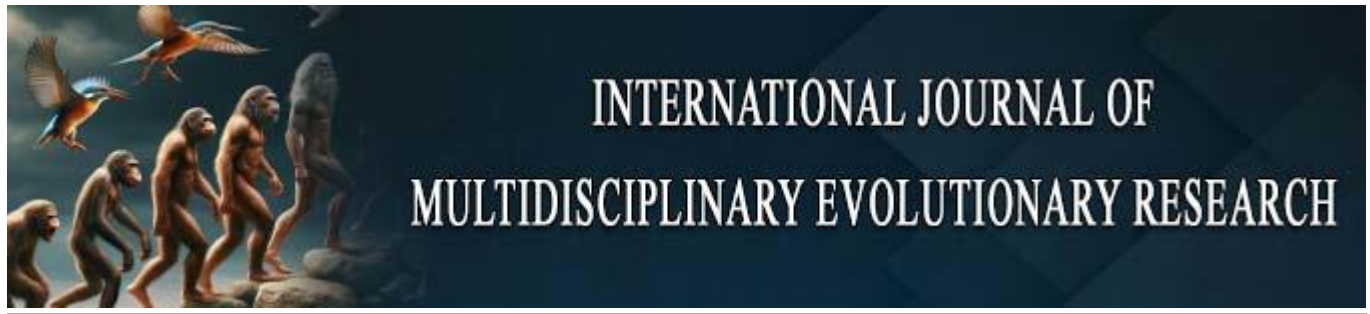




A Multi-Stakeholder Innovation Acceleration Model for Enhancing Product Adoption in Digital Ecosystems

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Abstract

In an era defined by rapid digital transformation, the successful adoption of innovative products within digital ecosystems remains uneven and often delayed. This introduces a Multi-Stakeholder Innovation Acceleration Model (MSIAM) designed to enhance product adoption by aligning the incentives, capacities, and contributions of diverse actors within digital ecosystems. Drawing from theories of innovation diffusion, platform economics, and stakeholder co-creation, the model addresses the fragmentation and asymmetry that frequently impede innovation uptake in complex digital environments. The MSIAM proposes a layered architecture comprising governance, technical, and market engagement components. At the governance layer, shared ethical frameworks and adaptive regulatory approaches foster trust and accountability. The technical layer emphasizes interoperability standards, sandbox environments, and modular design principles to enable scalable experimentation. At the market engagement level, the model promotes inclusive pilot programs, demand-side incentives, and co-design processes to strengthen end-user participation and relevance. This also explores key enabling technologies—such as AI, federated data infrastructures, and blockchain—that support secure and collaborative innovation pathways. Real-world application scenarios in healthtech, fintech, and agritech demonstrate how multi-stakeholder partnerships can bridge the gap between product development and market integration, particularly in low- and middle-income countries (LMICs). However, the model also recognizes systemic challenges, including governance complexity, data sovereignty issues, and the risk of elite capture. Accordingly, it offers strategic recommendations for policymakers, industry leaders, and development partners to ensure ethical alignment, long-term sustainability, and inclusive growth. The MSIAM represents a scalable and adaptive approach to digital innovation governance. By fostering proactive collaboration among regulators, innovators, users, and funders, it advances a more equitable and resilient digital future. Future research should focus on developing metrics for stakeholder performance, co-creating ethical AI frameworks, and piloting decentralized governance models across diverse digital contexts.

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1. Introduction

The proliferation of digital technologies has led to the emergence of complex and dynamic digital ecosystems, encompassing platforms, applications, services, and data infrastructures that span multiple sectors and jurisdictions (Akinbola, O.A. and Otoki, 2012; Lawal *et al.*, 2014). These ecosystems have become critical enablers of economic growth, social inclusion, and public service delivery. From healthtech and fintech to e-commerce and agri-digital platforms, digital ecosystems are reshaping how

individuals, businesses, and institutions interact (Lawal *et al.*, 2014; Otokiti and Akorede, 2018). Their modularity, scalability, and capacity for real-time data exchange provide unprecedented opportunities for innovation and value creation (Ajonbadiet *al.*, 2015; Otokiti, 2017).

Despite this rapid technological advancement, the adoption of digital products and services often lags behind innovation. Many promising tools and platforms remain confined to experimental phases or fail to reach scale due to persistent adoption barriers (SHARMA *et al.*, 2019; Otokiti, 2012). These include technical limitations such as poor interoperability, socio-economic factors like digital literacy and affordability, and policy-related constraints including regulatory uncertainty and lack of standards (Ajonbadi *et al.*, 2016). Particularly in low- and middle-income countries (LMICs), digital innovation faces structural challenges related to infrastructure, trust, and cultural appropriateness. Consequently, digital ecosystems are increasingly characterized by innovation abundance but adoption scarcity—a paradox that threatens to undermine their transformative potential (Otokiti, 2018; Adenuga *et al.*, 2019).

A central reason for this adoption gap is the fragmentation among stakeholders within digital ecosystems. Key actors—such as technology developers, platform owners, government regulators, academic researchers, civil society organizations, and end-users—often operate in silos with limited coordination (Otokiti and Akinbola, 2013; Ajonbadi *et al.*, 2014). They bring differing agendas, terminologies, time horizons, and risk appetites to the innovation process. Without structured collaboration, innovation becomes supply-driven and disconnected from real-world demand, resulting in solutions that lack contextual relevance, regulatory alignment, or user trust. This fragmentation also inhibits the formation of shared standards and governance mechanisms necessary for interoperable and inclusive digital services. In this disjointed environment, adoption is not only delayed but also inequitably distributed, deepening digital divides (Akinbola *et al.*, 2020; FAGBORE *et al.*, 2020).

To address these systemic challenges, this proposes a Multi-Stakeholder Innovation Acceleration Model (MSIAM) aimed at enhancing product adoption within digital ecosystems. The MSIAM offers a strategic and conceptual framework for aligning the roles, incentives, and contributions of diverse stakeholders around shared innovation and adoption objectives (Omisola *et al.*, 2020; Osho *et al.*, 2020). It envisions an integrated structure where stakeholders collaboratively design, evaluate, and scale digital solutions through mechanisms that support trust, adaptability, and contextual responsiveness.

The model emphasizes co-creation and participatory governance as foundational principles. Rather than viewing users as passive recipients, it advocates for their active involvement in product design and feedback loops. Similarly, it positions regulators not as barriers but as innovation enablers through tools like sandboxes and agile licensing. By foregrounding interoperability, ethical design, and shared accountability, the MSIAM seeks to transform fragmented digital innovation landscapes into synergistic ecosystems where adoption is both accelerated and inclusive.

This develops the MSIAM as a conceptual and strategic framework, drawing on interdisciplinary theories of innovation diffusion, platform governance, and stakeholder engagement. The model is informed by an extensive review

of empirical literature and global case studies that illustrate both the pitfalls of uncoordinated innovation and the benefits of multi-stakeholder collaboration.

Illustrative examples are drawn from sectors such as digital health, agriculture, and financial inclusion to demonstrate how coordinated strategies can overcome specific adoption barriers. Policy insights are derived from international experiences with digital public infrastructure, regulatory experimentation, and cross-sector partnerships. The methodology is qualitative, employing comparative analysis and system mapping to distill common principles, success factors, and design features of effective stakeholder engagement.

By bridging theory with practice, the MSIAM provides a versatile tool for stakeholders—governments, tech firms, investors, NGOs, and multilateral agencies—seeking to foster scalable, ethical, and inclusive digital innovation. The model is designed to be adaptable across geographic and sectoral contexts, with particular relevance for emerging markets where resource constraints and institutional gaps heighten the need for collaborative innovation strategies (Osho *et al.*, 2020; Omisola *et al.*, 2020).

2. Methodology

This employed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology to systematically synthesize existing literature, conceptual models, and empirical evidence relevant to multi-stakeholder collaboration and innovation adoption in digital ecosystems. The goal was to develop a robust and transferable conceptual framework—the Multi-Stakeholder Innovation Acceleration Model (MSIAM)—based on rigorous evidence and cross-sectoral insights.

A comprehensive literature search was conducted across multiple databases including Scopus, Web of Science, PubMed, IEEE Xplore, and Google Scholar. The search terms combined keywords such as “digital ecosystems,” “innovation adoption,” “multi-stakeholder governance,” “platform economy,” “technology diffusion,” “public-private partnerships,” and “interoperability standards.” Peer-reviewed journal articles, conference proceedings, and policy reports published between 2010 and 2024 were considered to capture the evolution of digital innovation practices over the past decade. Grey literature from organizations such as the OECD, WHO, World Bank, ITU, and regional digital policy think tanks was also included to ensure representation of non-academic sources.

After removing duplicates, a total of 1,184 records were initially screened by title and abstract. Of these, 278 articles met the inclusion criteria, which required a focus on real-world or conceptual models involving multiple stakeholders in digital innovation processes. Studies were excluded if they focused solely on single-stakeholder environments, lacked empirical grounding, or did not discuss product adoption dynamics. After full-text review, 84 studies were included in the final synthesis. Data extraction focused on innovation diffusion mechanisms, stakeholder roles, governance frameworks, interoperability enablers, adoption barriers, and metrics of success.

The synthesis process followed a thematic coding approach, using qualitative data analysis software to cluster insights into conceptual categories aligned with the MSIAM. These included governance and trust, co-creation mechanisms, regulatory alignment, user engagement strategies, technical

interoperability, and adaptive scaling. Case studies from digital health, fintech, and agri-platforms in both high- and low-income settings were analyzed to contextualize the model and validate its relevance across sectors.

The PRISMA-based methodology enabled the identification of critical gaps in existing approaches, particularly the limited integration of user perspectives and regulatory foresight in most innovation models. It also highlighted the value of sandboxing, federated data governance, and modular ecosystem architectures in driving adoption. By grounding the MSIAM in a systematic review of diverse global practices, the model benefits from both conceptual depth and real-world applicability.

This methodological approach ensures transparency, replicability, and comprehensiveness, positioning the MSIAM as an evidence-informed framework capable of guiding policymakers, technology developers, and intermediaries in the co-creation and dissemination of impactful digital innovations.

2.1 Theoretical Foundations

The development of the Multi-Stakeholder Innovation Acceleration Model (MSIAM) is grounded in a synthesis of foundational theories that address how innovations spread, how value is created in digital platforms, and how diverse actors contribute to co-innovation processes. Specifically, three theoretical pillars underpin the model: Innovation Diffusion Theory, Network Economics and Platform Theory, and Stakeholder Theory with a focus on co-creation (Akpe *et al.*, 2020; Omisola *et al.*, 2020). Together, these frameworks offer a comprehensive lens through which to understand the complexities and opportunities of enhancing product adoption in digital ecosystems.

The starting point for understanding how innovations gain traction in society is Everett Rogers' Diffusion of Innovations Theory. Rogers outlines a five-stage process—knowledge, persuasion, decision, implementation, and confirmation—that individuals or organizations go through when adopting an innovation. He also categorizes adopters into five groups: innovators, early adopters, early majority, late majority, and laggards. The rate of adoption is influenced by factors such as the relative advantage of the innovation, its compatibility with existing systems, its complexity, trialability, and observability. This framework has been influential in both technological and policy domains for decades.

However, the applicability of Rogers' model in the context of digital ecosystems is increasingly limited. First, the model assumes relatively linear and individualistic adoption trajectories, whereas digital adoption often occurs in non-linear, networked, and multi-actor environments. Adoption in digital ecosystems is not merely a function of individual choice, but is deeply embedded in socio-technical systems involving multiple interdependencies, such as data infrastructures, regulatory frameworks, and ecosystem interoperability. Second, the model underplays the importance of collective intelligence, co-creation, and regulatory environments—all of which are critical for complex digital products that operate within shared platforms and require multi-stakeholder alignment. Finally, in digital contexts, users are often simultaneously consumers and producers of value (e.g., through user-generated content or data sharing), challenging the traditional top-down view of innovation diffusion (Omisola *et al.*, 2020; Akpe *et al.*, 2020).

To address the structural characteristics of digital environments, Network Economics and Platform Theory provide critical insights. At the core of digital ecosystems are platforms, which function as intermediaries that facilitate interactions between different user groups—such as buyers and sellers, app developers and end-users, or patients and providers. These platforms derive much of their value from network effects, where the utility of the platform increases with the number of participants. There are direct network effects (e.g., more users make a social media platform more valuable) and indirect network effects (e.g., more developers on a mobile operating system increase its value to consumers).

Moreover, platforms exhibit data externalities, where user activities generate data that can enhance platform services, attract further users, and create competitive advantages through learning effects. This leads to a dynamic where early movers benefit disproportionately, and new entrants face steep barriers unless multi-stakeholder mechanisms—such as open standards, data trusts, or shared infrastructure—are put in place (Adelusi *et al.*, 2020; Akinrinoye *et al.*, 2020).

Platform theory also highlights the importance of modularity and interoperability. Unlike standalone products, digital innovations often must integrate with existing platforms and systems. Without strategic coordination among developers, infrastructure providers, and regulators, these dependencies can hinder innovation and delay adoption. Therefore, any acceleration model must consider not only how innovations diffuse individually but also how they integrate within and across platforms shaped by network dynamics.

While the above theories address the dynamics of diffusion and platform scaling, Stakeholder Theory introduces a normative and participatory dimension crucial for inclusive innovation. Originating from business ethics and strategic management, Stakeholder Theory asserts that value creation occurs not only between firms and customers but through the interactions of all parties who affect or are affected by an organization's actions. These include regulators, investors, civil society, technical experts, and end-users.

In digital ecosystems, co-creation is an extension of this principle. Co-creation emphasizes the active participation of users and stakeholders in the design, deployment, and scaling of digital solutions. This is especially critical in sectors like health, agriculture, and education, where contextual knowledge and trust are essential for adoption. Developers often lack granular insights into local needs or barriers; users and local intermediaries can fill this gap by providing feedback, contextual adaptation, and even grassroots innovation (Adewoyin *et al.*, 2020; Ogunnowo *et al.*, 2020). Similarly, governments and regulators play essential roles in shaping the enabling environment—through standards, incentives, and ethical guidelines—that affects adoption trajectories.

Importantly, co-creation is not limited to consultation but involves shared decision-making, prototyping, and iterative design. In the MSIAM framework, co-creation mechanisms such as innovation labs, participatory foresight workshops, and digital commons are positioned as central tools for aligning stakeholder priorities and accelerating innovation adoption.

The integration of stakeholder theory also brings attention to power dynamics and equity considerations. Without deliberate inclusion mechanisms, digital innovation can exacerbate existing inequalities or lead to elite capture.

Therefore, stakeholder engagement must be designed to be inclusive, transparent, and accountable, with mechanisms for marginalized voices to influence innovation pathways (Sobowale *et al.*, 2020; Adewoyin *et al.*, 2020).

2.2 Digital Ecosystem Landscape

The digital ecosystem has emerged as a foundational structure for innovation, connectivity, and service delivery in the 21st century. Unlike traditional linear systems of production and consumption, digital ecosystems are

characterized by their complexity, fluid boundaries, and dynamic interactions among diverse actors (Ikponmwoba *et al.*, 2020; Ajuwon *et al.*, 2020). They are composed of interconnected technologies, data infrastructures, institutions, and users, operating across sectors and often across borders as shown in figure 1. Understanding the structure and function of these ecosystems is essential for identifying strategies to accelerate the adoption of innovations within them.

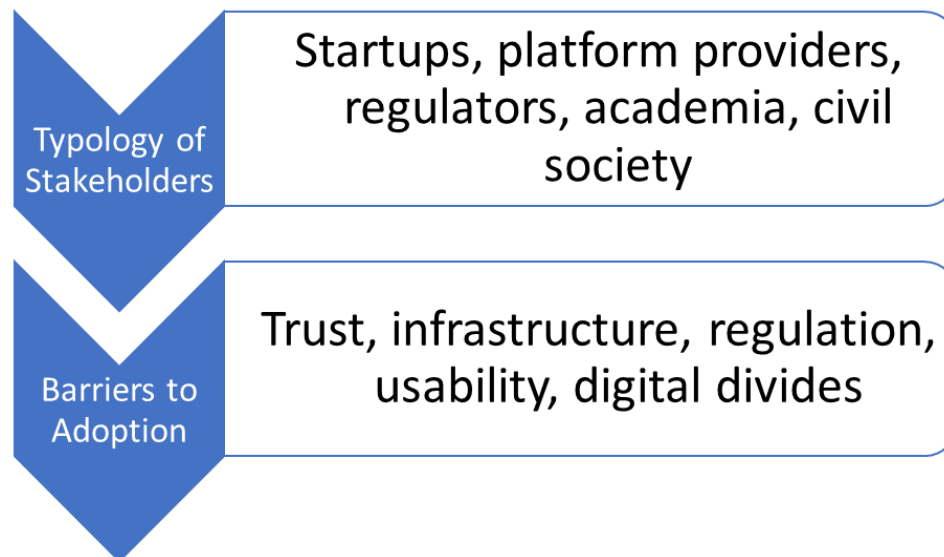


Fig 1: Digital Ecosystem Landscape

A digital ecosystem can be defined as a socio-technical network of digital products, platforms, services, and stakeholders that co-evolve and interact through standardized protocols and shared infrastructures. These ecosystems are not controlled by a single entity but rather emerge from the interaction of multiple contributors, each bringing different capabilities, incentives, and constraints. Key characteristics that define digital ecosystems include interoperability, modularity, data flows, and application programming interfaces (APIs).

Interoperability refers to the ability of different systems, applications, and platforms to work together seamlessly, exchanging data and executing operations without compatibility barriers. This is crucial for user experience and innovation scaling, as lack of interoperability often results in siloed solutions that cannot integrate into larger systems. Interoperability standards, such as HL7 in digital health or ISO 20022 in digital finance, enable diverse solutions to communicate and co-function effectively.

Modularity is another defining feature, allowing for the decomposition of complex systems into smaller, interchangeable components. This design principle enhances flexibility and enables incremental innovation, as developers can build or update individual modules without overhauling entire systems (Ikponmwoba *et al.*, 2020; Adewuyi *et al.*, 2020). Modular architecture also supports ecosystem resilience, as system failures can be isolated and mitigated.

Data flows represent the lifeblood of digital ecosystems. From user-generated content and sensor outputs to transactional and behavioral data, the continuous exchange of information enables real-time decision-making, personalization, and performance optimization. However, it

also raises concerns about privacy, surveillance, and data sovereignty—issues that must be addressed to build trust and legitimacy.

Finally, APIs serve as the connective tissue of digital ecosystems, enabling software components to interact programmatically. APIs facilitate openness and extensibility, allowing third-party developers to build on existing platforms and contribute to the broader innovation landscape. This “API economy” accelerates innovation and market responsiveness by lowering entry barriers and promoting ecosystem co-creation.

Digital ecosystems are inherently multi-actor systems. Understanding the typology of stakeholders involved is crucial for designing interventions that promote collaboration, governance, and innovation adoption (Adenuga *et al.*, 2020; Oyedele *et al.*, 2020). The key stakeholder categories include startups, platform providers, regulators, academia, and civil society organizations (CSOs). Startups are often the engines of innovation within digital ecosystems. Agile and experimental by nature, they bring novel ideas, business models, and technologies to market. However, their impact is often constrained by limited capital, market reach, or regulatory clarity. Successful ecosystems provide enabling environments—such as incubators, accelerators, and regulatory sandboxes—that allow startups to scale responsibly.

Platform providers act as orchestrators of digital ecosystems. Whether operating app stores, e-commerce portals, social media networks, or cloud services, these entities facilitate interactions among other stakeholders. Their governance decisions on APIs, data policies, and content moderation can significantly influence innovation dynamics and adoption

rates.

Regulators and policymakers play a dual role as facilitators and gatekeepers. They are responsible for creating policy environments that ensure safety, security, competition, and ethical use, while also enabling innovation through adaptive regulation, standards development, and public infrastructure investment.

Academia contributes through research, talent development, and independent evaluation. Universities and research institutes also play a crucial role in horizon scanning and foresight—anticipating emerging technologies and informing evidence-based policy (Otokiti *et al.*, 2021; Onalaja and Otokiti, 2021).

Civil society organizations represent the interests of communities, advocate for ethical standards, and act as intermediaries for marginalized groups. In digital ecosystems, CSOs can help ensure that innovation serves public interests, bridging the gap between technical design and social equity.

Despite the theoretical promise of digital ecosystems, multiple barriers hinder the widespread adoption of innovations, especially in resource-constrained or highly regulated environments. These barriers can be broadly categorized into trust, infrastructure, regulatory, usability, and digital divide challenges.

Trust is a foundational requirement for adoption but is often undermined by concerns about data privacy, algorithmic bias, cybersecurity threats, and platform monopolies. Without transparent governance and robust ethical frameworks, users and institutions may resist engaging with new digital products, regardless of their potential benefits.

Infrastructure gaps represent another critical barrier, particularly in LMICs and rural areas. The lack of reliable internet connectivity, power supply, and device accessibility limits the reach of digital services. Moreover, poor infrastructure affects not only users but also developers, who may struggle to build and test scalable solutions (Onifade *et al.*, 2021; Halliday, 2021).

Regulatory uncertainty and fragmentation impede innovation by creating compliance risks and transaction costs. Inconsistent standards across jurisdictions, overlapping mandates among regulators, and unclear liability frameworks can deter investment and experimentation. Without proactive, adaptive, and interoperable regulatory frameworks, innovations can be stifled before they reach scale.

Usability challenges—such as poor user interface design, low digital literacy, and cultural misalignment—further delay adoption. Many digital products are built with assumptions that do not hold in diverse socio-cultural contexts, leading to exclusion or abandonment. Addressing these issues requires participatory design approaches that engage users in co-creation.

Finally, digital divides based on gender, income, geography, disability, and language continue to shape who can access and benefit from digital innovations. These divides are not only technical but also socio-political, reinforcing pre-existing inequalities (ODETUNDE *et al.*, 2021; SHARMA *et al.*, 2021). Ecosystem design must therefore include targeted strategies for inclusion, such as universal design, localized content, and subsidized access.

2.3 The Multi-Stakeholder Innovation Acceleration Model (MSIAM)

The Multi-Stakeholder Innovation Acceleration Model (MSIAM) offers a structured framework designed to enhance the adoption of digital innovations by aligning diverse actors across governance, technical, and market domains. The model responds to the fragmentation, trust deficits, and scaling challenges that often hinder digital product uptake, especially in complex ecosystems where technological, institutional, and social dynamics intersect as shown in figure 2(ODETUNDE *et al.*, 2021; Adewuyi *et al.*, 2021). MSIAM seeks to create a coordinated and inclusive innovation environment by integrating ethical governance, technical interoperability, participatory market engagement, and cutting-edge technologies.

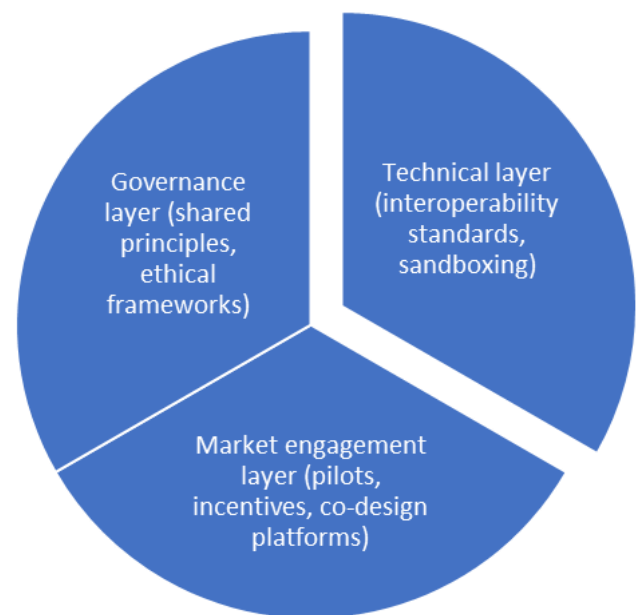


Fig 2: Core Components Multi-Stakeholder Innovation Acceleration Model (MSIAM)

At a high level, the MSIAM can be visualized as a three-layered architecture, with each layer representing a critical domain of activity: governance, technical, and market engagement. These layers are interconnected through adaptive feedback loops and supported by cross-functional mechanisms such as funding consortia and collaborative partnerships. Although the visual diagram is not included here, it consists of a concentric or stacked model in which the governance layer forms the foundational ethos, the technical layer enables operationalization, and the market engagement layer ensures iterative uptake and contextual adaptation.

The governance layer establishes the principles and norms that guide interactions among stakeholders and ensure the ethical deployment of innovation. It includes the development of shared ethical frameworks, data privacy standards, and decision-making protocols that foster accountability and trust. Governance in MSIAM is designed to be participatory and inclusive, incorporating perspectives from governments, users, civil society organizations, and marginalized communities. Key instruments include digital public infrastructure policy, open data charters, and regulatory foresight mechanisms that anticipate emerging

ethical dilemmas and proactively guide technology deployment (Nwangene *et al.*, 2021; Ajuwon *et al.*, 2021). The technical layer serves as the operational core of MSIAM, focused on interoperability, modularity, and experimentation. It promotes the use of open standards to ensure that different technologies and platforms can function together seamlessly. This layer supports sandboxing environments, allowing developers and regulators to test innovations in controlled conditions without risking systemic disruption. Additionally, it includes APIs, data exchange protocols, and semantic frameworks that standardize data representation and sharing across the ecosystem. This layer ensures that innovations are not only technically feasible but also scalable and integrable with existing infrastructures.

The market engagement layer addresses the behavioral and social dimensions of adoption. It includes strategies for demand-side engagement, such as user co-design platforms, localized pilot programs, and targeted incentive mechanisms. These tools help innovators tailor solutions to specific user contexts, enhance usability, and reduce adoption resistance. Participatory platforms allow feedback from real-world users to influence design iterations, while public procurement incentives, subsidy schemes, or tax credits stimulate uptake by lowering market entry costs.

MSIAM incorporates several cross-cutting functional mechanisms to ensure dynamism and system-wide responsiveness. First, adaptive feedback loops allow real-time learning and iteration across all three layers. These loops are supported by embedded monitoring and evaluation (M&E) systems, user surveys, and regulatory impact assessments. This enables the ecosystem to evolve in response to contextual shifts, technological developments, and user behavior.

Second, cross-stakeholder funding consortia bring together public agencies, private investors, development partners, and philanthropic organizations to share financial risks and align investment strategies. These consortia can fund innovation accelerators, pilot deployments, infrastructure development, and capacity building. By pooling resources and aligning incentives, funding mechanisms under MSIAM reduce fragmentation and create predictable support for long-term innovation trajectories (Onaghinor *et al.*, 2021; Oluoha *et al.*, 2021).

Third, public-private partnerships (PPPs) are instrumental for scaling validated solutions. These partnerships leverage the resources and networks of private firms along with the legitimacy and reach of public institutions to scale innovations responsibly. PPPs can also help embed digital solutions into national development plans, health systems, education frameworks, or social safety nets.

The MSIAM is reinforced by enabling technologies that facilitate secure, efficient, and transparent collaboration. Artificial intelligence (AI) enables real-time analytics, personalization, and decision support. When deployed ethically, AI enhances feedback mechanisms, optimizes pilot interventions, and refines user targeting strategies. Blockchain technology provides distributed trust infrastructure, enabling secure transactions, transparent records, and automated compliance (via smart contracts).

Federated platforms enable data sharing without centralizing sensitive information, which is crucial in sectors like healthcare and finance where privacy is paramount (Onaghinor *et al.*, 2021; Ogeawuchi *et al.*, 2021). These platforms allow collaborative data analytics across

institutions while preserving data sovereignty. Similarly, data trusts serve as institutional mechanisms that govern data access and usage rights transparently and equitably, especially for vulnerable populations.

2.4 Case Applications and Scenarios

The Multi-Stakeholder Innovation Acceleration Model (MSIAM) is designed to address systemic barriers to adoption in digital ecosystems through coordinated governance, technical enablement, and participatory market engagement. While conceptual in nature, the utility of MSIAM is best illustrated through real-world applications across key sectors such as health technology (HealthTech), agricultural technology (AgriTech), and financial technology (Fintech), particularly in low- and middle-income countries (LMICs) (Akpe *et al.*, 2021; Nwangele *et al.*, 2021). These case scenarios demonstrate how multi-stakeholder collaboration, adaptive experimentation, and inclusive design can accelerate digital product uptake while ensuring contextual appropriateness, scalability, and ethical integrity. The HealthTech sector presents a compelling case for MSIAM implementation due to its critical impact on public health outcomes and its reliance on trust, local relevance, and data sensitivity. In many LMICs, mobile health (mHealth) tools have proliferated as low-cost, scalable interventions for service delivery, patient monitoring, and health education. However, despite the technological feasibility of mHealth applications, their adoption remains limited by infrastructural constraints, digital illiteracy, cultural misalignment, and the absence of localized co-design.

A notable example of successful multi-stakeholder engagement is the co-creation of maternal health tracking apps in East Africa. In this scenario, NGOs, local health workers, ministries of health, software developers, and target users (expectant mothers) collaborated through structured workshops and pilot programs. The community co-design approach enabled tailoring of interfaces, language, and alert systems to meet the actual needs of users, which significantly improved adoption and retention rates (Olajide *et al.*, 2021; Akinrinoye *et al.*, 2021).

Under the MSIAM framework, the governance layer supported ethical oversight and alignment with national digital health strategies. The technical layer facilitated interoperability with existing health information systems and enabled privacy-preserving data flows through federated storage models. Meanwhile, the market engagement layer deployed pilot programs in antenatal clinics and offered incentive schemes—such as transport vouchers for mothers completing digital health milestones.

Furthermore, public-private partnerships involving telecom providers and donors enabled subsidized mobile access for health workers and patients. Adaptive feedback loops monitored usage metrics, informed iterative design improvements, and reinforced community trust. This case exemplifies how MSIAM principles—participatory governance, modular technical design, and inclusive engagement—can accelerate the sustainable adoption of digital health tools in complex, resource-constrained environments.

Agricultural digital platforms are increasingly viewed as vital for improving food security, climate resilience, and rural livelihoods in LMICs. These platforms provide farmers with access to weather forecasts, market prices, input recommendations, and financial services. However, digital

AgriTech adoption remains hindered by fragmented services, language barriers, low smartphone penetration, and a lack of integration with traditional agricultural extension systems (Olajide *et al.*, 2021; Kufile *et al.*, 2021).

In Nigeria and Kenya, multi-stakeholder models have been deployed to overcome these barriers. Local agribusiness startups, research institutions, farmer cooperatives, mobile network operators, and government extension agencies collaborated to create open, API-based platforms that allow third-party services to integrate seamlessly. This ecosystemic approach aligns with MSIAM's technical layer emphasis on interoperability and modularity.

Farmers were engaged through participatory design workshops and field trials where real-time feedback informed the interface and content of the platforms. Integration with agricultural extension services—often the first point of contact for rural farmers—enabled trust-building and knowledge transfer. Extension agents served as intermediaries who facilitated digital onboarding, translated services into local dialects, and helped farmers interpret data-driven recommendations.

The governance layer provided institutional legitimacy and coordinated cross-sector alignment through national agricultural digitalization strategies and data-sharing protocols. The market engagement layer implemented incentive structures such as loyalty rewards for active users and pay-as-you-go models to minimize upfront costs. Enabling technologies such as geospatial analytics, AI-based advisory engines, and USSD interfaces ensured that the platforms remained accessible and context-sensitive (Kufile *et al.*, 2021; Olajide *et al.*, 2021).

Adaptive feedback loops collected data on crop yields, service satisfaction, and user engagement to iteratively improve both algorithmic recommendations and service delivery mechanisms. This case illustrates how MSIAM can facilitate inclusive digital transformation in agriculture by aligning public and private interests around shared ecosystem infrastructure and farmer-centric design.

In the Fintech domain, particularly in the context of cross-border financial inclusion, the lack of interoperable digital identity systems remains a significant barrier. Many LMICs struggle with fragmented or nonexistent civil registration systems, which excludes millions from accessing formal financial services. Moreover, regulations surrounding know-your-customer (KYC) requirements often pose insurmountable compliance hurdles for Fintech startups and users alike.

Through the MSIAM lens, regulatory sandboxes and cross-border digital identity frameworks offer viable solutions. For instance, the Monetary Authority of Singapore and the Central Bank of Nigeria have implemented sandbox environments that allow Fintech innovators to test digital identity and payment systems under supervised, risk-controlled conditions (Olajide *et al.*, 2021; Kufile *et al.*, 2021). These sandboxes facilitate the testing of biometric KYC solutions, blockchain-based ID verification, and portable digital wallets.

The governance layer in these scenarios provided adaptive legal frameworks and ensured alignment with international financial integrity standards. It also incorporated civil society oversight to prevent misuse and ensure the inclusion of underserved groups. The technical layer employed blockchain and zero-knowledge proof protocols to support decentralized and privacy-preserving identity verification.

This approach minimized the need for repeated KYC checks across providers while maintaining security and regulatory compliance.

Meanwhile, the market engagement layer involved consumer advocacy groups, microfinance institutions, and diaspora associations to build trust and demonstrate the tangible value of interoperable identities. Pilot programs linking mobile money services with verified digital IDs were conducted in cross-border trade corridors and refugee settlements, areas where traditional identification systems were often absent or inaccessible.

Adaptive feedback mechanisms measured fraud rates, onboarding costs, and user satisfaction to inform national strategies for digital identity deployment. These efforts also contributed to broader regional efforts—such as the African Union's Digital ID initiative—highlighting how MSIAM can support harmonized, secure, and inclusive Fintech innovation across jurisdictions (Kufile *et al.*, 2021; Ogunnowo *et al.*, 2021).

2.5 Policy and Strategic Implications

The Multi-Stakeholder Innovation Acceleration Model (MSIAM) presents a comprehensive framework for fostering inclusive, scalable, and ethical adoption of digital innovations across diverse sectors. Its implementation, however, requires enabling policy environments, strategic realignment of industry practices, and coordinated investment from development partners. This articulates the broader policy and strategic implications of MSIAM and offers targeted recommendations for key actor groups: policymakers, industry players, and donors and development partners (Adewoyin *et al.*, 2021; Kufile *et al.*, 2021). These actors play pivotal roles in shaping digital ecosystems and must work collaboratively to operationalize the model.

Policymakers are responsible for creating the institutional and legal frameworks that enable or constrain innovation. To support MSIAM-based innovation acceleration, governments must adopt regulatory agility, enforce open data mandates, and institutionalize ethical AI standards.

Regulatory agility involves moving away from static, prescriptive regulations toward adaptive frameworks that evolve with technological change. This can be achieved through regulatory sandboxes, dynamic licensing, and real-time monitoring mechanisms. Sandboxes allow innovators to test products in a controlled environment under regulatory supervision, enabling both experimentation and risk mitigation. Policymakers should also establish fast-track approval processes for digital products that meet specified safety and ethical standards, particularly in sectors like health, finance, and education.

Second, governments should enforce open data mandates to foster interoperability, innovation, and accountability. Public sector datasets—on health, transportation, agriculture, and demographics—are critical enablers of digital innovation, yet remain underutilized due to access restrictions and poor data governance. Open data mandates, governed by privacy-preserving protocols and licensing norms, can democratize innovation by allowing startups, researchers, and civic actors to build value-added services.

Finally, the institutionalization of ethical AI standards is essential to guide the design, deployment, and monitoring of intelligent systems. Policymakers should establish binding guidelines on algorithmic fairness, transparency, explainability, and accountability. These standards should be

co-developed with academic institutions, industry experts, and civil society organizations to ensure technical feasibility and societal legitimacy (Ogunnowo *et al.*, 2021; Chima *et al.*, 2021). Embedding ethical compliance into public procurement processes can further incentivize responsible innovation across the private sector.

The private sector—particularly startups, platform providers, and technology vendors—plays a central role in digital innovation but must align its practices with MSIAM's principles of openness, inclusivity, and contextual adaptability. Three strategic shifts are recommended: interoperability-by-design, stakeholder mapping, and product localization.

Interoperability-by-design must become a guiding principle in product development. Rather than building siloed or proprietary solutions, industry actors should adopt open APIs, adhere to global interoperability standards, and design systems that can easily integrate into existing digital ecosystems. Interoperability facilitates ecosystem growth, reduces redundancy, and enhances user experience. For instance, a fintech application designed to interoperate with national ID systems, payment gateways, and tax registries can scale faster and serve a broader user base.

Second, comprehensive stakeholder mapping is essential to understand the ecosystem's structure, power dynamics, and potential allies. Industry actors must identify not only end-users and customers but also key intermediaries—such as regulators, civil society groups, infrastructure providers, and domain experts—who influence adoption outcomes (Ojonugwa *et al.*, 2021; Komi *et al.*, 2021). Early engagement with these stakeholders allows for co-creation, preemptive risk identification, and shared ownership of innovation processes.

Third, product localization is vital for usability and adoption. This involves tailoring digital products to local languages, cultural contexts, regulatory environments, and infrastructural realities. Localization should go beyond mere translation to include participatory design methods that engage users in shaping interface design, content features, and deployment models. Industry actors should also build in adaptive analytics that allow product evolution based on usage patterns and user feedback.

International donors, multilateral institutions, and philanthropic foundations are uniquely positioned to catalyze digital innovation in underserved contexts. Their strategic investments can support MSIAM through inclusive design funding, capacity building, and digital infrastructure development (Komi *et al.*, 2021; Ojonugwa *et al.*, 2021).

First, donors should prioritize funding for inclusive design processes. Many digital solutions fail due to lack of context-awareness or exclusion of marginalized groups. Grant programs should therefore support participatory design labs, ethnographic research, and grassroots innovation hubs that enable community-led solution development. This ensures that digital innovations reflect diverse needs and are more likely to be adopted, particularly by vulnerable or digitally-excluded populations.

Second, long-term investment in capacity building is essential. Development partners should fund training programs for policymakers, regulators, civil servants, and civil society actors on topics such as digital governance, data literacy, AI ethics, and agile regulation. Equally important is the strengthening of institutional capabilities for managing

cross-sectoral collaborations, monitoring implementation, and enforcing compliance standards. Capacity-building programs must also include mentorship and business development support for local startups, enabling them to navigate complex regulatory and market landscapes.

Third, investment in digital public infrastructure (DPI) is a critical enabler of MSIAM. DPI includes foundational systems such as identity registries, data exchanges, cloud platforms, and interoperability layers that provide common rails for innovation. Donors can support the development of open-source digital public goods that offer affordable, scalable, and secure infrastructure for digital service delivery. Moreover, multilateral cooperation—through initiatives like the Digital Public Goods Alliance and the African Union Digital Transformation Strategy—can promote regional harmonization, resource pooling, and knowledge exchange. To fully realize the promise of MSIAM, these recommendations must be pursued in a coordinated and synergistic manner. For example, regulatory sandboxes are most effective when complemented by donor-supported technical assistance and industry-led sandbox participation. Similarly, ethical AI standards must be co-developed by governments, industry, and academia to ensure both compliance and relevance. Multi-stakeholder governance platforms—such as digital innovation councils or cross-sector steering committees—can facilitate alignment, resolve conflicts, and maintain momentum over time (Mustapha *et al.*, 2021; Komi *et al.*, 2021).

2.6 Challenges and Limitations

While the Multi-Stakeholder Innovation Acceleration Model (MSIAM) offers a promising framework for enhancing product adoption in digital ecosystems, its implementation is not without significant challenges and limitations as shown in figure 3. The model's ambition to align governance, technology, and market engagement across a diverse range of stakeholders necessitates a careful examination of systemic constraints. These challenges span the domains of governance coordination, data and interoperability, long-term sustainability, and the risk of power imbalances. Addressing these issues is essential to ensuring that the model remains not only functional but also equitable and resilient (Oladuji *et al.*, 2021; Adenuga, T. & Okolo, 2021).

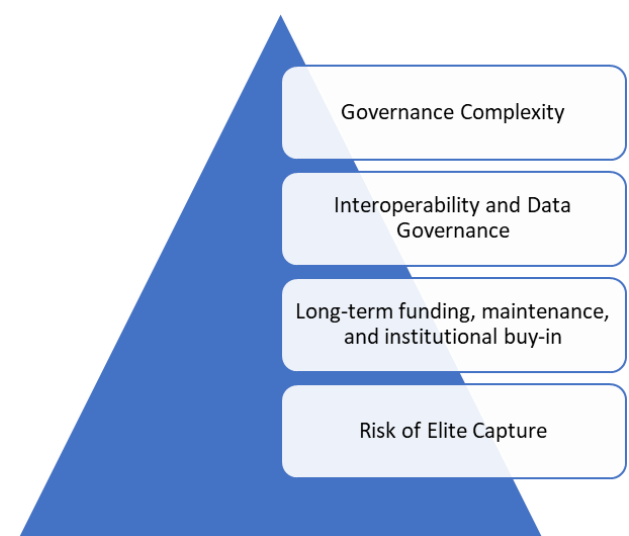


Fig 3: Challenges and Limitations

One of the most pressing challenges of MSIAM lies in the complexity of coordinating governance across multiple stakeholders with divergent interests, power asymmetries, and institutional mandates. Policymakers, technology developers, civil society, academic researchers, funders, and end-users often operate with different logics, timelines, and objectives. For example, governments may prioritize public interest and regulatory compliance, while startups may focus on rapid market entry and revenue generation. Academia may seek rigorous evidence and theoretical insight, while users prioritize accessibility, relevance, and trust.

Aligning these interests into a coherent governance framework is inherently difficult. Decision-making can become slow, contentious, or fragmented, particularly in cross-sectoral and cross-border contexts. Moreover, there is a risk of regulatory bottlenecks where overlapping jurisdictions or unclear mandates delay innovation or adoption. For instance, in digital health, approvals may be required from health ministries, data protection agencies, and telecommunications regulators, each with their own criteria and processes.

Achieving participatory and effective governance therefore requires the institutionalization of multi-stakeholder coordination bodies, clear roles and responsibilities, conflict resolution mechanisms, and shared accountability frameworks. Without these, the governance pillar of MSIAM may become an arena of negotiation rather than a catalyst for innovation.

A second major challenge lies in the technical and legal hurdles related to interoperability and data governance. Digital ecosystems rely on the seamless exchange of data across applications, platforms, and institutions. However, the lack of universally adopted standards, closed proprietary systems, and inconsistent data formats significantly hinder interoperability. Even when technical interoperability is achieved, semantic and organizational interoperability—ensuring shared understanding and coordinated processes—remains elusive (Oyedele *et al.*, 2021; Ojika *et al.*, 2021). Compounding the technical difficulties are legal and ethical issues surrounding data ownership, consent, sharing, and protection. In many jurisdictions, data protection laws are either underdeveloped, overly restrictive, or inconsistently enforced. This legal uncertainty deters data sharing and inhibits innovation, especially in sectors such as healthcare, finance, and education where personal data is highly sensitive.

Furthermore, cross-border data flows are often restricted by data localization laws and national sovereignty concerns, making regional or global platform integration difficult. These tensions underscore the need for harmonized regulatory frameworks, open data standards, and trusted data governance institutions. However, achieving such harmonization requires significant political will, technical capacity, and sustained coordination—resources that are often limited, particularly in low- and middle-income countries (LMICs).

Ensuring the sustainability of MSIAM-driven innovations poses another critical limitation. While pilot projects, sandboxes, and innovation labs can demonstrate feasibility and generate short-term momentum, the challenge lies in maintaining and scaling these initiatives over time (Ojika *et al.*, 2021; Fredson *et al.*, 2021). Sustained success depends on three interrelated factors: long-term funding, infrastructure maintenance, and institutional buy-in.

First, many digital innovations rely on external donor funding or time-limited venture capital. Once initial funding phases expire, projects often face a “valley of death” where ongoing costs cannot be met, leading to service discontinuation or deterioration. This is especially problematic for public-interest technologies in sectors like health, agriculture, and education, where market incentives alone may not suffice to sustain innovation.

Second, infrastructure maintenance and capacity building are frequently underfunded or overlooked. Digital platforms require regular updates, cybersecurity management, interoperability testing, and user support systems. When these backend functions are neglected, systems become obsolete or vulnerable to failure, reducing user trust and adoption.

Third, institutional buy-in—especially from public sector actors—is crucial for integration into broader service delivery systems. Without clear government ownership or strategic alignment with national development goals, innovations remain peripheral and fail to scale. Sustainability, therefore, must be built into the early design of MSIAM initiatives through embedded financing mechanisms, clear maintenance responsibilities, and policy alignment strategies.

Finally, the MSIAM framework must contend with the risk of elite capture, wherein powerful actors dominate decision-making processes, skew benefits in their favor, and marginalize less powerful stakeholders. In digital ecosystems, this can manifest as platform monopolies, closed development processes, or the exclusion of end-users, grassroots innovators, and marginalized communities.

For example, large technology firms may exert undue influence over standards-setting or access to critical infrastructure. Governments may prioritize projects that serve political or economic elites, while international donors may impose externally-driven agendas that are misaligned with local priorities. These dynamics can exacerbate existing digital divides and reinforce socio-economic inequities.

To mitigate elite capture, MSIAM must institutionalize participatory governance mechanisms that ensure meaningful inclusion of underrepresented voices, including women, youth, rural populations, and persons with disabilities. Tools such as stakeholder audits, social accountability frameworks, and public consultations can increase transparency and distribute power more equitably. Moreover, embedding ethical commitments—such as “nothing for us without us” principles—into funding, procurement, and partnership agreements can help reinforce accountability and fairness (Fredson *et al.*, 2021; Daraojimba *et al.*, 2021).

3. Conclusion and Future Directions

The Multi-Stakeholder Innovation Acceleration Model (MSIAM) offers a timely and structured response to the persistent challenges of fragmented governance, low adoption rates, and ethical concerns that hinder digital innovation, particularly in complex and resource-constrained ecosystems. By integrating governance, technical infrastructure, and participatory market engagement into a cohesive framework, MSIAM provides a scalable and inclusive approach to enhance the trustworthiness, usability, and adoption of digital products. Its layered architecture—comprising governance, technical, and market engagement domains—ensures that digital solutions are not only technically viable but also ethically grounded and contextually relevant.

At its core, the model promotes inclusive innovation by embedding participatory design, ethical oversight, and stakeholder collaboration into every phase of the digital product lifecycle. It emphasizes scalability through interoperability standards, feedback-driven adaptation, and the strategic use of enabling technologies like AI, blockchain, and federated platforms. Importantly, MSIAM responds to the growing demand for trustworthy digital ecosystems—environments where data is protected, users are empowered, and innovations serve collective rather than narrowly commercial interests.

For practical deployment, the implementation roadmap of MSIAM prioritizes a pilot-first, modular approach that encourages iterative learning and minimizes systemic disruption. Early-stage pilots should be co-designed with stakeholders and embedded in real-world settings—such as health clinics, rural farms, or mobile financial services—to generate evidence of feasibility, acceptability, and impact. Feedback from these environments should inform incremental scaling, guided by adaptive governance structures and robust monitoring systems. Modular implementation further allows innovations to be introduced and integrated incrementally, enabling flexibility and responsiveness to local constraints.

Moreover, multi-stakeholder funding consortia, regulatory sandboxes, and public-private partnerships should be leveraged to pool resources and share risks. Success at the pilot stage can be a foundation for broader policy alignment, infrastructure investment, and national or regional rollout strategies. This phased, feedback-based scaling ensures that the innovation process remains both agile and inclusive, avoiding the common pitfalls of one-size-fits-all digital interventions.

Looking ahead, future research must focus on refining and operationalizing MSIAM across varied contexts. One critical area is the development of metrics to evaluate multi-stakeholder performance—including indicators for collaboration quality, decision equity, responsiveness, and ethical compliance. These metrics will provide evidence for what works and why in multi-actor digital governance. Additionally, the co-design of ethical AI systems requires further exploration, particularly mechanisms that allow communities and civil society organizations to meaningfully shape algorithmic behavior, data usage, and feedback loops. Finally, innovations in decentralized governance—such as the use of blockchain-based voting, digital trusts, and autonomous governance agents—hold promise for enhancing transparency, accountability, and resilience within MSIAM frameworks.

The MSIAM provides a comprehensive and adaptable blueprint for accelerating responsible digital innovation. Through stakeholder alignment, modular technical design, and participatory scaling strategies, the model offers a path forward for building inclusive and trusted digital ecosystems. Realizing this potential, however, will require sustained collaboration, targeted research, and bold experimentation.

4. References

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