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Innovation for societal transformation in Africa: a strategic framework for inclusive growth

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Abstract: Innovation is increasingly recognised as a key driver of economic development and societal transformation, particularly in regions facing complex structural challenges. Many African economies continue to experience unemployment, poverty, energy insecurity, water scarcity and education gaps despite abundant resources and a growing population. This paper develops a conceptual framework that examines how innovation ecosystems can address these challenges while promoting inclusive growth. Drawing on innovation ecosystem, entrepreneurship ecosystem, inclusive innovation and resource-based industrialisation literature, the study proposes a societal innovation ecosystem framework integrating four key drivers: digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration. The framework explains how these drivers stimulate knowledge creation, entrepreneurial experimentation, industrial upgrading and technology diffusion, leading to outcomes such as employment creation, improved service access, inclusive growth and sustainable development. The study contributes by extending innovation ecosystem theory to the African context and providing strategic insights for policymakers, industry leaders and development institutions.

Keywords: innovation ecosystems; societal innovation; inclusive growth; digital transformation; entrepreneurship ecosystems; mineral beneficiation; Africa development.

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Biographical notes: Dinko Herman Boikanyo is an Associate Professor at the University of Johannesburg, South Africa, where he currently serves as the Head of the Department of Business Management. He holds a PhD degree and brings extensive experience spanning academia, leadership and industry. His research interests include strategic management, innovation, digital transformation, sustainability, organisational performance and business strategy, with publications in DOAJ, IBSS and Scopus-indexed journals. His scholarly contributions also include book chapters and conference papers. He has extensive experience in postgraduate supervision, curriculum development and academic leadership. He also serves as a Non-Executive Director of a company operating in the gas sector.

1 Introduction

1.1 Background and context

Innovation is increasingly recognised as a critical driver of economic growth, industrial competitiveness and societal transformation. While early innovation research primarily focused on technological advancement and firm-level performance, contemporary scholarship has broadened the scope of innovation to encompass societal value creation, sustainability and the resolution of complex developmental challenges (Fagerberg, 2018; Schot and Steinmueller, 2018). As societies face mounting pressures associated with inequality, climate change, resource constraints and technological disruption, innovation ecosystems are increasingly viewed as essential mechanisms for achieving inclusive and sustainable development.

Recent studies have reinforced the strategic importance of innovation ecosystems in addressing societal challenges. For example, research published in *Technological Forecasting and Social Change* highlights that innovation ecosystems facilitate collaboration among governments, businesses, universities and civil society, enabling collective responses to complex socio-economic problems while enhancing resilience and long-term competitiveness (Bogers et al., 2023). Similarly, recent work in *Research Policy* argues that transformative innovation policies are increasingly required to align innovation activities with societal missions, particularly in areas such as sustainability, social inclusion and economic resilience (Diercks et al., 2024). These studies suggest that innovation should no longer be viewed solely as a driver of economic performance but also as a mechanism for societal transformation.

The growing relevance of innovation ecosystems is particularly evident in developing economies. According to the *OECD Science, Technology and Innovation Outlook 2025*, innovation systems are increasingly expected to address interconnected societal challenges by fostering collaboration across sectors and mobilising technological capabilities towards transformative outcomes (OECD, 2025). The report further notes that fragmented innovation systems often struggle to deliver broad societal benefits, highlighting the need for integrated ecosystem approaches that combine technological innovation, entrepreneurship and institutional coordination.

For African economies, innovation assumes even greater significance. Despite possessing abundant natural resources, a youthful population and expanding digital connectivity, many African countries continue to face persistent challenges including unemployment, poverty, energy insecurity, water scarcity and educational deficits (African Development Bank, 2023; United Nations Development Programme, 2025). These structural challenges constrain economic diversification and limit the transition towards higher-value, knowledge-based economies. At the same time, Africa presents substantial opportunities for innovation-led development. The rapid growth of mobile technologies, fintech solutions, artificial intelligence applications and digital entrepreneurship has demonstrated the continent's capacity to leapfrog traditional development pathways and generate innovative responses to local challenges (Nambisan et al., 2019).

Recent evidence further suggests that Africa's emerging innovation hubs are becoming important engines of inclusive growth. Innovation hubs and entrepreneurial support ecosystems play an increasingly important role in fostering start-up growth, technology adoption and innovation diffusion by providing entrepreneurs with access to

knowledge, networks, mentoring and support infrastructure (Stam and van de Ven, 2021; Bogers et al., 2023). Entrepreneurial ecosystems create environments that enable productive entrepreneurship through the interaction of interdependent actors and ecosystem elements, thereby supporting venture development and broader socio-economic inclusion.

Likewise, contemporary innovation ecosystem research emphasises that effective innovation outcomes increasingly depend on coordinated interactions among governments, industry, universities and development institutions. Ecosystem governance, collaboration and institutional coordination facilitate knowledge flows, resource mobilisation and innovation performance, particularly in environments characterised by institutional and resource constraints (Bogers et al., 2023; Granstrand and Holgersson, 2020). These findings reinforce the argument that innovation-led societal transformation requires coordinated ecosystem-level interventions rather than isolated technological or entrepreneurial initiatives.

In addition, Africa's extensive endowment of critical minerals required for renewable energy technologies, battery production and advanced manufacturing presents significant opportunities for industrial upgrading through mineral beneficiation and value chain development. As global demand for critical minerals accelerates, African economies have the potential to move beyond resource extraction towards innovation-driven industrialisation that generates employment, technological learning and economic diversification (African Development Bank, 2023; UNDP, 2025).

Despite these opportunities, existing innovation ecosystem frameworks have largely been developed within advanced industrial economies and may not adequately capture the developmental realities and societal priorities of African contexts. Traditional innovation system approaches tend to focus on technological development and firm competitiveness while giving limited attention to broader societal outcomes such as poverty reduction, social inclusion and sustainable development (Lundvall, 2010; Nelson, 1993). Consequently, there remains a need for conceptual frameworks that explain how innovation ecosystems can be strategically configured to address Africa's unique societal challenges while simultaneously promoting inclusive growth and sustainable development. This study responds to this need by developing a societal innovation ecosystem framework that integrates digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration as key drivers of societal transformation in Africa.

1.2 Problem statement

Despite growing recognition of the role of innovation in economic development and societal transformation, many African economies continue to struggle to convert innovation potential into broad-based societal outcomes. While digital technologies, entrepreneurial activity, natural resource endowments and collaborative innovation initiatives present significant opportunities for development, these elements often operate within fragmented ecosystems characterised by weak coordination, uneven institutional capacity and limited knowledge diffusion. Consequently, innovation activities frequently remain concentrated within specific sectors, regions or urban centres, with limited impact on wider socio-economic development.

Furthermore, policy and research efforts have tended to focus on individual dimensions of innovation, such as digital transformation, entrepreneurship promotion or industrial development, without adequately examining how these elements interact within broader innovation ecosystems to generate societal value. As a result, innovation initiatives often fail to translate into outcomes such as employment creation, improved service access, inclusive growth and sustainable development.

Although existing literature has made important contributions to innovation ecosystems, entrepreneurial ecosystems, inclusive innovation and resource-based industrialisation, these theoretical perspectives remain largely fragmented. Limited attention has been given to the mechanisms through which key innovation drivers, namely digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration, collectively stimulate innovation processes and contribute to societal transformation in African contexts.

This gap highlights the need for an integrated conceptual framework that explains how innovation drivers interact within innovation ecosystems, the processes through which they generate value and the conditions under which they contribute to inclusive growth and societal transformation. Addressing this need forms the central focus of this study.

1.3 Research objectives and questions

The primary objective of this study is to develop a societal innovation ecosystem framework that explains how innovation can be leveraged to promote inclusive growth and societal transformation in African economies.

The specific objectives of the study are to:

- examine the role of innovation ecosystems in addressing societal transformation challenges in African economies
- identify the key drivers of societal innovation, namely digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration
- analyse the mechanisms through which these innovation drivers interact within innovation ecosystems to generate societal and economic value
- develop a societal innovation ecosystem framework linking innovation drivers, ecosystem processes, enabling conditions and societal outcomes
- derive theoretical and policy implications for promoting inclusive growth and sustainable development in African economies.

1.3.1 Research questions

Guided by the above objectives, the study addresses the following research questions:

- RQ1 What role can innovation ecosystems play in addressing societal transformation challenges in African economies?
- RQ2 What are the key drivers of societal innovation in Africa, and why are they important for inclusive development?

- RQ3 Through what mechanisms do digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration interact within innovation ecosystems?
- RQ4 How can these interactions be integrated into a societal innovation ecosystem framework for inclusive growth and societal transformation in Africa?
- RQ5 What theoretical and policy implications emerge from the proposed framework for African economies?

1.4 Methodological approach

This study adopts a conceptual research design based on theory synthesis and conceptual model development. Conceptual research seeks to advance knowledge by integrating existing theoretical perspectives, identifying gaps in current understanding and developing new conceptual frameworks that explain complex phenomena (Jaakkola, 2020). Specifically, this study follows a theory synthesis approach, whereby insights from multiple but fragmented theoretical streams are integrated into a coherent explanatory framework. Consistent with Jaakkola's (2020) conceptual article methodology, the study combines theory synthesis with model development to construct a societal innovation ecosystem framework for the African context.

The methodological process consisted of four stages: literature identification, literature screening, thematic analysis and framework development.

1.4.1 Literature identification

A structured search of peer-reviewed literature was conducted using the Scopus, Web of Science and Google Scholar databases, which are widely recognised as comprehensive sources of scholarly publications in innovation, entrepreneurship and development studies. The search focused on literature published between 2000 and 2025, allowing for the inclusion of foundational innovation ecosystem studies as well as recent developments in societal innovation and transformative innovation research.

The search utilised combinations of the following keywords: 'innovation ecosystem*', 'societal innovation', 'inclusive innovation', 'transformative innovation', 'entrepreneurial ecosystem*', 'digital transformation', 'digital innovation', 'mineral beneficiation', 'resource-based industrialisation', 'public-private collaboration', 'Africa', 'inclusive growth', 'sustainable development'.

Boolean operators (AND, OR) were used to refine the searches and identify relevant publications.

1.4.2 Literature screening and selection

The initial search yielded approximately 420 publications. A multi-stage screening process was then employed.

Inclusion criteria were:

- peer-reviewed journal articles, books and influential policy reports
- publications addressing innovation ecosystems, inclusive innovation, entrepreneurship, digital transformation or industrial development

- studies providing theoretical, conceptual or empirical insights relevant to societal transformation
- publications focused on developing economies and African contexts where available.

Exclusion criteria were:

- publications unrelated to innovation or societal development
- conference abstracts and non-scholarly publications
- studies lacking sufficient theoretical or empirical relevance to the research objectives
- duplicate records.

After title, abstract and full-text screening, a final corpus of approximately 95 highly relevant sources was retained for analysis.

1.4.3 Thematic analysis and theory synthesis

The selected literature was analysed using a thematic coding approach. Following the recommendations of Webster and Watson (2002), the literature was organised around key conceptual themes rather than individual authors. Four dominant themes emerged consistently across the literature:

- 1 digital technologies and digital transformation
- 2 entrepreneurship ecosystems and venture development
- 3 mineral beneficiation and industrial innovation
- 4 public-private collaboration and institutional coordination.

These themes were examined to identify recurring patterns, relationships, enabling mechanisms and societal outcomes associated with innovation-driven development.

The study further drew on innovation ecosystem theory, inclusive innovation theory, entrepreneurial ecosystem literature and transformative innovation perspectives to identify points of convergence and complementarity among the different theoretical streams.

1.4.4 Framework development

The final stage involved synthesising the findings from the thematic analysis into a conceptual model. Consistent with the conceptual model development approach proposed by Jaakkola (2020), the framework was constructed by linking societal challenges, innovation drivers, ecosystem processes and societal outcomes into an integrated explanatory structure.

The resulting societal innovation ecosystem framework represents a theory-driven conceptual model that explains how digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration interact within innovation ecosystems to facilitate inclusive growth and societal transformation in Africa.

This methodological approach enhances transparency and rigor by providing a structured process for literature selection, analysis and conceptual development, while

remaining consistent with established approaches to conceptual research and theory building.

1.5 Contribution of the study

This study makes several contributions to the literature and practice of innovation-driven development.

First, the study extends innovation ecosystem theory by integrating societal transformation objectives into the conceptualisation of innovation systems. While existing frameworks largely focus on technological innovation and firm competitiveness, the proposed framework emphasises the role of innovation ecosystems in addressing broader societal challenges such as unemployment, poverty and infrastructure deficits.

Second, the study contributes to the emerging literature on inclusive innovation by identifying key structural drivers that can support innovation-led inclusive growth in African contexts. By highlighting the roles of digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration, the framework provides a multidimensional perspective on how innovation can generate both economic and social value.

Third, the study offers practical and policy insights for governments, industry leaders and development institutions seeking to harness innovation as a strategic tool for societal transformation. The proposed framework provides guidance on how innovation ecosystems can be structured and coordinated to maximise their developmental impact.

2 Literature review and theoretical foundations

2.1 Innovation and economic development

Innovation has long been recognised as a central driver of economic development, industrial competitiveness and long-term societal progress. Classical economic theories emphasise the role of technological change and entrepreneurial activity in shaping economic growth and structural transformation. Schumpeter's theory of creative destruction highlights how innovation disrupts existing industries while generating new economic opportunities and productivity gains (Schumpeter, 1934). Subsequent scholarship in innovation studies has reinforced the view that sustained economic development depends on the ability of firms, institutions and societies to generate, absorb and diffuse new knowledge and technologies (Fagerberg et al., 2005).

Modern economies increasingly rely on knowledge intensive activities and innovation driven productivity growth. Innovation not only contributes to economic competitiveness but also plays a critical role in addressing complex societal challenges such as climate change, healthcare access, energy security and social inequality (Fagerberg, 2018; OECD, 2021). As a result, innovation policy has expanded beyond industrial competitiveness to include broader societal goals associated with sustainable and inclusive development.

For developing economies, innovation can serve as a powerful mechanism for structural transformation. Countries that successfully transition from resource dependent economies to diversified industrial systems typically invest heavily in innovation capabilities, technological learning and knowledge development (Rodrik, 2016).

However, developing countries often face significant constraints such as limited research capacity, weak institutional support and fragmented innovation systems that hinder their ability to leverage innovation for development (Fagerberg and Srholec, 2008). These challenges are particularly relevant in the African context, where innovation systems remain uneven and underdeveloped in many countries.

2.2 *Innovation systems and ecosystem perspectives*

The concept of innovation systems emerged as a dominant theoretical framework for understanding how innovation occurs within complex networks of institutions, organisations and policies. Early contributions from scholars such as Freeman (1987), Lundvall (1992) and Nelson (1993) emphasised that innovation is not the product of isolated firms but rather the outcome of interactions among universities, governments, industries and research institutions.

National innovation systems (NIS) highlight the importance of institutional arrangements and knowledge flows in shaping technological development and economic performance (Lundvall, 2010). These systems encompass a wide range of actors including firms, research institutions, universities, government agencies and financial institutions that collectively influence the production and diffusion of innovation. Empirical studies have shown that countries with well-developed innovation systems tend to achieve higher levels of technological advancement and economic growth (Fagerberg et al., 2005).

More recently, scholars have expanded this perspective to include the concept of innovation ecosystems, which emphasises dynamic networks of interdependent actors that collaboratively create and capture value through innovation (Autio and Thomas, 2014; Jackson, 2011). Innovation ecosystems typically involve interactions among entrepreneurs, investors, research institutions, government agencies and supporting organisations such as incubators and accelerators. These ecosystems facilitate knowledge exchange, resource mobilisation and collaborative problem solving that can accelerate innovation processes.

The ecosystem perspective is particularly useful for analysing innovation in emerging economies because it highlights the importance of coordination among multiple actors and institutions. Rather than focusing solely on individual firms or technological capabilities, innovation ecosystems emphasise systemic interactions and collective capabilities that enable innovation to flourish (Adner, 2017; Stam, 2015).

Despite the growing popularity of ecosystem frameworks, most existing models have been developed in the context of advanced industrial economies. As a result, their applicability to developing regions such as Africa remains an area of ongoing scholarly inquiry. African innovation ecosystems often operate within environments characterised by institutional weaknesses, infrastructure constraints and limited financial resources, which can significantly influence how innovation systems function (World Bank, 2020).

Recent studies have further highlighted the growing importance of innovation ecosystems in facilitating organisational adaptability, innovation performance and value creation in dynamic environments. Innovation ecosystems enable knowledge sharing, resource integration and collaborative innovation among interdependent actors, thereby enhancing innovation outcomes and competitiveness (Bogers et al., 2023; Granstrand and Holgersson, 2020). These benefits are particularly important in emerging economies characterised by resource constraints and institutional complexity.

2.3 *Inclusive innovation and societal transformation*

Traditional innovation models have often prioritised economic growth and technological advancement without adequately addressing issues of social inclusion and equitable development. In response to this limitation, scholars have increasingly focused on the concept of inclusive innovation, which emphasises innovations designed to improve the livelihoods and well-being of disadvantaged populations (George et al., 2012; Heeks et al., 2014).

Inclusive innovation involves the development of products, services and institutional arrangements that enable broader participation in economic opportunities while addressing societal challenges such as poverty, healthcare access and education disparities. These innovations often emerge in resource constrained environments and may involve frugal or grassroots approaches that prioritise affordability, accessibility and scalability (Prahalad, 2012).

Recent research suggests that innovation can serve as a critical mechanism for achieving the United Nations Sustainable Development Goals (SDGs) by enabling solutions to complex societal problems through technological and institutional transformation (Schot and Steinmueller, 2018). Mission oriented innovation policies have therefore gained increasing attention as governments seek to mobilise innovation ecosystems toward addressing societal challenges such as climate change, public health and sustainable development (Mazzucato, 2018).

For African economies, inclusive innovation is particularly relevant given the continent's socio-economic challenges and development priorities. Innovations in areas such as mobile banking, digital healthcare and renewable energy have demonstrated the potential of innovation to address societal needs while creating economic opportunities (Aker and Mbiti, 2010; Nambisan et al., 2019). Recent empirical evidence further supports the link between innovation and organisational competitiveness in developing economies. For example, Kiveu et al. (2019) found that process, marketing and organisational innovations significantly enhance the competitiveness of manufacturing SMEs in Kenya, demonstrating the potential of innovation to generate both firm-level and broader economic benefits. These findings reinforce the importance of innovation as a mechanism for inclusive growth and socio-economic development in African contexts. These examples illustrate how innovation ecosystems can generate both economic and social value when aligned with broader developmental objectives.

2.4 *Entrepreneurial ecosystems and innovation*

Entrepreneurship plays a central role in translating innovative ideas into marketable products and services. Entrepreneurial ecosystems refer to the interconnected networks of entrepreneurs, investors, institutions and support organisations that collectively facilitate new venture creation and innovation (Isenberg, 2010; Stam, 2015).

Strong entrepreneurial ecosystems typically include a combination of supportive policies, access to finance, human capital development, research institutions and market opportunities that enable entrepreneurial activity to flourish. The effectiveness of entrepreneurial ecosystems is also influenced by organisational learning and knowledge management capabilities. Research has shown that knowledge management enablers facilitate organisational learning, which subsequently promotes organisational innovation and enhances innovation performance. These findings highlight the importance of

knowledge creation and learning processes within innovation ecosystems (Allameh et al., 2017). These ecosystems contribute to economic development by fostering new business formation, job creation and technological innovation (Acs et al., 2017).

In the African context, entrepreneurial activity has expanded significantly in recent years, driven in part by rapid digitalisation, urbanisation and demographic growth. Innovation hubs, incubators and accelerators have emerged across major African cities such as Nairobi, Lagos, Cape Town and Kigali, supporting start up ecosystems and facilitating access to networks and funding (World Bank, 2020). These developments have contributed to the growth of technology-driven ventures, particularly in sectors such as fintech, e commerce and digital services.

Recent research further demonstrates the importance of entrepreneurial ecosystems in fostering innovation-led growth. Studies have shown that entrepreneurial ecosystems support innovation performance, venture creation and business growth by facilitating access to resources, networks, knowledge and institutional support (Acs et al., 2017; Stam and van de Ven, 2021). These ecosystem characteristics are particularly important for promoting innovation-led development in emerging markets. These findings suggest that entrepreneurial ecosystems contribute not only to venture creation but also to the broader diffusion of innovation and socio-economic development.

However, entrepreneurial ecosystems in many African countries remain constrained by structural challenges including limited access to venture capital, regulatory barriers and infrastructure deficits. Addressing these constraints requires coordinated policy interventions and stronger collaboration among public and private actors within innovation ecosystems.

2.5 Digital transformation and leapfrogging opportunities

Digital technologies have emerged as powerful enablers of innovation and economic transformation, particularly in developing regions where technological leapfrogging can accelerate development processes. Advances in mobile technologies, cloud computing, artificial intelligence and digital platforms have created new opportunities for innovation across sectors such as finance, healthcare, education and agriculture (Nambisan et al., 2019).

Africa has experienced remarkable growth in mobile connectivity and digital services over the past two decades. Mobile banking platforms such as M-Pesa have demonstrated how digital technologies can expand financial inclusion and enable new forms of economic participation (Aker and Mbiti, 2010). Similarly, digital platforms are increasingly being used to deliver educational content, healthcare services and agricultural information to underserved communities.

Recent evidence from literature suggests that digital transformation is increasingly becoming a strategic capability rather than merely a technological initiative. Studies indicate that organisations that successfully integrate digital technologies with innovation processes achieve higher levels of operational efficiency, innovation capability and value creation. Digital transformation has increasingly become a strategic capability that reshapes organisational processes, business models and innovation systems (Nambisan et al., 2019; Vial, 2019). These findings are particularly relevant for African economies, where digital technologies offer opportunities for leapfrogging traditional development constraints and accelerating inclusive growth.

Digital transformation also facilitates the emergence of new business models and value chains that can enhance productivity and competitiveness in African economies (Brynjolfsson and McAfee, 2014). Recent studies further suggest that digital technologies strengthen value co-creation and strategic performance by enhancing communication, knowledge sharing and stakeholder engagement. Drawing on diffusion of innovation theory, research demonstrates that e-marketing communication can accelerate innovation adoption and improve organisational performance during periods of environmental disruption and uncertainty (Awad et al., 2024). These findings highlight the strategic importance of digital technologies in supporting innovation diffusion within emerging economy ecosystems. By reducing transaction costs, improving information flows and enabling scalable solutions, digital technologies can strengthen innovation ecosystems and support inclusive development.

Nevertheless, the benefits of digital transformation depend on the availability of digital infrastructure, regulatory frameworks and human capital capable of supporting technological adoption and innovation. Bridging digital divides and strengthening digital capabilities therefore remain important priorities for many African countries.

2.6 Natural resources, industrial development and mineral beneficiation

Africa possesses significant natural resource wealth, including large reserves of minerals such as cobalt, platinum, lithium, manganese and rare earth elements that are essential for modern technologies and global energy transitions. However, many African economies continue to rely heavily on the export of raw materials with limited value addition or industrial processing (Kaplinsky and Morris, 2016).

The concept of resource-based industrialisation emphasises the importance of leveraging natural resources to stimulate industrial development and technological upgrading. Mineral beneficiation refers to the processing and value addition of raw minerals within domestic economies, thereby creating opportunities for manufacturing, employment and technological learning.

Scholars have argued that resource rich countries can overcome the so called 'resource curse' by developing industrial capabilities that enable participation in higher value segments of global value chains (Rodrik, 2016). Strategic investments in mineral processing, manufacturing clusters and industrial innovation can therefore play a critical role in promoting economic diversification and industrial transformation in African economies.

When integrated into broader innovation ecosystems, mineral beneficiation initiatives can stimulate technological development, research collaboration and entrepreneurship in resource related industries. Such integration can contribute to the creation of innovation driven industrial ecosystems that generate both economic and societal benefits.

2.7 Integrating innovation ecosystem perspectives: toward a societal innovation lens

Recent literature has increasingly recognised that innovation ecosystems play a critical role in addressing societal and developmental challenges. However, the existing body of knowledge remains fragmented across several theoretical streams. Innovation ecosystem research primarily focuses on value creation, actor interdependence and ecosystem

governance (Bogers et al., 2023), while entrepreneurial ecosystem studies emphasise venture creation, institutional support and entrepreneurial outcomes (Stam and van de Ven, 2021). Inclusive innovation research, on the other hand, focuses on improving the welfare of marginalised populations and expanding access to economic opportunities (George et al., 2012; Heeks et al., 2014).

Recent studies suggest that these streams are increasingly converging but remain insufficiently integrated. Similarly, contemporary innovation ecosystem research argues that digital platforms, entrepreneurial networks and institutional collaboration are becoming increasingly intertwined in generating innovation outcomes (Bogers et al., 2023).

Despite these developments, three important tensions remain evident in the literature.

First, innovation ecosystem studies predominantly emphasise competitiveness, value creation and firm performance, whereas inclusive innovation studies prioritise societal outcomes such as poverty reduction, social inclusion and equitable development. Consequently, there remains limited theoretical integration between economic and societal perspectives of innovation.

Second, entrepreneurial ecosystem research often focuses on venture creation and business growth while paying limited attention to broader societal transformation outcomes. This creates a disconnect between entrepreneurship-driven innovation and development-oriented innovation agendas.

Third, resource-based industrialisation and mineral beneficiation literature largely operate independently of innovation ecosystem scholarship. While these studies emphasise value addition, industrial upgrading and technological learning, they seldom examine how these activities interact with entrepreneurship ecosystems, digital transformation and collaborative innovation networks.

These tensions are particularly relevant in Africa, where economic transformation, social inclusion and industrial development must occur simultaneously. The fragmented treatment of these themes limits understanding of how innovation can be strategically mobilised to address complex societal challenges. The proposed societal innovation ecosystem framework addresses this gap by integrating digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration within a unified framework that links innovation activities directly to societal transformation outcomes.

Recent literature increasingly recognises innovation ecosystems as important mechanisms for addressing societal and developmental challenges. However, the existing body of knowledge remains fragmented across several theoretical streams. Innovation ecosystem research primarily focuses on value creation, ecosystem governance and actor interdependence (Bogers et al., 2023), while entrepreneurial ecosystem studies concentrate on venture creation, institutional support and business growth (Stam and van de Ven, 2021). Inclusive innovation research, by contrast, emphasises social inclusion, poverty reduction and equitable access to economic opportunities (George et al., 2012; Heeks et al., 2014).

Recent research points to increasing convergence among innovation ecosystem, entrepreneurial ecosystem and digital innovation perspectives. Bogers et al. (2023) argue that innovation ecosystems facilitate value creation through collaboration among diverse actors and institutions. Similarly, Stam and van de Ven (2021) highlight the importance of ecosystem elements and their interactions in shaping entrepreneurial outcomes, while Nambisan et al. (2019) demonstrate how digital technologies increasingly underpin

innovation and entrepreneurial activity. Together, these studies suggest that innovation outcomes emerge from interconnected ecosystem processes rather than isolated organisational activities.

Despite these advances, three significant tensions remain evident. First, innovation ecosystem studies continue to emphasise competitiveness, value creation and firm performance, whereas inclusive innovation studies focus on societal outcomes such as poverty reduction and social inclusion. Consequently, limited theoretical integration exists between economic and societal perspectives of innovation. Second, entrepreneurial ecosystem research largely concentrates on venture formation and business growth while paying insufficient attention to broader societal transformation outcomes. Third, resource-based industrialisation and mineral beneficiation literature operate largely independently of innovation ecosystem scholarship, despite their shared focus on technological learning, value creation and economic transformation.

These tensions are particularly relevant in Africa, where economic growth, social inclusion and industrial development must occur simultaneously. Existing theories provide important but partial explanations of innovation-driven development. The proposed societal innovation ecosystem framework seeks to overcome these limitations by integrating digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration within a unified framework that explicitly links innovation ecosystem processes to societal transformation outcomes.

2.8 Synthesis and research gap

The literature reviewed above highlights several important insights regarding the relationship between innovation ecosystems, entrepreneurship, digital transformation and development. Innovation systems and ecosystem perspectives emphasise the importance of networks and institutional coordination in enabling innovation. Inclusive innovation literature highlights the potential of innovation to address societal challenges, while entrepreneurial ecosystem research demonstrates how new ventures translate innovative ideas into economic opportunities.

Digital technologies offer significant opportunities for leapfrogging and scaling innovation across developing regions, while natural resource endowments provide a foundation for industrial upgrading through mineral beneficiation and value chain development.

Despite these insights, the existing literature remains fragmented in its treatment of innovation and societal transformation in African contexts. Few studies have integrated these theoretical perspectives into a comprehensive framework capable of explaining how innovation ecosystems can address major societal challenges such as unemployment, poverty and infrastructure deficits.

This study seeks to address this gap by proposing a societal innovation ecosystem framework that integrates digital technologies, entrepreneurship ecosystems, mineral beneficiation and public private collaboration as key drivers of innovation driven societal transformation in Africa. The framework aims to provide a conceptual foundation for understanding how innovation ecosystems can contribute to inclusive growth and sustainable development across African economies.

3 Key drivers of societal innovation in Africa

Innovation ecosystems do not emerge spontaneously; rather, they evolve through the interaction of multiple structural drivers that enable knowledge creation, entrepreneurial activity and technological diffusion (Autio and Thomas, 2014; Stam, 2015). In the African context, several drivers are particularly significant in shaping innovation capacity and its potential to generate societal transformation. These include digital technologies, entrepreneurial ecosystems, mineral beneficiation and public-private collaboration. Together, these drivers create the enabling conditions through which innovation can address critical societal challenges such as unemployment, poverty, energy insecurity, water scarcity and education deficits.

This section examines each of these drivers and their potential contribution to societal innovation ecosystems in Africa.

3.1 Digital technologies as catalysts for societal innovation

Digital technologies have emerged as one of the most powerful enablers of innovation and economic transformation in both developed and developing economies. Technologies such as mobile platforms, artificial intelligence, cloud computing, blockchain and data analytics are reshaping industries, creating new business models and enabling more efficient delivery of goods and services (Brynjolfsson and McAfee, 2014; Nambisan et al., 2019). These technologies significantly reduce transaction costs, enhance information flows and enable scalable innovation solutions that can address complex societal challenges.

For African economies, digital transformation presents unique opportunities for technological leapfrogging. In contrast to traditional industrial development pathways that rely heavily on physical infrastructure, digital technologies allow countries to bypass certain stages of technological development and rapidly adopt advanced solutions (Aker and Mbiti, 2010). Mobile banking innovations such as M-Pesa, for example, have demonstrated how digital platforms can significantly expand financial inclusion by providing accessible financial services to previously unbanked populations.

Beyond financial services, digital technologies are increasingly being applied across sectors critical to societal development. In agriculture, digital platforms provide farmers with access to market information, weather forecasts and financial services, thereby improving productivity and resilience (World Bank, 2020). In healthcare, telemedicine and digital health platforms are expanding access to medical services in remote areas. Similarly, digital learning platforms have the potential to improve access to education and training across geographically dispersed populations.

The role of digital technologies in innovation ecosystems extends beyond service delivery. Digital infrastructure also enables knowledge sharing, collaboration and entrepreneurial experimentation within innovation networks (Nambisan et al., 2019). The benefits of innovation extend beyond technology adoption to broader organisational and economic outcomes. Empirical evidence indicates that innovation contributes directly to growth and value creation by enhancing competitiveness, supporting new business development and improving organisational performance. These findings suggest that investments in digital innovation can generate both economic and societal returns when embedded within supportive innovation ecosystems (Jhunjhunwala and Chaudhuri, 2021). Innovation hubs, technology parks and digital start-up communities are

increasingly emerging across African cities, providing platforms for knowledge exchange and venture creation.

Despite these opportunities, digital transformation in Africa faces several structural challenges, including limited broadband infrastructure, regulatory constraints and digital skills shortages (African Development Bank, 2023). Addressing these barriers will be essential to fully leverage digital technologies as drivers of societal innovation ecosystems.

3.2 Entrepreneurship ecosystems and venture creation

Entrepreneurship plays a central role in transforming innovative ideas into viable products, services and business models. Entrepreneurial ecosystems consist of interconnected networks of entrepreneurs, investors, institutions and supporting organisations that collectively facilitate venture creation and innovation (Isenberg, 2010; Stam, 2015). These ecosystems provide access to resources, knowledge, markets and finance that enable entrepreneurs to develop and scale innovative solutions.

In recent years, entrepreneurial activity has expanded significantly across Africa, driven by demographic growth, urbanisation and the increasing availability of digital technologies. Technology start-ups and innovation-driven enterprises have emerged in sectors such as fintech, e-commerce, health technology, renewable energy and digital services. Cities such as Nairobi, Lagos, Cape Town and Kigali have become important hubs for entrepreneurial innovation, attracting investment and fostering start-up communities (World Bank, 2020).

Entrepreneurial ecosystems contribute to societal innovation by enabling the development of solutions tailored to local challenges. For example, African entrepreneurs have developed innovative business models that address energy access through off-grid solar systems, expand agricultural productivity through digital advisory services and improve financial inclusion through mobile payment platforms.

The effectiveness of entrepreneurial ecosystems depends on several structural factors, including access to finance, supportive regulatory frameworks, human capital development and strong networks among ecosystem participants (Acs et al., 2017). Venture capital, angel investment and development finance institutions play critical roles in providing funding for innovation-driven enterprises. Similarly, universities and research institutions contribute by generating knowledge, developing talent and supporting technology transfer.

However, many African entrepreneurial ecosystems remain constrained by limited access to early-stage financing, bureaucratic barriers and insufficient support infrastructure. Strengthening entrepreneurial ecosystems therefore requires coordinated efforts from governments, investors and industry stakeholders to create enabling environments for innovation-driven entrepreneurship.

3.3 Mineral beneficiation and resource-based industrial innovation

Africa is endowed with significant natural resource wealth, including large reserves of minerals essential for global industries such as electronics, renewable energy technologies and advanced manufacturing. Despite this resource abundance, many African economies remain heavily dependent on the export of raw materials with limited

local processing or value addition (Kaplinsky and Morris, 2016). This pattern has constrained industrial development and limited opportunities for technological learning and employment creation.

Mineral beneficiation refers to the processing and value addition of raw minerals within domestic economies before export. By moving up the value chain from extraction to processing and manufacturing, countries can capture greater economic value from their natural resources while stimulating industrial development. Resource-based industrialisation strategies emphasise the importance of leveraging natural resource endowments to build industrial capabilities and technological expertise (Rodrik, 2016).

Recent global shifts toward renewable energy and digital technologies have increased demand for minerals such as lithium, cobalt, manganese and rare earth elements, many of which are abundant in African countries. This presents significant opportunities for African economies to participate more actively in global value chains associated with energy transitions and advanced technologies.

Integrating mineral beneficiation into innovation ecosystems can stimulate research and development activities, foster industrial clusters and encourage collaboration between universities, firms and government institutions. Such integration can support the development of new technologies, manufacturing capabilities and knowledge-intensive industries linked to resource-based sectors.

However, achieving effective resource-based industrialisation requires strong governance frameworks, infrastructure investment and industrial policies that encourage local value addition and technological learning. Without such coordination, resource-rich economies risk remaining locked into extractive development models that generate limited societal benefits.

3.4 Public-private collaboration and institutional coordination

Innovation ecosystems rely heavily on collaboration among multiple stakeholders, including governments, businesses, universities and civil society organisations. Public-private collaboration plays a crucial role in facilitating knowledge exchange, mobilising resources and coordinating innovation activities across sectors (Etzkowitz and Leydesdorff, 2000; Mazzucato, 2018).

The triple helix model of innovation emphasises the interaction between universities, industry and government as a key driver of innovation and technological development (Etzkowitz and Leydesdorff, 2000). Universities contribute through research and knowledge creation, industry actors commercialise innovations and governments provide policy frameworks and institutional support. In many successful innovation ecosystems, these actors collaborate closely to support research commercialisation, entrepreneurial development and technological advancement.

For African economies, public-private collaboration is particularly important due to the structural challenges that often limit private sector investment in innovation. Governments can play a catalytic role by investing in infrastructure, supporting research institutions and implementing policies that encourage innovation and entrepreneurship (Mazzucato, 2018). Public sector initiatives such as innovation funds, technology parks and industrial development programs can help stimulate innovation ecosystems and attract private investment.

Development finance institutions, international organisations and multilateral development banks also play an important role in supporting innovation ecosystems in

Africa by providing funding, technical assistance and capacity building programs. These partnerships can help address financing gaps and support the scaling of innovation-driven enterprises.

Nevertheless, effective collaboration requires strong institutional capacity, transparent governance and policy coherence. Weak institutional frameworks and fragmented policy environments can undermine coordination among ecosystem actors and limit the effectiveness of innovation initiatives.

3.5 Integrating innovation drivers for societal transformation

While each of the drivers discussed above plays an important role in enabling innovation, their transformative potential is maximised when they operate as part of an integrated ecosystem. Digital technologies provide platforms for innovation, entrepreneurial ecosystems translate ideas into ventures, mineral beneficiation enables industrial upgrading and public-private collaboration ensures coordination and resource mobilisation.

When effectively integrated, these drivers can generate innovation processes that lead to societal outcomes such as job creation, poverty reduction, improved service delivery and sustainable economic growth. Innovation ecosystems therefore function as complex systems in which multiple actors, institutions and technologies interact to produce both economic and social value (Adner, 2017).

In the African context, integrating these drivers within a coherent societal innovation ecosystem is essential for addressing structural development challenges while harnessing emerging opportunities associated with digital transformation and resource-based industrialisation. The next section builds on these insights by proposing a societal innovation ecosystem framework that conceptualises how these drivers interact to generate inclusive and transformative development outcomes.

4 The societal innovation ecosystem framework

4.1 Conceptual foundations and driver selection

A key objective of this study is to identify the primary drivers that directly stimulate societal innovation processes within African innovation ecosystems. While numerous factors influence innovation performance, not all operate at the same level of analysis. Existing innovation ecosystem literature identifies factors such as institutional quality, governance capability, access to finance, human capital, infrastructure and innovation policy as important determinants of innovation outcomes (Adner, 2017; Autio and Thomas, 2014; Stam, 2015). However, these factors generally function as enabling or contextual conditions that shape the effectiveness of innovation ecosystems rather than directly generating innovation activities.

This study distinguishes between innovation drivers and enabling conditions. Innovation drivers are defined as ecosystem components that directly initiate, mobilise and transform resources into innovation activities. Enabling conditions are contextual factors that strengthen or weaken the effectiveness of these drivers.

This distinction is also consistent with research demonstrating that innovation outcomes are often mediated by organisational learning and knowledge management

processes. For example, studies have shown that knowledge management enablers strengthen organisational learning, which subsequently enhances organisational innovation and performance. Such findings suggest that knowledge creation and learning function as important innovation mechanisms within ecosystems, while broader structural factors determine the extent to which these mechanisms can be effectively mobilised (Allameh et al., 2017). This perspective supports the positioning of knowledge creation as a core ecosystem process within the proposed framework rather than as a primary innovation driver.

Based on the literature synthesis, four drivers were selected because they consistently appear as direct mechanisms through which innovation is translated into societal and economic value in African contexts:

- 1 digital technologies provide the technological infrastructure that enables innovation, knowledge exchange and scalable solutions
- 2 entrepreneurship ecosystems transform knowledge and opportunities into new ventures and innovative business models
- 3 mineral beneficiation and industrial innovation provide a pathway for resource-rich economies to move from extraction to value-added industrial development
- 4 public-private collaboration facilitates coordination among ecosystem actors and enables resource mobilisation, knowledge transfer and institutional support.

In contrast, institutional quality, governance capability, human capital, infrastructure, innovation policy and access to finance are conceptualised as enabling conditions and boundary factors that influence the strength of relationships within the ecosystem rather than functioning as primary innovation drivers themselves.

4.2 Levels of analysis and boundary conditions

The proposed framework operates primarily at the national and ecosystem levels of analysis. The focus is not on individual firms or entrepreneurs but on how interactions among ecosystem actors generate innovation-driven societal transformation.

The framework is intended primarily for African economies characterised by:

- significant societal development challenges
- emerging or evolving innovation ecosystems
- increasing digital transformation
- opportunities for entrepreneurship-led growth
- potential for industrial upgrading through resource beneficiation.

The framework is therefore most applicable to emerging and developing African economies seeking to leverage innovation for inclusive growth. While the framework is pan-African in scope, the relative importance of the drivers may vary across countries depending on institutional maturity, technological readiness and industrial structure.

4.3 *Innovation ecosystem processes as causal mechanisms*

The innovation ecosystem processes represent the mediating mechanisms through which innovation drivers generate societal outcomes.

Rather than operating independently, these processes occur in a sequential and reinforcing manner.

Stage 1 Knowledge creation and resource mobilisation

Digital technologies and public-private collaboration facilitate knowledge generation, information sharing and resource mobilisation among ecosystem actors. Universities, research institutions, innovation hubs and industry participants contribute to the creation of new knowledge and technological capabilities.

Stage 2 Entrepreneurial experimentation and venture formation

Knowledge generated within the ecosystem is transformed into entrepreneurial opportunities through experimentation, opportunity recognition and venture creation. Entrepreneurial ecosystems play a critical role in translating knowledge into innovative products, services and business models.

Stage 3 Industrial scaling and value chain development

Successful innovations are subsequently scaled through industrial upgrading, manufacturing development and value chain expansion. In resource-rich African economies, mineral beneficiation serves as a critical mechanism for converting natural resource endowments into industrial capabilities and technological learning.

Stage 4 Technology diffusion and societal adoption

Innovations diffuse across industries, institutions and communities through networks, partnerships and market mechanisms. Diffusion enables broader societal access to technologies, services and economic opportunities.

This sequence explains how innovation drivers ultimately generate societal outcomes rather than assuming a direct relationship between drivers and development outcomes.

4.4 *Revised societal outcomes*

The framework distinguishes between first-order and second-order outcomes.

First-order outcomes

- innovation capability
- venture creation
- industrial upgrading
- technology adoption.

Second-order societal outcomes

- employment creation
- improved service access
- inclusive economic growth
- sustainable development.

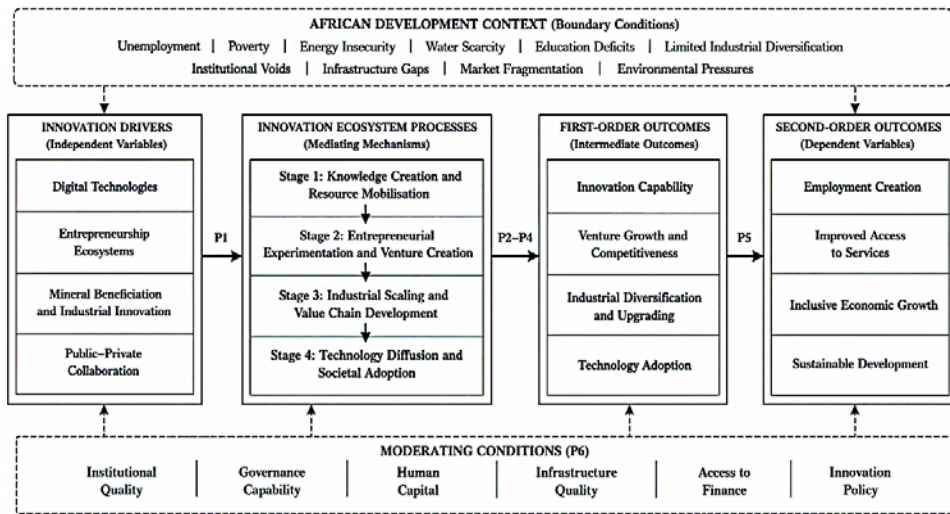
This distinction improves theoretical clarity by recognising that societal outcomes emerge through intermediate innovation processes rather than directly from innovation drivers.

4.5 Theoretical propositions

The proposed framework suggests that societal transformation occurs through a sequence of innovation ecosystem mechanisms rather than through isolated innovation activities.

- Proposition 1 (Innovation drivers → ecosystem processes)
The combined presence of digital technologies, entrepreneurship ecosystems, mineral beneficiation capabilities and public-private collaboration positively influences knowledge creation and resource mobilisation within African innovation ecosystems.
- Proposition 2 (Knowledge creation → entrepreneurial activity)
Knowledge creation and resource mobilisation positively influence entrepreneurial experimentation and venture formation within innovation ecosystems.
- Proposition 3 (Entrepreneurial activity → industrial development)
Entrepreneurial experimentation and venture formation positively influence industrial upgrading, value chain development and innovation scaling.
- Proposition 4 (Industrial development → societal outcomes)
Industrial upgrading and technology diffusion positively influence employment creation, service accessibility and inclusive economic growth.
- Proposition 5 (Moderating effects of enabling conditions)
Institutional quality, governance capability, human capital, infrastructure and access to finance positively moderate the relationships among innovation drivers, ecosystem processes and societal outcomes.
- Proposition 6 (Integrated ecosystem effect)
The positive impact of innovation drivers on societal transformation is strongest when digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration operate as an integrated ecosystem rather than as isolated initiatives.

Figure 1 Societal innovation ecosystem framework



The societal innovation ecosystem framework developed in this study synthesises insights from innovation ecosystem theory, entrepreneurial ecosystem literature, inclusive innovation, transformative innovation and resource-based industrialisation perspectives. The framework advances existing scholarship by moving beyond fragmented explanations of innovation and proposing an integrated ecosystem model that explicitly links innovation drivers, ecosystem processes and societal transformation outcomes within the African context.

A key contribution of the framework is its articulation of the causal mechanisms through which innovation generates societal value. Specifically, the framework proposes that digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration function as primary innovation drivers that stimulate knowledge creation and resource mobilisation. These activities foster entrepreneurial experimentation and venture formation, which in turn support industrial upgrading, value chain development and technology diffusion. Through these sequential processes, innovation ecosystems generate first-order outcomes such as innovation capability, venture growth, industrial diversification and technology adoption, ultimately contributing to second-order societal outcomes including employment creation, improved access to services, inclusive economic growth and sustainable development.

The framework further recognises that these relationships are contingent upon enabling conditions such as institutional quality, governance capability, human capital, infrastructure, access to finance and innovation policy. These factors do not directly drive innovation but influence the effectiveness with which innovation ecosystem processes translate into societal outcomes.

By positioning innovation as a systemic and coordinated process rather than an isolated technological activity, the framework provides a theoretically grounded explanation of how African economies can leverage innovation to address complex development challenges. The next section discusses the policy and managerial implications of the framework for governments, businesses, research institutions and

development agencies seeking to harness innovation as a strategic instrument for inclusive growth and societal transformation.

5 Policy and managerial implications

The societal innovation ecosystem framework highlights that innovation-driven societal transformation requires more than technological advancement alone. Effective innovation outcomes emerge from the interaction of innovation drivers, ecosystem processes and enabling conditions operating within specific national and regional contexts. Consequently, policymakers, industry leaders and research institutions must focus on strengthening the mechanisms that translate innovation activities into inclusive development outcomes.

5.1 Implications for government and public policy

Governments play a critical role in creating the enabling conditions that support innovation ecosystem effectiveness. Rather than acting as direct drivers of innovation, public institutions shape the policy, regulatory and infrastructural environment within which innovation ecosystems operate. This includes strengthening institutional quality, investing in digital and physical infrastructure, enhancing human capital and improving access to finance.

Given the diversity of African economies, innovation policies should be context-specific rather than adopting a one-size-fits-all approach. For example, resource-rich economies may prioritise mineral beneficiation and industrial upgrading, while innovation-led economies may focus on digital transformation and entrepreneurial ecosystem development. Governments should also promote mission-oriented innovation strategies that align innovation investments with societal priorities such as employment creation, energy access, water security and education improvement (Mazzucato, 2018; Schot and Steinmueller, 2018).

Furthermore, public policy should facilitate collaboration among universities, industry, entrepreneurs and development agencies to support knowledge creation, innovation scaling and technology diffusion across sectors.

5.2 Implications for industry and corporate strategy

The framework suggests that firms should move beyond firm-centric innovation approaches and actively participate in broader innovation ecosystems. Companies can strengthen ecosystem effectiveness by collaborating with universities, start-ups, research institutions and government agencies to accelerate knowledge exchange and innovation commercialisation.

Corporate strategies should also align innovation activities with societal value creation. Investments in digital transformation, industrial upgrading and local value addition can simultaneously enhance competitiveness and contribute to employment creation, service delivery and economic inclusion. For firms operating in resource-intensive sectors, mineral beneficiation presents opportunities to increase domestic value creation while supporting broader industrial development.

Importantly, businesses should view innovation not only as a source of competitive advantage but also as a mechanism for addressing societal challenges and creating shared value (Porter and Kramer, 2011).

5.3 Implications for universities and research institutions

Universities and research institutions occupy a central position in the innovation ecosystem by supporting knowledge creation, capability development and technology transfer. The framework highlights the need to strengthen the link between research outputs and societal impact through greater emphasis on research commercialisation, entrepreneurial education and industry collaboration.

In addition, universities should promote interdisciplinary research that integrates technological, economic and social perspectives to address complex development challenges. Such collaboration can improve the translation of knowledge into innovative products, services and policy solutions while strengthening the knowledge creation stage of the innovation ecosystem.

5.4 Implications for innovation ecosystem governance

The framework underscores the importance of effective ecosystem governance in coordinating interactions among diverse actors and ensuring that innovation activities translate into societal outcomes. Governance mechanisms should focus on facilitating collaboration, reducing institutional fragmentation and strengthening alignment between innovation initiatives and development priorities.

Particular attention should be given to the enabling conditions identified in the framework, namely institutional quality, governance capability, human capital, infrastructure, access to finance and innovation policy as these factors influence the effectiveness of ecosystem processes. Strengthening these conditions can enhance the transition from knowledge creation and entrepreneurial experimentation to industrial development, technology diffusion and societal transformation.

Finally, regional and international partnerships can provide valuable opportunities for knowledge exchange, investment mobilisation and capability development, thereby strengthening innovation ecosystems across diverse African contexts.

6 Conclusions

This study developed a societal innovation ecosystem framework to explain how innovation can be leveraged to address key development challenges in Africa. The framework contributes to the literature by integrating four primary innovation drivers, namely digital technologies, entrepreneurship ecosystems, mineral beneficiation and public-private collaboration, within a coherent ecosystem model that links innovation activities to societal transformation outcomes. In doing so, the study extends innovation ecosystem theory beyond firm-level competitiveness by explicitly incorporating inclusive growth, employment creation and sustainable development as desired outcomes.

From a theoretical perspective, the framework provides a novel synthesis of innovation ecosystem, entrepreneurial ecosystem, inclusive innovation and

resource-based industrialisation literatures. From a managerial and policy perspective, it highlights the importance of coordinated ecosystem governance, context-specific innovation strategies and enabling conditions such as institutional quality, human capital, infrastructure and access to finance.

The study is subject to certain limitations. As a conceptual paper, the framework has not been empirically tested and does not account for all contextual differences across African economies. Future research should empirically validate the proposed relationships, examine country-specific ecosystem configurations and investigate the relative importance of innovation drivers across different sectors and development contexts.

Overall, the study argues that innovation ecosystems can serve as strategic mechanisms for promoting inclusive growth and societal transformation when innovation drivers, ecosystem processes and enabling conditions operate in an integrated and coordinated manner.

Declarations

Human participants were not used for this study.

The author declares that he has no conflicts of interest.

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