

Mapping the Innovation Ecosystem in Kenya

Acknowledgment

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This report is a developing body of knowledge that has benefited from valuable contribution from multiple actors in the innovation ecosystem particularly the innovators, start-ups, and innovation hubs. We are grateful to everyone who shared their experiences, knowledge, and insights with us.

For more information on this report, please contact the project lead, Caroline Kiarie at caroline.kiarie@undp.org

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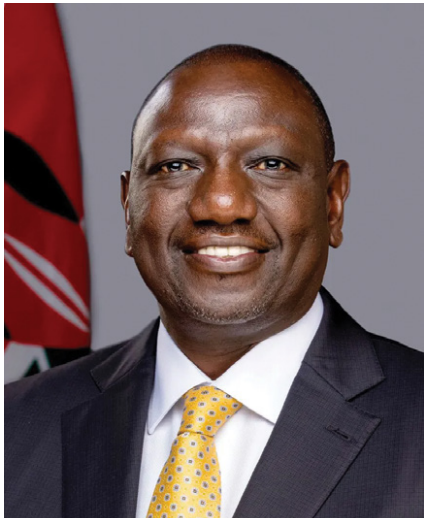
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Foreword by His Excellency Dr. William Samoei Ruto, President of the Republic of Kenya



H.E. Hon. Dr. William Samoei Ruto
President of the Republic of Kenya

The Government of Kenya recognizes the crucial role technology plays in accelerating the country’s economic transformation agenda and specifically, the Digital Economy. My administration has clearly outlined the important role the digital economy will play in driving economic growth and job creation especially for the youth. Consequently, we are establishing a robust ICT driven economy, powered by ICT infrastructure towards meeting the 21st century needs.

Kenya is home to M-PESA and a vibrant startup ecosystem that is contributing to economic transformation. The government is keen on taking advantage of these achievements to digitize its operations in an ambitious plan towards E - government solutions, to streamline processes, improve productivity and efficiency and enhance service delivery to citizens. This ambition requires investment in the best IT solutions ranging from applications, infrastructure, and security systems to guarantee safe, reliable, and sound software systems.

It is against this backdrop that my government has set out an ambitious plan to ensure universal access to internet and broadband solutions, driven by a robust optic network backbone that is the ‘Digital Superhighway’. This is anchored by six undersea cables landing in the port city of Mombasa as well as the rich terrestrial infrastructure across the country. The government is committed to enhance last mile connectivity, and to deliberately put in place strategies to facilitate access to low cost internet ready devices to enable more Kenyans onboard into the Digital economy.

The government has further invested heavily in the establishment of the Silicon Savanna – Africa’s technology gateway powered by the Konza Technopolis, a smart city, science park and innovation hub that is projected to contribute 2% of the country’s GDP. Konza Technopolis is envisioned to catalyze Kenya’s development in Knowledge Economy and Innovation. The Technopolis is playing a catalytic role in the development of the Innovation Ecosystem in Kenya by providing relevant supporting infrastructure to unlock the potential in this sector.

Kenya’s Innovation Ecosystem ranks among the top three in Africa. Pioneering technologies continue to be realized across all sectors of development driven by the country’s innovative startup community. Kenya prides itself as regional innovation leader and a hub for tech startups.

It therefore gives me much joy to launch this Innovation Ecosystem report that provides insights for the government and development organizations to make data backed decisions towards the enhancement of the Innovation Ecosystem in Kenya. I applaud our development partners who are playing a crucial role in the advancement of our Innovation Ecosystem which can only thrive and achieve its potential when all players collaborate to deliver on a shared vision. The quadruple helix approach to innovation calls for government, industry, academia, and non-state actors to collaborate. This report is testimony to the impact of such collaborations.

Kenya is committed to engage development partners in enhancing capacity for innovation and the contribution of ICT sector to the overall economy of the country. We commit to consider the recommendations in this report to influence policy direction, even as we strengthen the partnership between the government, private sector and non-state actors.

Preamble by Cabinet Secretary, Ministry of Information, Communications and the Digital Economy, Mr. Eliud Owalo



Mr. Eliud Owalo
Ministry of Information, Communications and the Digital Economy

Kenya’s innovation ecosystem has registered significant growth over the years. The growth of innovation hubs, both at the national and local levels, has played a key role in advancing our innovation ecosystem, by supporting the growth of start- ups and incubation of businesses. It has unlocked value in a knowledge-based economy and created jobs. The institutions of higher learning have further contributed to the growth of our innovation ecosystem, by introducing programmes that are geared towards preparing students for participation in innovation and entrepreneurship while, at the same time, setting up their own university-led innovation hubs.

The government continues to play its part by providing the strategic infrastructure for an empowered digital Kenyan society. Our strategic initiatives include deployment of critical infrastructure such as the laying of fiber optic cable, and an elaborate undersea cable network that will enhance universal access to digital technology in the country. In this regard, the government is committed to delivering 100,000 kilometres of the national fibre optic network and ensuring that Kenyans can access smart technology devices at very competitive costs, as a strategy to bring many Kenyans into the digital economy. Additionally, the government is committed to building digital capacity among Kenyans so that they are not left behind in the global digital migration. With this solid foundation, we are confident to report that the country’s ecosystem is on a positive trajectory and should continue to witness gains and contribute to the economy of the country.

The government recognises the strong role that our development partners like UNDP play towards the realization of our goals. It is, therefore, my pleasure to join our innovation ecosystem players in the launch of this Innovation Ecosystem Report that has been championed by UNDP Kenya, Konza Technopolis Development Authority, and other collaborating partners. The report provides solid baseline information on the state of the innovation ecosystem in Kenya.

This report also serves as a launching pad, from which we will strengthen our innovation ecosystems as we empower them to deliver on two strategic priorities of the Government – job creation (leveraging digital solutions) and augmenting the impact of the creative and digital economy. As we implement the findings and recommendations of this report, we will continue to position Kenya as a leader in digital technology in Africa, through Konza’s Silicon Savanna, as the home of technology in Africa.

I pledge my commitment to working with all stakeholders towards building a strong innovation ecosystem in the country. I look forward to the realisation of the benefits of a robust digital ecosystem, following the implementation of the findings in this report.

Message from CEO of Konza Technopolis Development Authority, Eng. John Tanui



We are glad as Konza Technopolis Development Authority (KoTDA) to be part of this great document that has mapped out the Kenya Innovation Ecosystem. The evidence from this report will go a long way in accelerating the gains made in the ecosystem.

This report offers a holistic and comprehensive outlook into Kenya's Innovation Infrastructure, maintaining a keen focus on the existing challenges highlighted by startups, and innovation ecosystem stakeholders. The report also deep-dives into the regional and national innovation barriers and gives an outlook on opportunities for mitigating these challenges and promoting an innovation-driven economy. The report provides a timely data-driven approach that calls for increased interconnectedness and collaboration of relevant stakeholders and innovation ecosystem players in driving innovation interventions to transform Kenya's economy.

We have noted several challenges affecting the innovation ecosystem among them commercialisation of innovations, low investment in technology, low number of people in STEM, uncoordinated innovation

pipeline, human resource development and government support. This has been captured in this report, to solve the challenges It is critical for the key players to get involved in and fully support the development of the space.

We are committed as Konza Technopolis to play our part to ensure that the sector thrives. Konza is developing an innovation ecosystem through the physical space as well as bringing together the various stakeholders within the industry to support the commercialization of research findings and the development of new solutions and enterprises. We are glad to note that the Kenyan innovation ecosystem is driven by youthful and well-educated innovators and entrepreneurs, with formally registered start-ups.

We are committed to providing an enabling environment for this category of players in the ecosystem to thrive.

Message from Resident Representative, UNDP Kenya, Anthony Ngororano



The relevance of a robust innovation ecosystem to a country's economy cannot be gainsaid. The potential impact of innovation in supporting social and economic development depends on the maturity of national innovation ecosystems. A vibrant and enabling innovation ecosystem facilitates the emergence and growth of businesses and is evidenced by the presence and fluidity of ideas and solutions.

The innovation ecosystem in Kenya has grown through leaps and bounds in the last decade supported by the improvement of key development indicators such as an increased number of innovation hubs across the country, increased broadband connectivity, increased funding for start-ups and increased government and private sector efforts towards decentralization and local capacity building. Kenya ranked 4th in Sub-Saharan Africa in 2022 Global Innovation Index and is one of the countries that holds a record for outperforming as an innovation achiever for the 12th year in a row.

Without a doubt, the complexities of today's development challenges and realities require new solutions and approaches to match them.

UNDP is keen to foster partnerships that build on the transformative power of innovation to address present day challenges across the world. Our recently approved Strategic Plan (2022-2025) has innovation and digital technology as strategic enablers of development which underpin UNDP's determination to stay at the forefront of development thinking and innovation.

UNDP in Kenya through the UNDP Accelerator Lab has played a critical role in strengthening the innovation and digital ecosystems by fostering critical connections between Government, academia, development partners, the private sector, and innovators. In partnership with Konza Technopolis Development Authority, African Centre for Technology Studies (ACTS), and Association of Countrywide of Innovation Hubs, UNDP has conducted an assessment of the innovation ecosystem to provide insights on the key drivers necessary for its growth.

This report presents the findings of the assessment and offers opportunities for collaboration, learning and investment that are relevant to any stakeholder engaged in innovation development. It uniquely contextualizes the role that industrialization has played in innovation development and the policies that have shaped the trajectory of the innovation ecosystem. The report further provides clarity on the existing infrastructure with a particular focus on innovation assets such as innovation hubs, accelerator labs, and others and the role they play in developing capacities for innovation and entrepreneurship. More than 150 innovation assets across the country were identified and mapped and the report highlights areas such as capacity building for hub managers, certification for innovators and innovation hubs, intellectual property management, access to finance and information as key for stakeholders to support.

Going forward, UNDP will continue working closely with the actors in the innovation ecosystem to enhance linkages between local, regional, and national innovation mechanisms, in the quest to accelerate the implementation of the country's development objectives.

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Table of Abbreviations

ACTS	African Centre for Technology Studies
AfDB	African Development Bank
ASME	American Society of Mechanical Engineers
BMGF	Bill and Melinda Gates Foundation
B2B	Business to Business
BSc	Bachelor of Science
CA	Communication Authority of Kenya
CEC	County Executive Committee
CISCO	Commercial and Industrial Security Corporation
CUEA	Catholic University of Eastern Africa
DANIDA	Danish International Development Agency
DUE	Directorate of University Education
DRST	Directorate of Research Science and Technology
EA	East Africa
EAIRO	East African Industrial Research Organization
EDGE	Enhanced Data for Global Evolution
GCI	Global Connectivity Index
GSMA	Global System for Mobile Communications Association
GDP	Gross Domestic Product
ICT	Information Communication Technology
IBM	International Business Machines Corporation
ICT	Information Communication and Technology
ICDC	Industrial and Commercial Development Corporation
ISHOW	Innovation Showcase
IoT	Internet of Things
IP	Intellectual Property
ITES	Information Technology Enabled Services
IIEC	Innovation Incubation and Entrepreneurship Centre
12C	Innovation and Incubation Centre
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KALRO	Kenya Agricultural and Livestock Research Organization
KEBS	Kenya Bureau of Standards
KENIA	Kenya National Innovation Authority
KIE	Kenya Industrial Estate

KIMBO	Kenya Industrial Management Board
KIRDI	Kenya Industrial Research and Development Institute
KYEOP	Kenya Youth Employment Opportunity Program
KU	Kenyatta University
MSMEs	Micro, Small and Medium Enterprises
MoE	Ministry of Education
MNO	Mobile Network Operators
MSc	Master’s degree
MTP 3	Medium Term Plan
MMUST	Masinde Muliro University of Science and Technology
NACOSTI	National Commission of Science Technology and Innovation
NCST	National Council of Science and Technology
NETFUND	National Environment Trust Fund
NGO	Non-Governmental Organization
NRF	National Research Fund
NOFBI	National Fibre Optic Backbone Infrastructure
NGAAF	National Government Affirmative Action Plan
PhD	Doctor of Philosophy
RA	Research Assistant
SACCO	Savings and Credit Corporative Organization
SAP	Structural Adjustment Program
SDGs	Sustainable Development Goals
SGCs	Science Granting Councils
SGCI	Science Granting Councils Initiatives
SIDA	Swedish International Development Cooperation Agency
STI	Science Technology and Innovation
TVET	Technical and Vocational Educational and Training
UKAID	United Kingdom Department of International Development
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USIU	United States International University
USF	Universal Service Fund
UoN	University of Nairobi
YEDF	Youth Enterprise Development Fund



A virtual reality set used in teaching children on the autism spectrum



An innovator presenting a smart intelligent solar powered waste bin



An innovator presenting a solution for LED enabled indoor farming



In Kenya, innovation ecosystems are concentrated in urban areas, with many of the initiatives being run independently. There is therefore a risk of duplication and saturation of focus on the efforts being applied.

1.1. Background to the Study

The study has been undertaken by the United Nations Development Programme (UNDP) in collaboration with Konza Technopolis Development Authority (KOTDA), the Association of Countywide Hubs and the African Centre for Technology Studies (ACTS).

1.2. Problem Statement

This study addresses the context and challenges related to the Kenyan innovation ecosystem as follows:

- a. The potential impact of technology innovation in the socio-economic development in developing countries depends on the level of maturity of the national innovation ecosystem. It has been observed that technological innovation does not grow equally in all cities in Kenya. It is therefore important to understand the factors that cause different growth rates and how the growth can be supported and sustained across a national landscape.
- b. In Kenya, innovation ecosystems are concentrated in urban areas, with many of the initiatives being run independently. There is therefore a risk of duplication and saturation of focus on the efforts being applied. There is also limited distribution of hubs and resources in locations outside Nairobi.
- c. Innovation spaces are insufficiently differentiated and have sustainability challenges with their business models, limited funding, and entrepreneurship support as well as insufficient collaboration and coordination between stakeholders.

The situation above prompted the mapping of the innovation ecosystem with a view to identify opportunities for collaboration, learning and investment; and to support the growth and development of local innovators across the country.

1.3. Purpose, Objectives, and Scope

The purpose of this study is to conduct a mapping of the Kenya innovation ecosystem and generate evidence that can be used to accelerate its growth. To realize this purpose, the study pursued the following objectives:

- Establish the status of the Kenyan Innovation Ecosystem across the country: characteristics, organization (players and actors), challenges, and opportunities.
- Identify key levers and approaches on how to stimulate the sector for more economic growth towards achieving key development agenda items (SDGs, Vision 2030), including requisite skill sets, partnerships, and resources.
- Highlight emerging themes and opportunities for collaboration, partnership, and cross-learning across sectors.

The scope of the study included:

- a. A review of global trends in innovation and key innovation hubs in the innovation ecosystem as a background to the Kenyan context.
- b. Cover the innovation ecosystem across the country - Kenya
- c. Compile data on existing innovation hubs and accelerators disaggregated by location, focus and years of existence.
- d. Identify existing or prevailing challenges within the ecosystem for vulnerable and marginalized communities.
- e. Focus on sector players, Innovators (start-ups, SME and select large innovators); innovation ecosystems: academia, hubs, labs, accelerators, corporate sponsors, development organizations and regulators).



CHAPTER ONE

Introduction, Objectives and Methodology



1.4. Approach and Methodology

1.4.1. Desk Review

The desk review included the review of the global innovation trends, case studies of selected leading innovation hubs, historical perspectives of the Kenyan innovation ecosystem and its indicators of growth as well as the existence of the driving vision for the Kenyan innovation ecosystem. The review of the global innovation trends was necessary to show how Kenya is performing regionally and globally in the innovation front, identify areas where the country is performing well, areas where it is lagging, and what lessons can be learned from better performing countries. The desk review also documented the existing innovators and innovation hubs to obtain preliminary information on the characteristics of the Kenyan innovation ecosystem. An online desk study was carried out to help identify the innovation centres, hubs, accelerator labs, incubators, workspaces, and maker spaces. The key terms were identified like 'hubs/accelerators/incubators in Kenya' were used to help source information. The websites and social pages of the identified potential organizations were visited, and information gathered. This included: their names, location (county), age (from year of establishment), type of organization- whether private or public, number of employees, the supported entities (successfully supported), their focus areas, etc. This data was collected in an excel sheet where clarification and more data was gathered. In total over 200 hubs and 220 innovators were identified, and basic data documented.

1.5. Field data collection

1.5.1. Scope and targeted actors

The field data collection covered all the 47 counties and targeted the following key actors in the Kenyan innovation ecosystem:

- a) Innovators (start-ups, SMEs, select large innovators).
- b) Hubs (Innovation hubs, accelerators, incubators, and co-working spaces)
- c) Academic innovation labs

- d) Industry led innovation labs/ hubs, hubs by corporate organisations.
- e) Government departments and agencies
- f) Networks and marketing organizations
- g) Skills trainers
- h) Financing institutions

1.5.2. Data collection approach and tools

The study deployed research assistants (RAs) in all the 47 countries to collect data from the above-mentioned actors in the ecosystem at the county level. The research assistants were taken through four training sessions on the data collection tools and research protocols required for the exercise. A data collection tool was developed and customized for each of the actors in the innovation ecosystem, so that only questions relevant to the specific actor were captured. For flexibility, the tools could be deployed both online and offline with a view to reaching as many stakeholders as possible. The research assistants had two options to administer the questionnaires: (a) the option of sharing the online tool with the potential respondents, and (b) printing the questionnaires and either ask the respondents to fill the hard copy at their own pleasure or have a face-to-face interview where the research assistants asked the questions and filled the questionnaire. For the hard copies, the research assistant was required to feed the responses onto the online platform or share the hard copy with ACTS staff who could then input the responses onto the online platform. The initial tools were refined and improved based on discussions with research assistants and from insights gathered from a workshop for innovators and representatives of hubs held in Kisumu, January 2022.



To enable continuous consultation and feedback with research assistants, an online forum was formed where they (research assistants) could raise questions and have them addressed by members of the ACTS team instantaneously.

1.5.3. Sampling and data collection

The sampling frame for this study comprised of all actors in the innovation ecosystem as mentioned above. The RAs were required to interview at least two respondents from each of the actors per county. Since the exercise also purposed to identify existing innovators and hubs, the RAs were required to document any existing innovators and hubs that they could not reach. To ease selection of the respondents, an initial list of pre-selected innovators and innovation hubs, which had been identified through desktop research and through the Kisumu workshop, was provided to the research assistants as a starting point. The research assistants used purposive sampling and snowballing to identify and select respondents to be interviewed. In some cases, they approached Government offices at the County levels to get information including ICT Directorate, Department of Trade and Industry, Department of Culture and Social Services, and the department of agriculture to get information on potential respondents. To enable continuous consultation and feedback with research assistants, an online forum was formed where they (research assistants) could raise questions and have them addressed by members of the ACTS team instantaneously.

For selected 10 counties (Nairobi, Mombasa, Kisumu, Nakuru, Uasin-Gishu, Kakamega, Nyeri, Makueni, and Tana River), at least 30% of the identified hubs were interviewed. Most of these respondents were interviewed by ACTS team through telephone.

1.6. Structure of this Report

This report consists of five chapters. After chapter one, which is introduction, the report has three chapters on key findings. Chapter two provides an overview of the Kenyan innovation ecosystem based on the desk study undertaken. Chapters three and four presents the results from field data collection, with chapter three focusing on the characteristics of the innovators and start-ups while chapter four covers the hubs, incubators, accelerators, and innovation labs as well as other support agencies. Finally, chapter five provides conclusions and recommendations based on the study findings.



The quality parameter considers the number of staff per start-up, unicorns, exits, pantheon firm, global start-ups events, and the prevalence of global start-up leaders

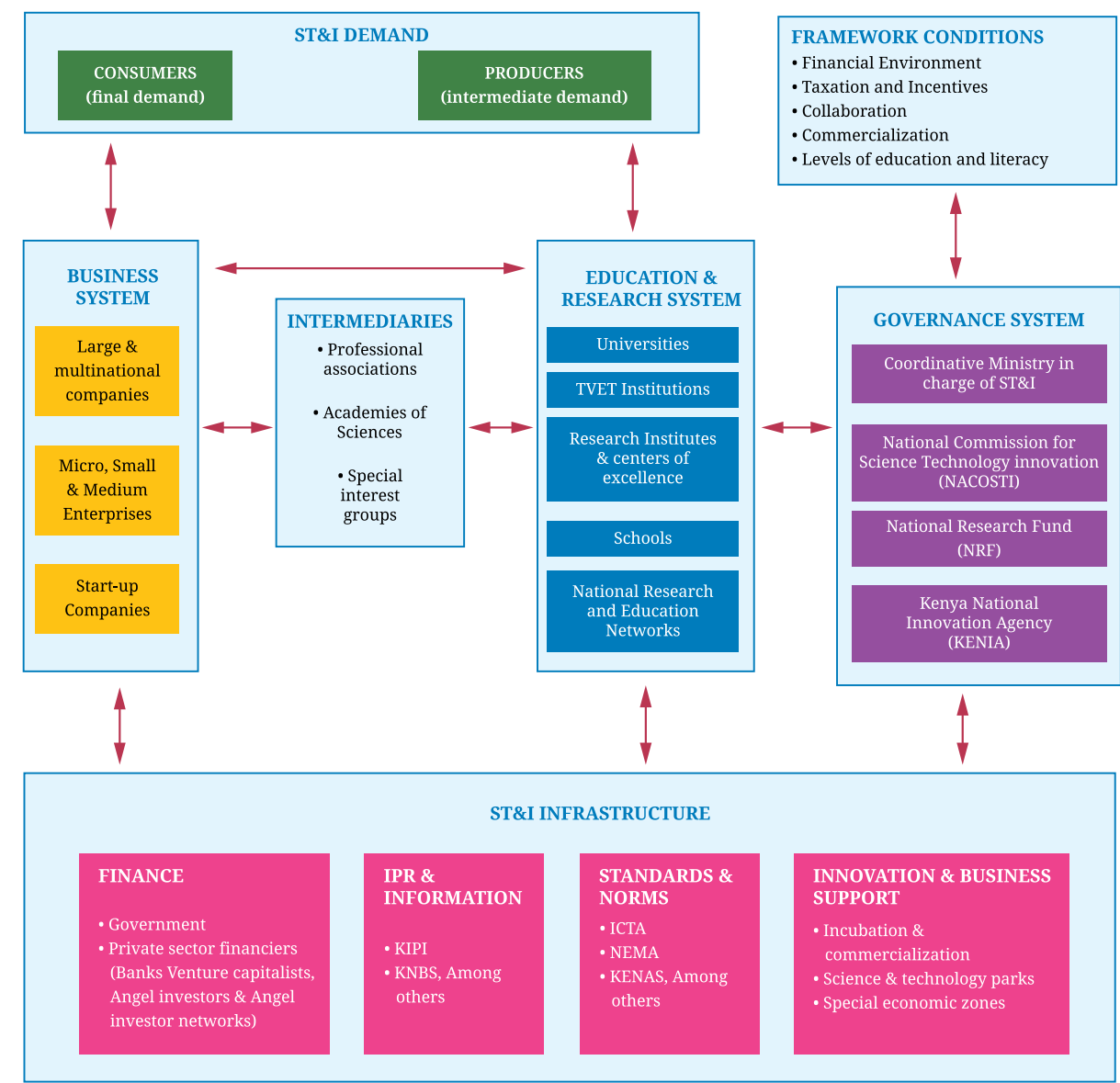
2.2. Global Trends in the Innovation Ecosystem

Analysis of the global innovation trends was undertaken to provide context and metrics for benchmarking the Kenyan innovation ecosystem. The study considered the following: The Global Start-up Ecosystem Index (2021), Global Innovation Index Report (GNI) 2021, the United Nations Conference on Trade and Development (UNCTAD's) Technology and Innovation Report (2021) and Cisco's Digital Readiness Index (2019) and the Global Innovation Hubs Index (2020).

2.2.1. Global Start-up Ecosystem Index 2021:

The Global Start-up Ecosystem Index 2021 ranked the start-up ecosystems of 100 countries and 1000 cities. It assigned score based on three factors: quantity, quality, and business environment. The quantity factor considers number of start-ups, co-working spaces, accelerators, and start-up-related meetings. The quality parameter considers the number of staff per start-up, unicorns, exits, pantheon firm, global start-ups events, and the prevalence of global start-up leaders. The business environment includes the ease of forming and conducting business, broadband speeds and freedom, English proficiency, R&D investment, and patent capita. At the global level, Kenya is ranked number 61 and occupies position four in the Middle East and African region behind Israel, UAR and South Africa (Table 2.2). Regionally, Kenya is in position 2 behind South Africa.

Table 2.1:
Brief description of the various key players in the Kenya Innovation Ecosystem.



Key: STI - Science Technology & Innovation, TVET - Technical Vocational Education & Training, NRF - National Research Fund, NACOSTI - National Commission for Science Technology and Innovation, KENIA - Kenya National Innovation Agency, IPR - Intellectual Property Rights, KIPi - Kenya Industry Property Rights, KNBS - Kenya National Bureau of Statistics, ICTA - Information commission and Technology Authority, NEMA - National Environment Management Authority

Table 2.2:
Top 10 countries in Middle East and African Region.

Rank	Country	Number of Ranked cities	Global Rank	Total Score
1	Israel	11	3	27.741
2	United Arab Emirates	2	25	6.951
3	South Africa	4	48	3.518
4	Kenya	2	61	1.565
5	Nigeria	7	63	1.517
6	Jordan	1	64	1.108
7	Bahrain	1	66	0.946
8	Rwanda	1	69	0.918
9	Egypt	2	70	0.893
10	Saudi Arabia	4	71	0.864

- **The innovation producers** consist of innovators, universities, TVETs, research organizations and centres of excellence, schools and national research and education networks. Some of these institutions have policies and support structures to help commercialization of their innovations.
- **Innovation consumers** consists of large companies, SMEs, and start-ups. It is also important to note that some of these enterprises also generate innovations. Furthermore, entrepreneurs in the industrial clusters, which consist of informal enterprises, also generate innovations.
- **The innovation enablers and assets** consist of accelerators, incubators, science and industrial parks, special economic zones. There are over 200 hubs consisting of incubators and accelerators, markers spaces, and co-working spaces.
- **Governance of innovation:** In Kenya, the governance of the innovation ecosystem is provided by the STI Act 2013 and implemented by the National Commission for Science Technology and Innovation (NACOSTI) which is responsible for policies related to STI, National Research Fund (NRF), responsible for funding research including innovation, and Kenya National Innovation Agency (KENIA), which is responsible for promotion

of innovators, start-ups and hubs as well as commercialization of R&D outputs. There are additional government agencies such as the Kenya Industrial Property Institute (KIPi) which concerns itself with protection of innovation and branding and the Kenya Bureau of Standards (KEBS) which provides standards for innovation to enhance access to market.

- **Policies and legislations.** The innovation policy framework guides the interaction amongst the key players within the ecosystem. Some of the policies relevant to innovation include the STI policy (2020), STI Act 2013, the Industrial Property Act 2001, which governs protection of innovation including patents, trademarks, and industrial design and the copyright Act 2001, which governs the protection copyright-related innovation such as ICT applications.
- **Innovation financing.** Finance is important to the development of the innovation ecosystem since most of the players – innovators and start-ups, incubators, and accelerators – all require access to affordable finance to develop their innovation related businesses. Government financial programs as well as interventions by the private sector financiers (banks, venture capitalists, Angel investors and Angel investors networks) are all important.



2.2. Relevance of Cities to the Innovation Ecosystem

An analysis of cities revealed Lagos to be the highest-ranking African city, at position 122 globally followed by Nairobi which is ranked position 134 globally. In the region, Nairobi is ranked number 6 behind Tel Aviv, Jerusalem, Dubai, Haifa but ahead of Cape Town and Johannesburg, which are in position 7 and 8, respectively (Table 2.3.)

2.2.2. Global Innovation Hubs Index 2020

Innovation hubs play a significant role to sustain innovation ecosystems by offering several entry points to innovators, actors, and consumers. The Global Innovation Index defines Global Innovation

Hubs to mean cities and metropolitan areas that can lead the flow of global innovation elements and influence the efficiency of allocation of resources while taking advantage of unique advantages that science, technology, and innovation (STI) offers, (Center for Industrial Development and Environmental Governance, Nature Research, 2020). Innovation hubs are global cities that integrate research with innovation, support an innovation economy, and provide a supportive ecosystem for innovation. The Global Innovation Hubs Index (GIHI) 2020 report highlights 30 global cities that have done well in terms of research innovation, innovation economy, and innovation ecosystem (Table 2.4).

Table 2.3:
Top 10 cities in Middle East and African Region.

Rank	City	Country	Global rank	Total score
1	Tel Aviv	Israel	8	27.084
2	Jerusalem	Israel	54	7.776
3	Dubai	United Arabs Emirates	67	6.883
4	Haifa	Israel	119	4.777
5	Lagos	Nigeria	122	4.693
6	Nairobi	Kenya	136	4.277
7	Cape Town	South Africa	145	4.047
8	Johannesburg	South Africa	152	3.864
9	Abu Dhabi	UAR	169	3.188
10	Cairo	Egypt	180	2.732

Table 2.4:
Description of The Three Dimensions of Global Innovation Hubs

Innovation Research: an innovation hub is a centre with extensive research activities and research networks. In the GIHI, the dimension of research innovation examines the scientific and technological resources of its people, research institutions, research infrastructure, and knowledge creation of the city or metropolitan area.
Innovation Economy: a global innovation hub, with vibrant innovation activities, typically has a booming innovation economy. This dimension includes metrics on the region's technological innovation capacity, high-tech enterprises, emerging industries, and economic growth.
Innovation Ecosystem: the development of a global innovation hub benefits from a supportive innovation ecosystem. This dimension focuses on the openness and collaboration networks of a region, its support for start-ups, public service and innovation culture.

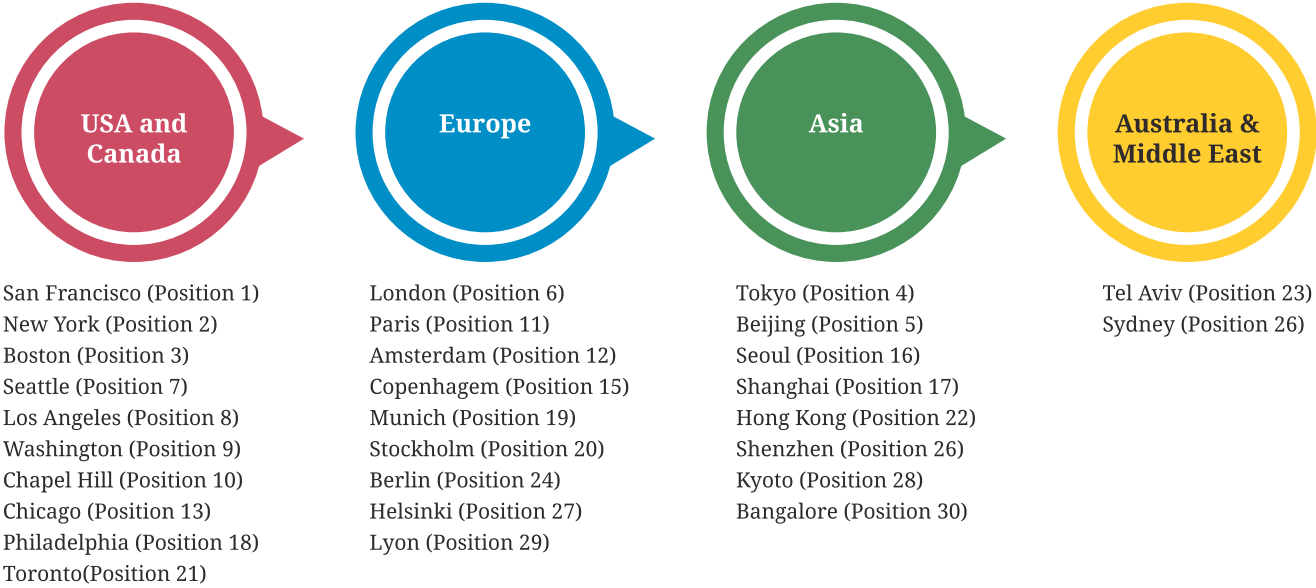


In the GIH Index, USA leads with 9 Global Innovation Hubs, followed by China (4), France, Germany and Japan, 2 each while the remaining ten countries

(UK, Sweden, Finland, India, Canada, Germany, Netherlands, Australia, South Korea and Israel) have one each (Table 2.5).

Table 2.5:
Top 30 global innovation cities.

Ranking of Global Innovation Hubs and Cities



Relevant to the Kenyan Innovation Ecosystem is the third dimension (Innovation Ecosystem) which covers the following four aspects:

- Openness and collaboration:** Openness to technologies, and active science and technology collaboration accelerate the process of knowledge creation and dissemination promoting the accessibility of knowledge and the impact of technology. This is essential for a city to attract global capital and promote the international impact of its economy.
- Support to start-ups:** Support for start-ups is essential for promoting commercialization of innovations. This is measured by the amounts of venture capital (VC) investment and private equity (PE) investment, along with the ease of doing business.

- Public services:** These are the infrastructure and facilities provided by cities to support innovation and entrepreneurship. These includes speed of broadband connection, internet access and number of data centres.
- Innovation culture:** This is measured in terms of talent attraction, entrepreneurial spirit, degree of internationalization of culture-related industries, and the number of public museums and libraries (per million people). Talent attraction reflects people's recognition of a city's culture of innovation. The entrepreneurial spirit is a driving force behind technological innovation and a source of economic growth.



2.2.3. Global Innovation Index Report (GNI) 2021:

The GNI report (2021) considered five input components (institutions, human capital and research, infrastructure, market sophistication, and business sophistication) and two outputs components (knowledge and technology outputs as well as creative outputs) to rank countries (Table 2.6).

GII (Global Innovation Index) 2021, ranks Kenya in position 3 behind South Africa and Mauritius in SSA while in position 85 globally (Table 2.7).

Table 2.6: Pillars in which Kenya performed well

The market sophistication pillar consists of knowledge workers, innovation linkages (which includes university-industry R&D collaboration, state of cluster development and depth, presence of joint venture and strategic alliances and Gross Expenditure on R&D (GERD) financed by abroad) and knowledge absorption, which includes intellectual property payments, high-tech imports, ICT services imports and research talent.
The knowledge and technology output pillar consists of knowledge creation, knowledge impact and knowledge diffusion. Knowledge creation is measured through patent by origin, PCT patents, utility models, scientific articles, and citable documents. The knowledge impact is measured through labor productivity, the business and software spending, ISO 9001 certification and high-tech manufacturing. Knowledge diffusion is measured through IP receipts, production and export complexity, high-tech exports and ICT services export
Infrastructure pillar measures information and communication technologies, general ICT related infrastructure and ecological sustainability
Human Capital and research evaluated basic education, tertiary education and research and development
Business sophistication
Creative outputs measure intangible assets, creative goods and services and online creativity.

Table 2.7: Ranking of Kenya against the global best

Innovation Index Pillar	Position 1 Globally	Position 2 Globally	Position 3 Globally	Kenya's position (85)
Institutions	Singapore	Finland	Norway	80
Human capital and research	Republic of Korea	Sweden	Germany	92
Infrastructure	Norway	Switzerland	Sweden	114
Market sophistication	Canada	United States of America	Hong Kong, China	54
Business sophistication	Sweden	United States of America	Singapore	77
Knowledge and technology outputs	Switzerland	Sweden	United States of America	65
Creative outputs	Hong Kong, China	Switzerland	Luxembourg	95

Kenya performed well in the market sophistication and knowledge and technology outputs with a global ranking of 54 and 65 respectively. However, Kenya seems to be struggling in the infrastructure pillar as well as human capital and research in which Kenya is globally ranked at position 114 and 90, respectively.

2.2.4. The United Nations Conference on Trade and Development (UNCTAD's) 2021 Technology and Innovation report

UNCTAD's 2021 Technology and Innovation report selected the following five building blocks to measure the capacity to use, adopt and adapt frontier technologies (Table 2.9)

Table 2.9: Description of the five technology and innovation building blocks

- ICT deployment** – Using, adopting and adapting frontier technologies requires sufficient ICT infrastructure, especially since AI, IoT, big data and blockchain are internet-based technologies. Two aspects of ICT infrastructure considered are access to and quality of infrastructure that allows for more advanced and efficient use. For these purposes, internet users as a percentage of the population capture the prevalence of internet infrastructure, while the mean download speed measures the quality of internet connection.
- Skills** – Using, adopting, and adapting frontier technologies requires building the capacities of people with relevant skills. These may be advanced but are generally lower than those required to originate the technologies. Two types of skills need to be considered: skills acquired through education, and skills acquired in the workplace through practical training or learning-by-doing. The

overall educational attainment of the population is measured through expected years of schooling, while the skill level in the labor market is measured by the extent of high-skill employment.

- R&D activity** – R&D activity is needed not just to produce frontier technologies, but also for adoption and adaptation, as these technologies often require adjustment or modification for local use. R&D activities are measured using the number of publications and patents filed on the 11 frontier technologies in a country.
- Industry activity** – This looks at ongoing activities in an industry related to the use, adoption and adaptation of frontier technologies. It considers three sectors that are early adopters: manufacturing, finance; and ICT, which tends to interact with other technologies.
- Access to finance** – This assesses the availability of finance to the private sector. Better access to finance could accelerate the use, adoption and adaption of frontier technologies. For this purpose, domestic credit to the private sector as a percentage of GDP was selected as part of the index. This indicator measures resources provided by financial corporations such as finance and leasing companies, money lenders, insurance corporations, pension funds and foreign exchange companies. It also includes various financial instruments including loans, purchases of non-equity securities, and trade credits and other accounts receivable. However, there could also be other, unconventional financing providers or financial instruments that are not covered sufficiently by this indicator



Kenya seems to be struggling in the infrastructure pillar as well as the human capital and research pillar.



Table 2.8:
UNCTAD’s ranking of top 10 SSA countries

Country	Total Score	Ranking					
		Total	ICT	Skills	R&D	Industry	Finance
South Africa	0.55	54	69	84	39	71	13
Mauritius	0.45	77	83	58	94	74	40
Namibia	0.34	91	97	109	101	59	58
Gabon	0.33	94	103	99	133	43	143
Cabo Verde	0.29	101	92	107	153	82	63
Ghana	0.28	103	106	121	81	90	148
Kenya	0.28	105	108	123	78	89	108
Botswana	0.26	111	111	104	109	114	102
Nigeria	0.24	124	124	106	74	155	149
Cameroon	0.16	132	144	118	103	123	140

Table 2.9:
Cisco ranking of top Sub-Saharan African countries

Country	Overall DRI Score	Ranking					
		Basic needs	Ease of doing business	Human Capital	Start-up environment	Technology Adoption	Technology Infrastructure
Mauritius	13.61	3.60	2.81	2.64	0.70	1.13	1.33
Botswana	11.53	2.51	2.61	2.46	0.95	0.96	0.76
South Africa	11.39	2.71	2.62	2.10	0.67	1.18	1.06
Namibia	9.95	2.26	2.60	2.17	0.32	0.76	0.60
Gabon	9.77	2.82	1.48	2.17	0.31	1.01	0.76
Ghana	9.55	2.45	2.32	1.71	0.25	0.86	0.68
Kenya	9.15	2.11	2.32	2.31	0.31	0.48	0.50
Singapore	20.26	3.97	3.69	3.43	1.66	1.96	2.84
Luxemburg	19.54	3.93	3.24	2.89	2.56	2.03	2.48
USA	19.03	3.81	3.41	3.21	1.40	2.22	2.69
Denmark	18.98	3.88	3.76	3.26	0.79	1.70	3.44
China	13.22	3.65	2.98	2.70	0.68	0.97	1.28
Thailand	13.21	3.65	2.87	2.60	0.42	1.24	1.25
Serbia	13.13	3.59	2.39	2.87	0.30	1.19	1.45



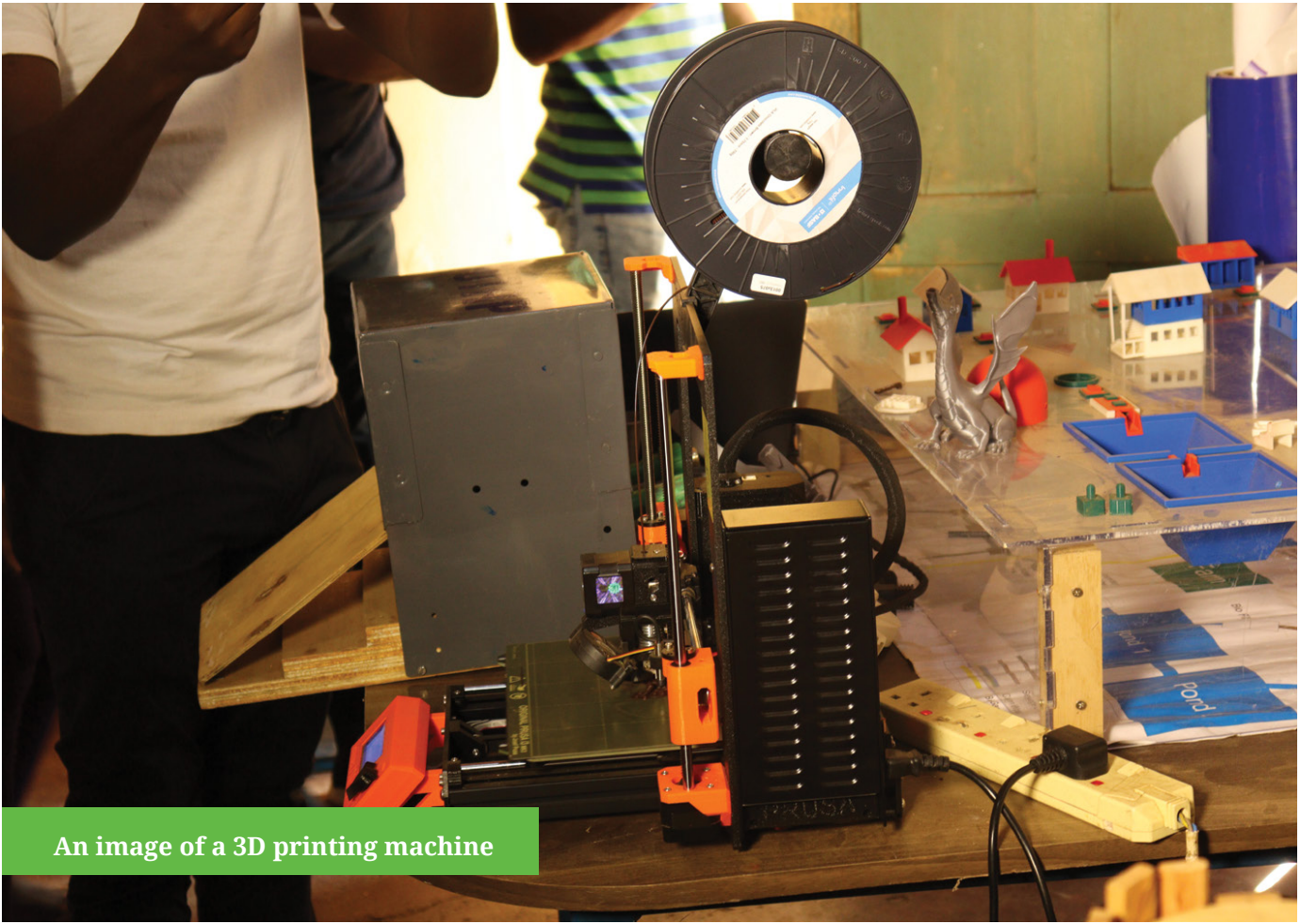
2.2.5. Cisco Digital Readiness Index 2019

The 2019 Cisco Digital Readiness Index was based on seven component frameworks developed by Cisco to help build an understanding of the factors supporting digital readiness and a model to define, measure, and discover the key interventions that can help countries move forward in their digital readiness journey. These are basic needs, human capital, ease of doing business, business and government investments, start-up environment, technology infrastructure and technology adoption. Amongst the top ten African countries, Kenya is number 7 (Table 2.10).

Amongst these seven, Kenya scored lowest in basic needs, start-up environment, technology adoption, and technology infrastructure. The start-up environment was assessed using factors such as its venture capital availability and investment, new business density, and patent and trademark registrations.

2.2.6. Registered Active Innovation Hubs in Africa

While Africa may not have tangible and well-established cities/metropolitan areas designated to be global innovation hubs like the 16 countries as presented in section 2.2.2, some elements of innovation initiatives such as Tech Hubs are evident within the continent. This is important because it speaks to the uniqueness of the African approach to fostering innovation enterprises and start-ups. Out of the quoted 643 hubs estimated to be active in the African continent, 39% are projected to provide a co-working environment where innovation and technological development take place, while 14% are projected to be accelerators and 24% to be innovation hubs and lastly, 41% being incubators (Figure 2.2). The mapping in Figure below indicates that Kenya boasts of a total of fifty (50) Hubs with countries like Egypt (56 Hubs) South Africa (78 Hubs) and Nigeria (90 Hubs) falling within the same ranking with 50+ hubs (Shapshak, 2019).



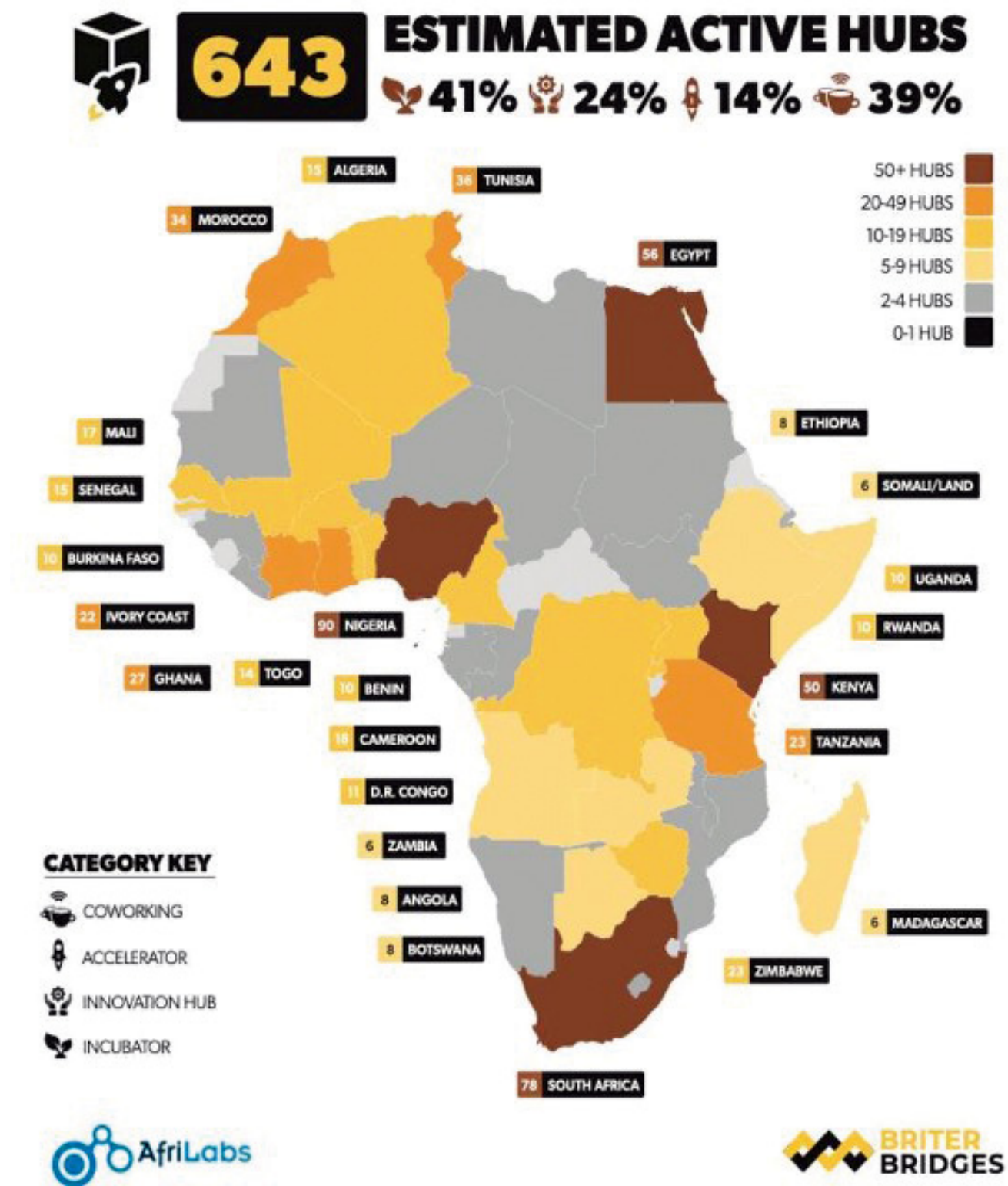


Figure 2.2: Registered Active hubs in Africa: Source: Adapted from (Shapshak, 2019)

2.3. Key Features of the Leading Global Innovation Ecosystems.

2.3.1. Silicon Valley, United States of America

Silicon Valley is in the southern part of the San Francisco Bay Area in Northern California in the United States of America. The region is home to many of the world's largest technology companies including Apple, Google, HP, Intel, and Oracle. The term originally referred to the region's large number of silicon chip innovators and manufacturers, but eventually came to refer to all the high-tech businesses in the area; it is now generally used as a metonym for the American high-tech sector. Despite the development of other high-tech economic centers throughout the United States and the world, Silicon Valley continues to be the leading hub for high-tech innovation and development, accounting for 1/3 of all the venture capital investment in the United States. Since the early twentieth century, Silicon Valley has been home to a vibrant, growing electronics industry. The industry began through experimentation and innovation in the fields of radio, television, and military electronics. Stanford University, its affiliates, and graduates have played a major role in the development of this area. Cisco, Google, Hewlett-Packard, Intel, and Oracle. The term originally referred to the region's considerable number of silicon chip innovators and manufacturers, but eventually came to refer to all the high-tech businesses in the area. It is now generally used as a metonym for the American high-tech sector. Despite the development of other high-tech economic centres throughout the United States of America and the world, Silicon Valley continues to be the leading hub for high-tech innovation and development, accounting for a third of venture capital investment in the United States. Since the early twentieth century, Silicon Valley has been home to a vibrant, growing electronics industry. The industry began through experimentation and innovation in the fields of radio, television, and military electronics. Stanford University, its affiliates, and graduates have played a significant role in the development of this area.

What made Silicon Valley to become the world's leading tech hub?

Talent and Research

During the 1940s and 1950s, Frederick Terman, as Stanford's Dean of Engineering and Provost, encouraged faculty and graduates to start their own companies. He is credited with nurturing Hewlett-Packard, Varian Associates, and other high-tech firms, until what would become Silicon Valley grew around the Stanford campus. Terman is often called "the father of Silicon Valley." During 1955-85, solid state technology research and development at Stanford University followed three waves of industrial innovation made possible by support from private corporations such as Bell Telephone Laboratories, Shockley Semiconductor, Fairchild Semiconductor, and Xerox PARC. In 1969 the Stanford Research Institute operated one of the four original nodes that comprised ARPANET, the predecessor to the Internet.

Destination Location

Silicon Valley is a destination on its own. Starting a tech business in such an environment with an established business infrastructure, talented resource pool, and a flourishing marketplace provides a clear head start compared to other locations. Hosting your business on a cloud service offered by a company next door gives you more confidence to operate the business than partnering with firm hundreds of miles away.

Benefits of Networking and Specialization

The entrepreneurial environment of Silicon Valley is characterized by innovation, collaboration, and risk-taking. It provides the essential motivational framework required for tech startups. Many startups are founded by employees and partners of established tech giants. It is easy to find and connect with experienced and supportive mentors belonging to the same field.



Legal support

Silicon Valley has efficient laws, policies, and regulations to safeguard business interests, trade secrets, and ownership of ideas. These act as a necessary shield for tech businesses, especially the ones that are starting small.

Joint Industry Strength

Industries can come together to mobilise support or lobby the government. Examples of such are, lobbying the government to increase the cap on foreign employees' visas, requesting a dedicated transport facility from a nearby suburb, sharing common service providers for employee benefits and joining hands for a charitable cause are a few of the benefits of co-location. This joint industry strength is an advantage to businesses in the Silicon Valley

Easy Financing Opportunities

Silicon Valley is a high-cost location—it requires a significant amount of capital to establish a company. However, it has also established itself as an epicenter of substantial capital funding for qualified business ideas thus attracting financing opportunities.

2.3.2 Research Triangle Park, United States of America

Research Triangle Park (RTP) is the largest research park in North America and remains one of the most successful science parks across the globe. With 7000 acres stretching across Durham and Wake counties, the park is home to 250+ businesses, ranging from Fortune 100 multinational R&D operations to entrepreneurial-driven start-ups.

The park was founded by a committee comprising of government, university, and business leaders as a model for research, innovation, and economic development.

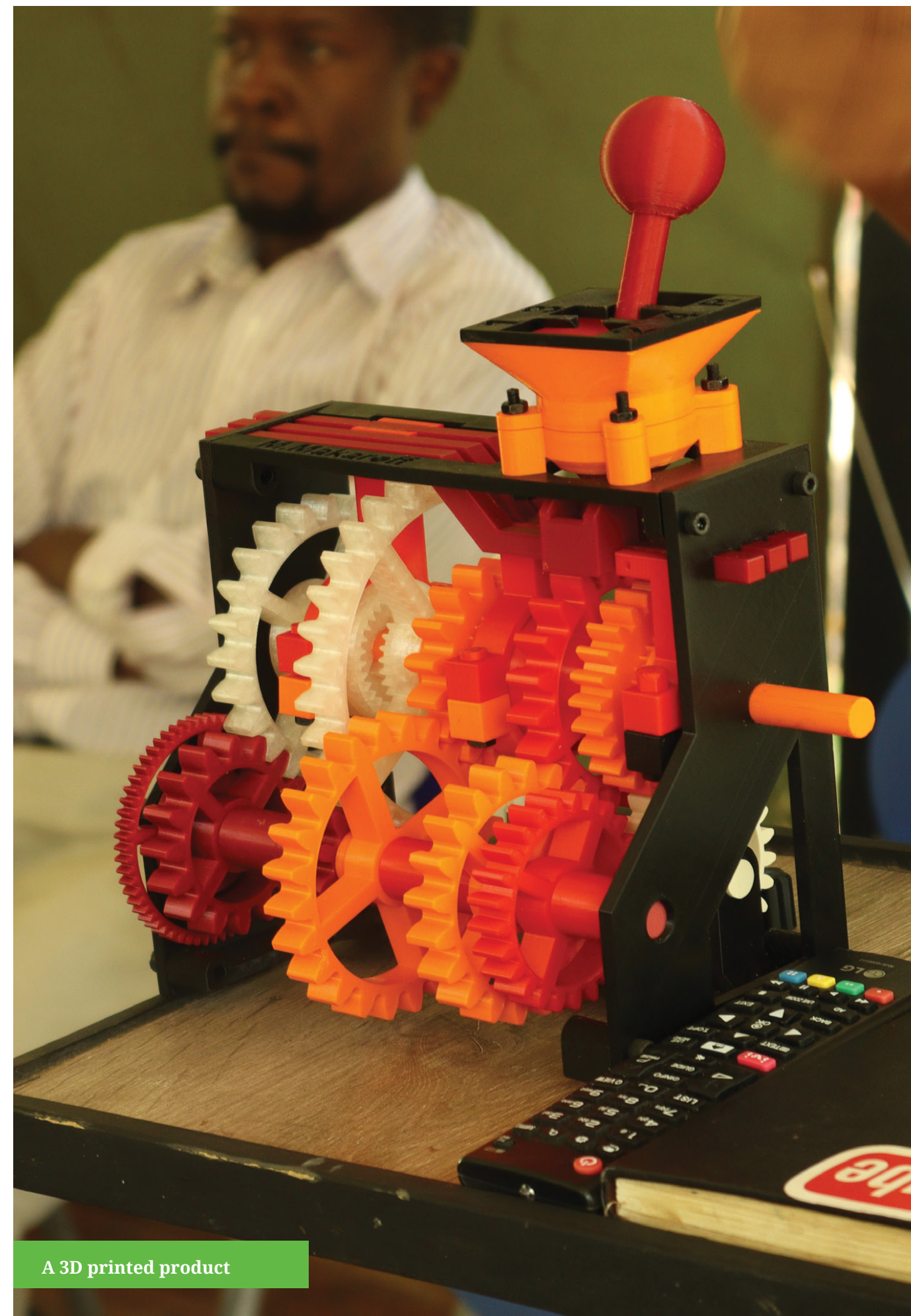
By establishing a place where educators, researchers, and businesses would come together as collaborative partners, the founders of the Park hoped to change the economic composition of the region and state, thereby increasing opportunities for citizens of North Carolina. In addition to the academic and research capacity, the region possesses an established network and infrastructure to support a diverse range of companies. Ranging from the Council of

Entrepreneurial Development to the North Carolina Biotechnology Centre to the RTI International, a host of organizations and networks exist to complement and catalyse activities around several cluster industries. These institutions and companies work together with Park companies and the universities, reflecting a spirit of cooperation and learning within the scientific and technological community. Since it was established, the Park has witnessed a steady and stable increase in the number of companies and employees. Currently, there are 136 research and development facilities in RTP. More than 37,600 people work in RTP with combined annual salaries of over \$2.7 billion. The average salary in the Park is \$56,000 annually, nearly 45 percent larger than the regional and national average .

More than a location and an engine for the economic growth, RTP has been a centre of innovation. It is home to winners of the Nobel and the Pulitzer Prizes, as well as recipients of the U.S. Presidential Award and National Foundation Awards. Equally important are the technical, chemical, and biomedical scientists and patent holders working in the Park whose discoveries have impacted the lives of all citizens in this country and across the world. Some of the most profound discoveries of the 20th century have been influenced by scientists and researchers working in RTP, including the invention of the Universal Product Code, 3D ultrasound technology, and Astroturf. Among the most significant of RTP accomplishments was the discovery of Taxol, hailed by the National Cancer Institute as the most important new anti-cancer drug of the past 15 years, and AZT, a drug used to fight HIV-AIDS.

2.3.3 China

China has put in place policies to accelerate indigenous innovation and large-scale investment in human resources through training professionals overseas, and programmes attracting foreign professionals, scientists, and researchers to work in China (OECD, 2018). The strategy appears to have borne fruits with some cities in China becoming global innovation hubs such as China's capital Beijing, Shanghai, Hong Kong, and Shenzhen. Beijing is home to 90 Universities and 1,000 scientific research institutes. Other important resources that support the growth of a robust innovation ecosystem include the 9,000 tech



A 3D printed product



companies in the Zhongguancun Hub. China's biggest city, Shanghai prides itself as a global financial hub and a potential breeding ground for innovative and creative technology solutions. The same can be said about the Hong Kong Science Park which hosts about 600 Technology companies where an approximate of 13,000 tech talents are cultivated. China is projected to have high levels of R&D investment, educational reforms that promote a skilled workforce, and a comprehensive innovation framework (Information Technology and Innovation Foundation, 2019). The Chinese innovation ecosystem is defined by six key sectors namely, Central Government, Granting Council, Higher Education, Private Sector, Global Market, Provincial/Municipal institutions working collaboratively towards achieving economic results, social results, and environmental results .

2.3.4. India

Knowledge economy, fundamental research that is driven by the marketplace, and disruptive technologies like machine learning and artificial intelligence are the key drivers of the Indian innovation ecosystem (The Economic Times, 2021). The structure and depth of the Indian ecosystem shows that the start-up environment has strong government support which has contributed immensely towards the robust innovation ecosystem that India boasts of (The Business France, 2020). The start-up ecosystem in India enjoys vast support from venture capitalists and private equity investors who have reportedly played a critical role in fuelling the innovation ecosystem's growth (The Business France, 2020). In addition to access to funding, local talent, infrastructure, industries, and local government support that the start-up initiatives enjoy, the cost arbitrage has not only promoted the growth of start-upstart-ups in the established hubs like Bangalore, Mumbai, Delhi-NCR, Hyderabad, Pune and Chennai but also in smaller cities and towns cities. The innovation ecosystem in India is enabled by a wide range of stakeholder matrices and an array of innovation hubs.

The innovation ecosystem boasts of 9,300 start-ups, 100 unicorns , 330 incubators and accelerators in the country and an estimated 1,000 co-working spaces. Total funding received by start-ups in 2019 was USD 4.4 billion. India's academic institutions such as the Indian Institute of Technology (IIT) is reported as

the 4th largest producer of unicorn start-ups in the world after Stanford University, Harvard University and the University of California (The Business France, 2020), with most of the IIT and IIMs having their Entrepreneurship cells (E-cells) where they provide incubation services and support for entrepreneurs.

Bangalore is an innovation hub often referred to as the Indian version of Silicon Valley and features several engineering colleges and renowned academic institutes that have helped multinational companies set up their R&D centers there, (The Business France, 2020). Other cities such as New Delhi and Mumbai that focus on FinTech follow with 21% and 13% of Indian start-ups respectively. Pune is credited with the animation and virtual reality industry while Hyderabad is associated with the Internet of Things and Artificial Intelligence industry and Chennai is associated with FinTech, Internet of Things and AgriTech.

The underlying culture of frugal innovation also provides a strong foundation for a robust innovation ecosystem which can be seen with other countries like Japan leveraging on cultural emphasis on efficiency and teamwork in its manufacturing and engineering industries revolutions and Korea's leveraging on its emphasis on speed culture to build world-class companies (Deloitte, 2014).

2.3.5. South Korea

In South Korea, cities such as Seoul, Pangyo, and Daejeon are known for technology development with Seoul appearing as a global innovation hub according to the Global Innovation Hub report (Center for Industrial Development and Environmental Governance, Nature Research, 2020). The Pangyo Tech Valley can be seen to have created an innovation ecosystem with the ability to compete in the global innovation space. Driven by robust investment in R&D portfolio, South Korea exhibits heavy research and development commitment with cities like Pangyo and Daejeon considered as Asia's largest R & D clusters which has led to their current technological advancement and innovation. As one of the tech-hubs leaders in South Korea, Daejeon, has earned the name of "Asia's Silicon Valley" or "The Hightech Technopolis" and has a world-renowned reputation as a city of science and technology.



2.4. A Brief Historical Perspective of the Kenyan Innovation Ecosystem

The development of the Kenyan Innovation Ecosystem has been driven by efforts to realise industrialization in Kenya. These include the initial industrialization efforts, import substitution strategy, structural adjustment programs, sessional paper No 2 of 1996 on industrial transformation, export-oriented industrialization, Vision 2030, the Science Technology, and Innovation Act (2013) and the current digital transformation agenda. These are briefly discussed here below with emphasis on the contribution of each effort to industrialization.

2.4.1. Initial industrialization efforts (1941-1945)

Structured industrial innovation in Kenya dates to the colonial period specifically in 1942 when colonial government set up a Central Laboratory at Kabete, Nairobi for the purposes of developing industries to relieve the industrial goods shortages occasioned by the Second World War. The laboratory was administered by the Kenya Industrial Management Board (KIMBO). One of the first products of the laboratory, was a cooking oil (KIMBO) which took the name of the Board. As the laboratory expanded, it was renamed the East African Industrial Research Organization (EAIRO) and become part of the East African Community after independence to spearheaded innovation development to produce products that were required in the region. It however, ceased its operations in 1977, following the collapse of the then East African Community and in 1979 an act of Parliament established the National Council of Science and Technology (NCST) . The Act led to the establishment of six research institutions including the Kenya Industrial Research and Development Institute and the Kenya Agricultural Research Institute, that were key in promoting innovation development and deployment in agriculture and industry sectors.

Over 1,300 research institutes, universities, and high-tech companies are in several specialized zones named 'Daedeok Innopolis' within the city. Fifteen percent of all of Korea's national R&D investment is spent in this Daedeok Innopolis.

2.3.6. United Kingdom

United Kingdom's post-Brexit discourse on innovation has brought with it a lot of thinking behind accelerating innovation in the post-Brexit era. The era has made the United Kingdom develop a strategy that is pegged on four pillars namely,

- **Pillar 1:** Unleashing business – fuelling businesses who want to innovate
- **Pillar 2:** People - Making the UK the most exciting place for innovation talent
- **Pillar 3:** Institutions and places - Ensuring research, development and innovation institutions serve the needs of businesses and places across the UK
- **Pillar 4:** Missions and technologies – Stimulating innovation to tackle major challenges faced by the UK and the world and drive capability in key technologies.

Research and development expenditure in the United Kingdom also shows a substantive part of the national budget going towards research and development. The city of London, which is considered as one of the global innovation hubs according to the Global Innovation Index, has experienced high rates tech investment in recent years. The UK capital's tech start-ups received USD13.3 billion in the first seven months of 2021 (January to July 2021), which is more than the USD10.9 billion raised in the whole of 2020. This was boosted by major funding rounds in 2021 namely, Revolut (USD 800 million), Checkout.com (USD 450 million) and Hopin (USD400 million). According to the Global Start-up Ecosystem Report (2021), start-ups in London have access to more seed capital (with an average of USD 653,000) than the global average of USD 494,000. London is also home to over 1,370 VC firms - more than any other European city, providing access to a vast network of investors and a depth of capital in the ecosystem .



2.4.2. Import Substitution Strategy (1945-1980)

The import-substitution industrialization strategy, pursued in the first two decades of independence, was largely a continuation of the industrial strategy pursued by the colonial administration. The manufacturing sector grew at an average rate of 8% and was second only to agriculture in terms of employment creation during this period. Manufacturing output grew faster than not only the rest of the Kenyan economy but also other industrial sectors in Sub-Saharan Africa. Industries that recorded rapid development during this period included plastics, pharmaceuticals, steel rolling and galvanizing, electrical cables, paper, vehicle assembly, industrial gases, rubber, ceramics and batteries. Light industries accounted for the lion's share of gross industrial production followed by intermediate industries. Some industries expanded from a few establishments into industries with a wide range of products and a large number of employees. These included paper, textiles and garment manufacturing, food processing, leather tanning and footwear. The import substitution strategy was successful in establishing industries in textiles and garments, food, beverages and tobacco—industries that are still industries today. Relevant to the promotion of the Kenyan innovation ecosystem at this time were the following efforts:

- a. **Establishment of the Kenya Industrial Estate (1967)** The launch of the Kenya Industrial Estates programme in 1967 for the purpose of supporting small local entrepreneurs to increase their capacity to participate in manufacturing. KIE became the first government incubator to support start-ups. The new government also promoted local industrial production by attempting to reduce the cost of borrowing and therefore spur private sector growth.
- b. **The Industrial Development Bank** was also established in 1973 with the mandate of promoting joint ventures between domestic and foreign capital around import substitution activities. In early 70s, the government began to recognize the need to harness indigenous entrepreneurship through the Industrial and Commercial Development Corporation (ICDC) which was tasked to promote the participation of indigenous

Kenyans in industrial and commercial activities. These two institutions became the source of financing for new businesses most of which were in the technology-oriented enterprises.

Of importance to manufacturing in this period was the emergence of the informal sector, supported by official recognition and pro-informal sector policies. The manufacturing outcomes of such policies were, however, eroded by selective implementation that made provision for the exploitation of linkages between the informal sector and other sectors. The government continued to subsidize and guarantee industrial expansion through foreign capital in ways that made it possible for African industrialists to penetrate large-scale manufacturing (Kinyanjui 2013).

The import strategy helped to promote the innovation ecosystem by enabling the development of new products locally.

2.4.3. Structural Adjustment Programmes and Liberation (1980-1999)

During the 1980s, the Government introduced structural adjustment programmes (SAP) to, inter alia, strengthen competitiveness and reduce excess capacity in the industrial sector to address concerns raised about distortions caused by the ISS strategy. A major restructuring of policies and the institutional framework was also initiated through the publication of a sessional paper on Economic Management for Renewed Growth (Republic of Kenya 1986). The government also undertook to completely remove restrictive import licensing and tariffs. In 1993, import licensing schedules were abolished and capital and current transactions were fully liberalized in 1994 with the removal of all price controls. SAP have been attributed for the collapse of several technology-oriented enterprises and by extension negatively impacted on the innovation development.

2.4.4. Session Paper No. 2 of 1996 on Industrial Transformation of Kenya

For the first time in Kenya, sessional Paper No. 2 of 1996, identified industrialization as a key avenue to achieve the transformation of the Kenyan economy to a newly industrialized country. The paper was unique in the sense that 1) industry was for the first time taken to be the leading sector in economic development and 2) specific industries were for the first time earmarked for government support. The strategy was to be implemented in two phases: In the first phase, the government would selectively encourage labour-intensive, resource-based, and light manufacturing industries, where the country enjoys comparative advantage. To be targeted in this phase would be primarily small-scale industries that use locally available raw materials and simple labour-intensive technologies and therefore capable of generating employment. Examples are agro-based industries like textiles; horticultural processing; skins, hides and leather; tea, coffee and sugar processing; and building and construction, such as brick manufacturing. The focus of the strategy on small-scale enterprises and the use of locally available materials revamped interest in innovation. The Kenya Industrial Property Institute, and the Kenya Copyright Board, were amongst the institutions established in this period to promote innovation and creativity.

2.4.5. Vision 2030

The Kenya Vision 2030 provides the collective aspiration for the country to become industrialized by 2030. The Vision identifies Science, Technology, and Innovation as a key foundation on which the social, political, and economic pillars of national development are anchored. Amongst the achievement of its first Medium Term Plan is the enactment of the STI ACT (2013), that created the following institutions that are currently driving the Kenyan Innovation Ecosystem:

- a. The National Commission for Science, Technology, and Innovation (NACOSTI), which is responsible for, amongst other, STI policy as well as setting up research priorities. It was established in 1979 as a council for science and technology and re-established in 2014.

- b. The National Research Fund (NRF), which is responsible for funding research and development. It was established for the first time in 2014.
- c. The Kenya National Innovation Agency (KeNIA), which is responsible for the promotion of innovation and innovation enterprises in Kenya. It was also established in 2014.
- d. Konza Technopolis was established as a key flagship project under the Ministry of ICT and Youth Affairs to propel Kenya into a middle level industrialising economy leveraging technology and innovation. The project was approved by the Government of Kenya in 2008.

In line with the implementation of Vision 2030, the STI sector in MTP II (2013-2017) had an overarching theme on STI. The theme laid emphasis on policies that support the establishment of regional systems of innovation through analysis of gaps and opportunities which promote first order learning. The plan further intensified the coordination of STI.



The combination of Kenya's digital payments platform and its identification system opens the way to leverage digital technology in many ways to better provide a range of services, and opportunities to beneficiaries of public programs...





Construction at the Konza Technopolis Development Authority (KoTDA)

2.4.6. Konza Technopolis Development Authority (KoTDA)

Konza Technopolis (KT) is a key flagship project of Kenya's Vision 2030 economic development pillar whose establishment is envisioned to create a world class smart city and area of innovation. Konza Technopolis Development Authority (KoTDA) is the implementing agency under the Ministry of Information, Communications and Technology (MoICT). Konza has an important role in Science, Technology, and Innovation (ST&I) to enhance utilization of the contemporary scientific revolution in improving production and productivity in all sectors. In 2012, the then Ministry of Information, Communications and Technology initiated the process of establishing Konza Technopolis by retained a team of consultants to prepare a detailed business plan and master plan for Phase 1. The team held extensive interviews with stakeholders, business leaders, potential investors, and led 5 workshops with government officials over nearly a year to develop a comprehensive plan for Konza .

The Government, through the Ministry of ICT, Innovation and Youth Affairs set aside funds to put up a wastewater plant and various design guidelines for roads, security access, and set up KoTDA offices to the tune of an estimated KES. 52.2 billion while another KES 43.2 billion meant to finance ICT Network, electricity distribution and water distribution would be sourced from the private sector through Public Private Partnership. In addition, the government provided land, clean water, and high voltage power connection to the city as incentives to attract investors and demonstrate commitment to the development of Konza Technopolis. An estimated at Kes. 600 billion was invested in Phase 1, by both government and private sector out of which the government provided about 10% in the development of core infrastructure to facilitate investment by the private sector.

2.4.7. Ministry of ICT, Innovation and Youth Affairs

The Ministry of ICT Innovation and Youth Affairs has also set up constituency innovation hubs and the Ajira program to provide ICT training to innovators. These initiatives are meant to support entrepreneurs have access to free Wi-Fi in all the 290 constituencies countrywide. This has enhanced awareness and uptake of on-line platforms for employment and business opportunities.

2.4.8. Digital Transformation

The digital economy is propelling Kenya's economic growth, driven by mobile telephony, rising internet usage and uptake of e-commerce and digital services. The story of tech entrepreneurship in Kenya is often linked to the development of MPESA, a mobile money service launched in 2007. The combination of Kenya's digital payments platform and its identification system opens the way to leverage digital technology in many ways to better provide a range of services, and opportunities to beneficiaries of public programs, business, and taxpayers and investors. The creation of iHub in 2010 (one of Nairobi's first tech hubs and co-working spaces) paved the way for other tech hubs, such as Nailab, Nairobi Garage, and SwahiliBox in Nairobi and beyond.

This has in turn spurred the growth of start-ups and accelerators, with nearly 40 start-up incubators and accelerators currently in operation in greater Nairobi, each with more than 30 start-ups. Kenyan start-ups such as CarePay, Twiga Foods, Tulaa, FarmDrive, Apollo Agriculture, and others have demonstrated how digitally anchored businesses can provide scalable revenue and job creation opportunities while maintaining sustainable growth in the digital ecosystem.

In 2012, the then Ministry of Information, Communications and Technology initiated the process of establishing Konza Technopolis by retained a team of consultants to prepare a detailed business plan and master plan for Phase 1.



2.5. Key Drivers of the Kenyan Innovation Ecosystem

2.5.1. Coordination and Governance

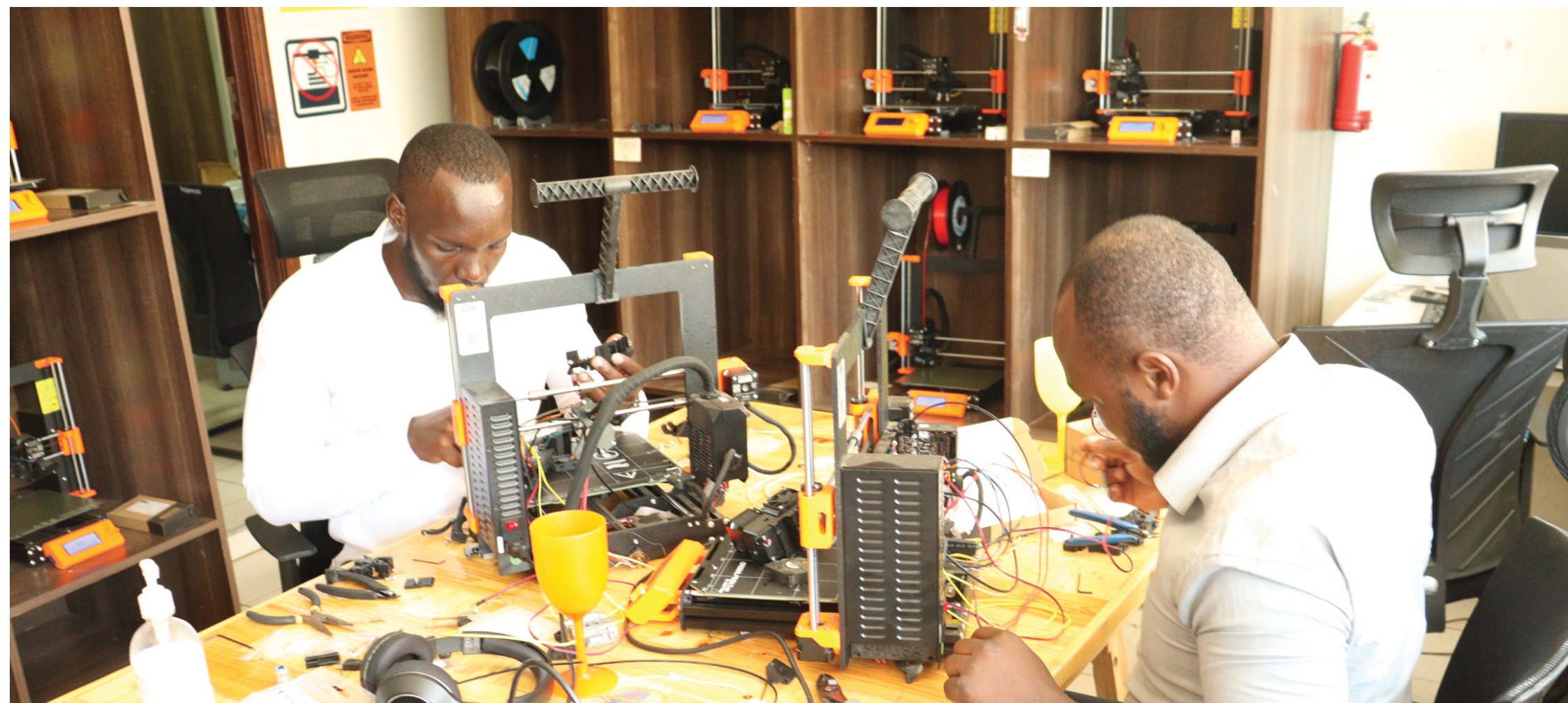
The coordination and governance of the Kenya innovation ecosystem is currently domiciled in three ministries: The Ministry of Information, Communication and Technology (ICT) Innovation, Youth Affairs, the Ministry of Education, Science and Technology, and the Ministry of Trade, Industrialization and Enterprise Development

The Ministry of Education (MoE) which is responsible for STI has improved coordination of government efforts in the sector. The State Department for University Education and Research oversees departments, parastatals, and agencies with mandates in university education, R&D, NACOSTI, NRF, and KeNIA that report to the state department through the Directorate of Research, Science and Technology (DRST). All universities report to the state department through the Directorate of University Education (DUE). The MoE supports strengthening of the link between academia and the industry through the establishment of research infrastructure with private sector involvement and facilitating the establishment of intermediaries to enable the translation of research findings.

Under MTP III, the ministry is keen on the establishment of science parks and incubators in selected public universities. In the 2018/2019 fiscal year, Dedan Kimathi University of Science and Technology was supported to establish a science park. In the previous years, the government with support from the private sector, facilitated the University of Nairobi and Kenyatta University to establish Fablabs and Chandaria Innovation Centre respectively. To strengthen STI governance and coordination within the academia, the University Act of 2014 and the TVET Act of 2014 were enacted and implemented. The University Education Act of 2014 has led to the establishment of positions of Deputy Vice-chancellor in charge of research and innovation. This has given impetus to the development of university-based incubators and improved focus on entrepreneurship.

On the other hand, since 2008, the Ministry of ICT, Innovation and Youth Affairs has been driving the establishment of Konza City as a flagship project of Vision 2030. In collaboration with other partners, the Ministry of ICT and Youth Affairs is spearheading the establishment of Constituency Innovation Hubs and establishment of Ajira centres. The key programmes and projects implemented in the ICT sector include expansion of the national optic fibre infrastructure, enhancement of digital Government and e-Government services, boosting cyber security and establishment of the requisite policy, legal, regulatory and institutional frameworks.

The role of the Ministry of Trade, Industrialization and Enterprise Development is discussed in section 2.4 above.



2.5.2. Vision and Strategy

A country's development goals, objectives and priorities for innovation is critical in strengthening its innovation ecosystem. This is in recognition of the fact that they provide direction that shapes the innovation ecosystem. Kenya's vision and various strategies provide a strong ground for the growth of the innovation ecosystem. For example:

1. Vision 2030: Vision 2030 recognizes the role of STI to economic development and has identified STI as one of the foundations of the vision. The economic pillar of vision 2030 has also prioritized Konza Technopolis as one of the flagship projects to drive innovation towards Kenya becoming an industrialising middle-income knowledge-based economy.

2. Science Technology and Innovation Act (2013): Kenya is amongst the few countries in Africa that has created a dedicated Agency, through the STI Act 2013, mandated to develop and manage the Kenya national innovation system. The Kenya National Innovation Agency – is now in place, with critical staff appointed in 2020. This provides opportunities to strengthen the Kenyan Innovation Ecosystem.

3. The Start-up bill (2021): Kenya is the third African country (after Tunisia and Senegal) to have in place a legislation on start-ups. The bill provides a framework to encourage growth and sustainable technological development and entrepreneurship, to create a more favourable environment for innovation and to attract Kenyan talents and capital. The bill has addressed some of the challenges facing innovators and hubs including (a) defining the role of the national





and county government on development, transfer and commercialization of innovation at both levels of the government, (b) the role of the Kenya Innovation Agency and the County Executive Committees (CECs) for trade and industry promoting the innovation ecosystem in Kenya, (c) registration of start-ups at national and county level, (d) certification of incubators and accelerators; and (e) incentives for start-ups.

4. Digital Economy Strategy (2021): The Digital Economy Strategy (2021) for Kenya is a culmination of collaborative work of multiple stakeholders under the leadership of the National Communications Secretariat (NCS) and Ministry of Information, Communications, Technology, Innovation and Youth Affairs (MoICT). The strategy puts emphasis on the innovation/knowledge driven economy. The strategy is anchored in five pillars – digital government, digital business, infrastructure, innovation driven entrepreneurship and digital skills and values. Whereas all the five pillars are important for strengthening the innovation ecosystem, pillar four on innovation driven entrepreneurship speaks directly to the needs of innovators and the innovation ecosystem since the pillar aims to see the presence of an ecosystem that supports homegrown world class products and services which help to widen and deepen digital economic transformation.

Amongst the objectives of the pillar are to increase the number of innovations that progress to market locally and regionally; and develop a vibrant and sustainable support system for innovation through industry and academic research collaboration as well as access to funding.

5. Visions and strategies of universities and research organizations: Universities and public research institutes include in their vision and mission statements aspects of innovation, entrepreneurship, community outreach, extension, enterprise. Hence an indication these universities are in support of innovation and entrepreneurship agenda. For example, Jomo Kenyatta University of Agriculture and Technology (JKUAT) envisions a university of global excellence in training, research, innovation and entrepreneurship for development, while the University of Nairobi has a research, innovation and enterprise division which envisions excellence in research, innovation and enterprise.

6. Global and Continental Frameworks: Other key international frameworks include the United Nations (UN) 2030 Agenda for Sustainable Development Goals (SDGs), Africa's Agenda 2063, the Big 4 initiatives focusing on 100% Food and Nutrition Security, Manufacturing, Affordable Housing and Universal Health Coverage; the Third Medium Term Plan (MTP III), Digital Economy blueprint among other global and local strategic policy documents.

2.5.3. Talents and Skills

Strengthening of skills and talents is one of the areas that Kenya will require to invest in more to strengthen the Kenya national innovation ecosystem. This is evidenced through the following facts:

- The review of the global innovation trend through analysis of the various innovation measurement frameworks has shown that skills and talents is one of the components that Kenya has scored lowest across the six frameworks reviewed. Investment in skills and talent will enhance Kenyan innovation performance in future ranking.
- Preliminary feedback from key players in the Kenyan innovation ecosystem interviewed during the phase one field data collection, have identified and managers of innovation hubs during the Kisumu impact workshop, showed that skills and talent cultivation is amongst the main challenges that will need to be addressed to enhance the performance and growth of the ecosystem.

- A recent white paper prepared by ACTS for Huawei and UNESCO on Talent Cultivation for the digital economy, indicated that there are gaps between existing ICT knowledge and skills and the project demand by the industry. By 2030, 50-55% jobs in Kenya will depend on digital skills, with agriculture accounting for 35-40%, ICT industry 45-50% and services 60-65%. On the skills and talent supply side, the paper identified the following challenges, which are also relevant to strengthening innovation ecosystem: Inadequate number of ICT graduates at intermediate and advance ICT skills level, low level of eLearning, lack of market driven curricula, limited opportunity for industrial attachment, internship and mentorship, weak academia-industry collaboration, and limited incentives for private sector participation in talent development.
- The government also developed a harmonized ICT curriculum in preparedness for the Jubilee Laptop project launch. This curriculum was developed out of a felt need to equip learners with modern ICT skills which is in line with one of the flagship projects in Kenya vision 2030. The Government recognizes that an ICT literate workforce is the foundation on which Kenya can acquire the status of a knowledge economy by 2030.

2.5.4. Infrastructure

All the innovation measuring frameworks have included infrastructure as a key driver of innovation and a requirement for strengthening the innovation ecosystem. Preliminary desk review has shown that there are opportunities to take advantage of and challenges to address when considering improving the innovation ecosystem in Kenya.

1. Access to broadband: Through the MTP III, great strides have been made in the development of infrastructure. For example, some 6000 kilometres of the National Fibre Optic Backbone Infrastructure (NOFBI) have been installed across all the 47 counties. This has provided a robust infrastructure to citizens, eased communication across counties as well as improved government service delivery to the citizens. However, the rural areas are seriously lacking coverage with about 50% of the locations not having 3G coverage.

Furthermore, 83% of the landmass lacks broadband services; and the quality of broadband services manifests in low-speed connections and poor reliability (The Republic of Kenya, 2018) .

2. Access to electricity: Access to electricity, which is an important component for innovation and development of start-ups, was at 70% in 2019, behind China, Ghana, Morocco, Singapore, and South Africa. Rural access to electricity stands at 62% with urban access at 91%. Morocco, Singapore, and China are amongst the benchmark countries with almost 100% rural access to electricity.

3. Ajira Digital: The project aims at bridging the gap between skills demand and lack of jobs and further seeks to gather lessons to inform the project scale up. The Ajira Digital Project seeks to position Kenya as a choice labor destination for multinational companies as well as encourage local companies and the public sector to create digital work. The overall objective of the project is to make Kenya a freelance hub and the global destination for online work by the year 2022. The project aims to raise the profile of online work amongst all Kenyans; promote a mentorship and collaborative learning approach to finding online work; enable access to online work for all Kenyans; and promote Kenya as a destination for online workers.

4. Constituency Innovation Hubs: The government has also established close to 200 innovation hubs across the country. This is after the Ministry of ICT, Innovation and Youth Affairs in collaboration with the National Government Constituency Development Fund Board conceptualised and rolled out the Constituency Innovation Hubs Project. The hubs provide an environment where tech communities, entrepreneurs, start-ups, and creative minds can explore their talents and skills in coming up with solutions. They also provide platforms where innovators can easily network with investors for funding.





5. Konza National Data Center: This project is being implemented by the Ministry of ICT, Innovation and Youth Affairs through Konza Technopolis Development Authority (KoTDA). It is a key enabler towards Kenya's digital economy and is modelled to support data, voice, video, services, systems and applications. The Data Centre serves both government and enterprises with high-quality world-class cloud computing services. It provides various cloud services like Infrastructure as a Service (IaaS), Software as a Service (SaaS), and Platform as a Service (PaaS).

2.6. Indicators of Growth of the Kenyan Innovation Ecosystem

This study has used the following indicators to demonstrate the growth of the Kenyan innovation ecosystem – Labour market, market environment, hubs, activeness of the ecosystem, ICT, capital and resources, policy and regulation, university-industry linkages, economic performance, as well as technology diffusion and adoption systems.

- 1. Labour Market:** Nairobi is ranked second in the Middle East and Africa Start-up Friendliness Index with a score of 91.73.
- 2. Market Environment:** After Lagos, Nigeria, Nairobi, Kenya is recognized as Africa's second-best start-up ecosystem. Application development, Business to Business (B2B) solutions, software development; ICT solutions in the Financial, Health, Agriculture, and Education sectors, ICT Training, and community problem solving; and Hardware are all areas where the digital innovation ecosystem offers market prospects.
- 3. Hubs:** Nairobi is ranked as the 136th worldwide, 6th in the Middle East and Africa region, and second in Africa . It is currently ranked sixth and eighth in the world in terms of the number of accelerators and incubators per capita. The number of inexpensive and available Co-Working Spaces is also increasing, giving the city a slightly better score, placing it fifth. The government is promoting the ecosystem's development in cooperation with the World Bank with the "Kenya

Industry and Entrepreneurship Project," which aims to impact 162 start-ups participating in an International Accelerator Programme.

- 4. Activeness:** The activity subdomain includes indicators for events, the number of start-ups and whether there are high-equity situations. Nairobi receives a score of 60.13 on these factors, placing it at the top of the Middle East and Africa SFI. Nairobi presently has over 650 start-ups, far more than the regional average of around 100, putting the city foremost in this category.
- 5. Internet Access and Infrastructure:** The ICT sub-sector in Kenya is expanding very fast. This is because of the dynamism of telecoms, the acceptance of e-commerce, and the widespread use of the internet. However, internet costs are higher than twice the regional average and internet penetration in Kenya is 42% . Hard infrastructure has seen tremendous growth in Kenya, particularly with respect to mobile phone penetration and broadband connectivity including 4G, with 5G testing already ongoing with Mobile Network Operators (MNO). Kenya is considered a mobile first country, with mobile penetration level at 90%, the country has witnessed significant increases in international Internet bandwidth, mobile cellular subscriptions, and active mobile broadband subscriptions.
- 6. Policy and Regulation:** Many regulatory and policy changes under the Kenya Vision 2030 have led to the growth of the economy and the development of the ICT ecosystem. These include the STI Act (2013), the STI policy (2020), the digital economy strategy (2021) and the start-up bill (2021).
- 7. Technology Diffusion and Adoption Systems:** In 2006, the government of Kenya launched an e-governance system, which is an integrated system that helps all government agencies with all elements of their operations. All government entities, for example, are required to utilize IFMIS (Integrated Financial Management and Information System) a software for integrated financial management.

2.7. Disparity in the Distribution of Benefits in The Growth of Innovation Ecosystem

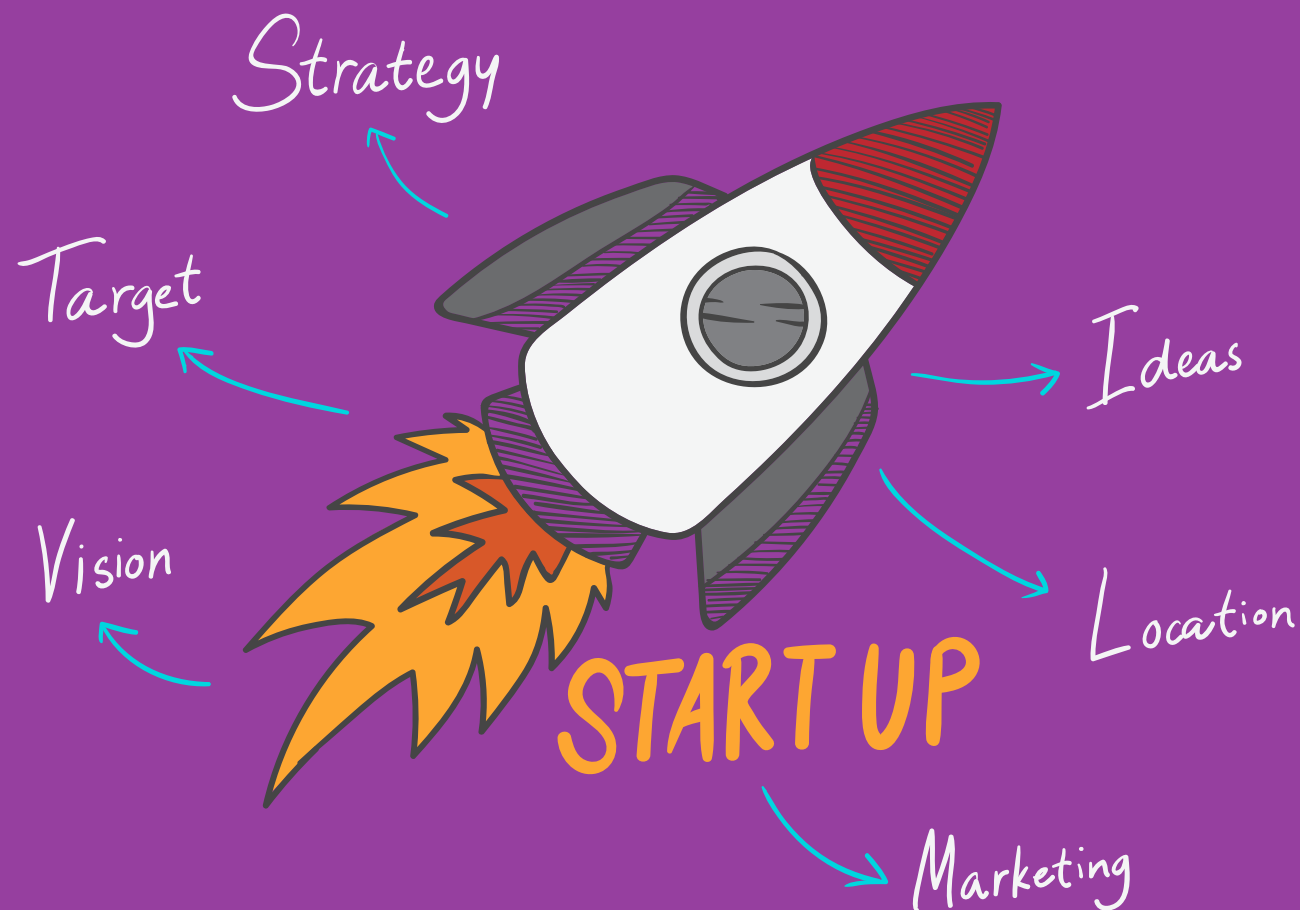
Despite this growth in the Kenyan innovation ecosystem, the benefits are not uniformly distributed, with the bulk of innovators and innovation hubs found in Nairobi and other urban areas. This is due to the following reasons:

- 1. Limited access to internet:** The deployment of digital technology in Kenya's rural areas is hampered by a variety of distinct development problems. According to the World Bank's Kenya Economic Update, while 44% of the urban population has access to the internet, just 17% of individuals in rural regions have. As a result, at the present, more individuals are working on technologies that are more suited to urban environments.
- 2. Limited infrastructure:** People in rural locations have less access to innovation hubs, learning institutions, Internet services, mobile networks, and grid electricity than city dwellers. Deficits in services are a result of critical absences. In addition, access to computers and laptops is lower in rural than urban areas.

- 3. Limited digital skills:** Basic reading and numeracy, as well as specialized technical knowledge and abilities, are required to use digital technology. People who lack these skills may find themselves marginalized in increasingly digitized societies.
- 4. Higher level of poverty:** While poverty is a big issue throughout Kenya, rural communities bear a disproportionate amount of the burden. Because residents in rural locations do not have as much discretionary cash as those in urban areas, demand for many services is lower. Even if the overall population is considerable, lower population density makes economics more difficult. Many digital services may be outweighed by competing demands in low-income settings. Any digital product that charges customers for a service should be able to meet fundamental, urgent requirements.

Understanding these difficulties, on the other hand, may motivate more product creators to focus on rural markets.





CHAPTER THREE

Characteristics of Innovators and Start-ups

3.1. Introduction

This chapter presents the results of field data collection from innovators and start-ups. It covers a deeper understanding of the characteristics of the start-ups, their business status and capabilities, target market for their innovations and their successes in accessing funding for commercialization of their innovations. In addition, this chapter also highlights challenges the start-ups face and existing opportunities they can tap into.

3.1.1. Innovators and Start-ups Mapped and Interviewed

The Global Start-up Ecosystem Index 2021 defines a start-up as any business that applies an innovative/technology solution that validates a scalable economic model. The Kenya Start-up Bill 2021 defines a start-up as an innovative entity, legally recognized by the laws of Kenya, with strong growth potential, and a disruptive economic model. Start-ups distinguish themselves from large businesses primarily in terms of their size. They are more flexible and innovative and characterized by flat organizational structure and small founding teams. Start-ups can quickly react to market and technology changes under remarkably uncertain conditions. Start-up businesses often start with limited financial investment and the initial capital is raised either by an individual or by the founders of that start-up. In the initial phases the overheads supersede revenue as start-up start-ups develop, test and market the idea. The study mapped 232 start-ups in the country (Figure 3.1 shows the distribution of the innovators per county). Out of these, 118 innovators were interviewed.

3.2. General Characteristics of Innovators/Start-ups

3.2.1. Age, Levels of Education and Gender of the Innovators

About 50% of the innovators were less than 35 years of age, while those within 36-45-year age bracket accounted for 34%. Those above 45 years old were only 16% (Figure 3.2). On the other hand, 81% of the innovators had at least a diploma certificate

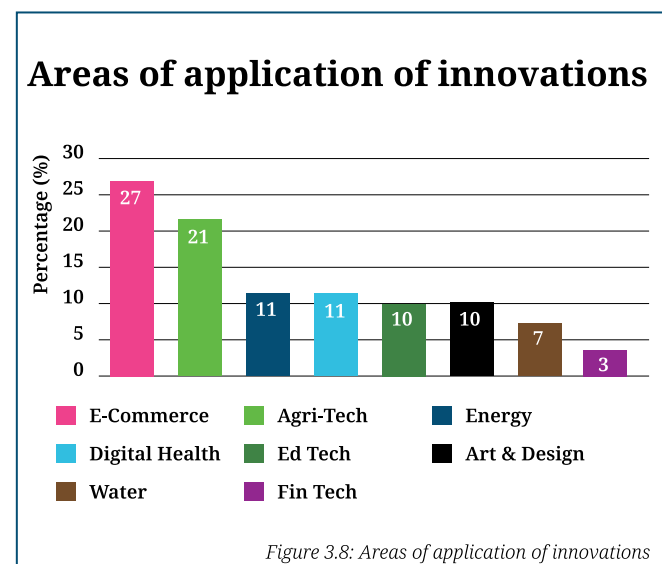
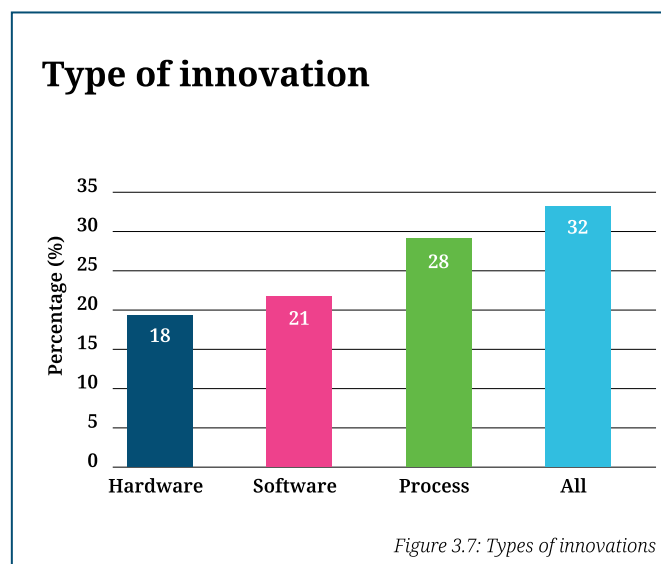
of education with 57% having a degree level of education and above (Figure 3.3.). It can therefore be concluded that the Kenyan innovation ecosystem is driven by youthful and well-educated innovators and entrepreneurs, with formally registered start-ups. In terms of gender distribution, women are lagging, only 22% out of the start-ups are female originated or led.

3.2.2. Registration status and size of the start-ups

Figure 3.4. shows the registration status of the start-ups, while Figure 3.5 shows the classifications of the start-ups according to early level (1 to 3 years), middle level (3 to 5 years) and advance level (above 5 years)

The study showed that:

- 74% of the start-ups are formally registered. This is different from MSME sector, which is dominated by informality. This is consistent with findings from a study by the UNDP Accelerator Lab team in Kenya on the impact of COVID-19 on Kenyan Micro, Small and Medium Enterprises.
- Out of those registered, about 40% of the start-ups are sole proprietorships, while the remaining are fairly distributed amongst partnerships (18%), corporations (16%), and limited liability companies (26%).



The bulk of innovations (32%) provide all-in-one (hardware, software and process) solutions. 29% of the innovations are process innovation, 21% software innovation and 19% hardware innovation.

3.3. Business Status and Capability of the Start-ups

3.3.1. Type of Innovations

The bulk of innovations (32%) provide all-in-one (hardware, software and process) solutions. 29% of the innovations are process innovation, 21% software innovation and 19% hardware innovation (Figure 3.6). Examples are given here below:

- An example of software innovation is the Plant Signal which targets to address the problem faced by farmers of pest and diseases, which affects their crops thereby reducing the quality and quantity of the produce. Just by taking a picture of a suspicious sick leaf the farmer can be able to get diagnosis of what is affecting their crops.
- On the other hand, Imarisha Innovation is an automated Ambu-bag ventilator which replaces manual Ambu-bag used in hospitals to support patients with breathing problems. Such innovation has all the three components – hardware, software and process.
- First-mile solar-powered cold storage by SokoFresh Agri Innovations EA which helps to minimize post-harvest losses, would be considered as a hardware innovation

3.3.2. Areas of Applications of the Innovations

As can be seen from Figure 3.8, 48% of the innovations are in E-commerce (27%) and Agriculture (21%). The remaining are distributed amongst Energy (11%), Health (11%), Education (10%), Art& Design (10%) and Water (7%) and Finance (3%). From these results, the following observations were made:

- All the e-commerce innovations center on ICT which corresponds to the increasing prominence given to the digital economy in the country.
- Agriculture is currently the backbone of the economy of Kenya, accounting for over 30 % of the GDP. The current government's development agenda – the Big Four Initiative (2018-2022) has agriculture as one of the four priority sectors with a vision of increasing productivity and income of the smallholder farmers. Some of the agricultural innovations are ICT driven, which is an interesting entry point for youth into the sector.
- The innovations in health and education are also ICT driven. COVID-19 pandemic has created more interest in developing solutions that can expand access to education through e-learning. As a result, the bulk of the solutions in education are related to e-learning.
- However, most innovations in energy, water and some agro-processing innovations are hardware and process oriented.

Most respondents indicated that the educational background of the innovators influences the type of their innovations and influences the type of innovations and level of commercialization. Examples are given here below:

- **Alhajiri Limited:** The founder holds BSc in Agronomy and developed a Fintech innovation to support financial transactions by smallholder farmers. "We ventured into Fintech, to try to solve lack of trust, low transparency, and certain customer's habit among our members. My agronomy background helped me to conceptualize the innovation".
- **AgriCity Foods:** The founder holds BSc in Food Science and Technology. The innovation seeks to integrate technology in urban farming, address urban food security, regenerative farming (farming that has no waste), extreme hunger, and nutrition. "My training has helped me in commercializing the innovation. I can define my product well, explain its value proposition, benefits, and its advantages".
- **CRESNET:** The founder holds a degree in Education. The innovator developed a 'virtual reality' innovation for immersive learning targeting children with learning disability. "Knowledge around teaching helps determine the content required for teaching and understand pain points for teachers"

- **Ikodawa Solutions Ltd:** The founder holds a degree in Pharmacy. The innovation is a software solution which helps users/clients identify centers or places where they can access both pesticides and pharmaceutical drugs i.e., medicines. "My field of education has made it easier to identify problem areas and find solutions".

Whereas the above is the normal trend, there are also a few extreme cases where people innovate outside their areas of education. For example, one innovator, an Epidemiologist, is producing organic fertilizer from sludge obtained from cleaning plastics to address food security, adding bones, calcium, carbon and iron to get organic fertilizer. He is also developing cement from organic waste to address the cost of building materials. He says, "my field of education has not helped much in commercializing the innovations as compared to on-the-job experience"



Table 3.2:
Examples of innovations in AgriTech, E-commerce, HealthTech, EdTech and Fintech.

Innovator	Innovation	County	Area of application
Kisumu Urban Areas Association	Agricity Foods	Kisumu	Agri-Tech
Kuza Coolers Limited	Kuza Freezer	Mombasa	Agri-Tech
Plant Signal	Plant Signal	Nyeri	Agri-Tech
Agri-Flora Organic Solutions	Agri-flora	Laikipia	Agri-Tech
Savanna Circuit Technologies Limited	Savanna Circuit Technologies	Nairobi	Agri-Tech
Mugumo Communications Limited	Mugumo Brands	Nairobi	E-commerce
Soko RaEasy	Soko RaEasy	Kisumu	E-commerce
Icons Hub	Icons Hub	Kisii	E-commerce
Sidai Media group limited	Sidai Media	Samburu	E-commerce
Bushman Robots	Bushman Robots	Makueni	E-commerce
Jambokid	Jambokid	Lamu	Digital Health
Ohospital	Ohospital	Nairobi	Digital Health
Imarisha	Imarisha	Nandi	Digital Health
Eco-Lab Collectors ltd	Eco-Lab Collectors	Kiambu	Digital Health
Ikodawa solutions ltd	IkoDawa	Nandi	Digital Health
T-Bin	T-Bin	Nyeri	Ed-Tech
CRESNET	CRESNET	Nairobi	Ed-Tech
babfahim technology	babfahim technology	Lamu	Ed-Tech
Swyft	Swyft	Lamu	Ed-Tech
Global Talanta system	Global Talanta system	Baringo	Ed-Tech
Green pavers	Green pavers	Nairobi	Energy
Rafode ltd	Rafode	Kisumu	Energy
Masai cables	Masai cables	Kajiado	Energy
Flemibriqs Enterprises	Flemibriqs Enterprises	Kilifi	Energy
Bizcom Technologies	Bizcom Technologies	Baringo	Fin-Tech
ALPHAJIRI LIMITED	ALPHAJIRI LIMITED	Migori	Fin-Tech
Emoji Technologies	Emoji Technologies	Muranga	Fin-Tech

3.3.3. Age of start-ups, number of employees And technical capacity

The status of the start-ups was analysed in terms of their age, size, number of employees, and technical skills of the innovators and the employees (Figures 3.9 and 3.10). 50% of the start-ups were registered between 2019-2022. These start-ups are, in theory, vulnerable, given the fact that the majority of Kenyan MSMEs do not celebrate their 3rd birthday .

The other 50% which were registered between 2011 and 2019, may be considered to have passed the valley of death. Despite 2020 being a difficult year, it was surprising that the year recorded the highest number of registered start-ups, which was followed by a drop in 2021. In terms of number of employees, 49% of the start-ups may be considered as Micro Enterprise (1-5 people), 35% small (5-49), 2% medium (51-100) and 6% large (100 and above).

Technical Capacity of the employees of the start-ups

- In terms of skills of the employees, 85% of the start-ups consider the level of the skills of their staff as inadequate (16%) and satisfactory (69%). Only 15% of the start-up rate the level of the skills of their staff as adequate.
- The topmost mentioned skills required by the employees of the start-ups are: (a) marketing (38%), (b) legal and intellectual property management (35%), (c) Business development (29%), and (d) Data base management (29%).

3.3.4. Market for the innovations

The market analysis covered the target market and demand for the innovations.

- The top target market for the start-ups/innovators are individuals (55%), companies (38%), and Government (33%). Others are NGOs and Development partners. Regional market and internal market are less targeted (Figure 3.11).
- Most of the innovators rated the demand for their innovations as very good (23%) and good (56%). Only 21% rated the demand as low (Figure 3.12). This is a clear indication that these innovations are providing solutions that are missing and therefore demand driven.

3.3.5. Influence of the market on innovation

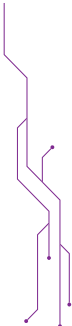
Analysis showed that most of the innovations were driven by a gap in the market. For example:

- **Alphajiri Limited.** The start-up developed a Fintech solution to address lack of trust, and low transparency in the informal table- banking sector. Agricity Foods. The start-up has developed a technology for household urban farming, to address urban food security.
- **CRESNET.** The start-up has developed a 'virtual reality' learning solution targeting children with learning disability.
- **Emoji Technologies.** The start-up has developed Micro USB cables. There are very few locally made USB in the current market.
- **Giomerc.** The start-up has developed a low-cost feed production innovation to meet the increasing demand for fish feed due to expansion of aquaculture.
- **The Circular List.** The start-up has developed a software solution that documents the real effect of industrial manufacturers to the environment and promote circular economy.
- **Savanna Circuit Technologies Ltd.** The start-up has developed a solar powered cold storage system to reduce electricity bills and expand access to cold storage services.
- **Nyangorora Banana processors.** The start-up had developed value added banana products to enhance income for the farmers.
- **Ikodawa Solutions Ltd.** The start-up has developed a web-based solution that helps users/ clients identify centres or places where they can access both pesticides and pharmaceutical drugs i.e., medicines.
- **Sweet potatoes Processors.** The start-up developed a process solution for making bread from sweet potatoes. There was need in the market for the sweet potato bread.

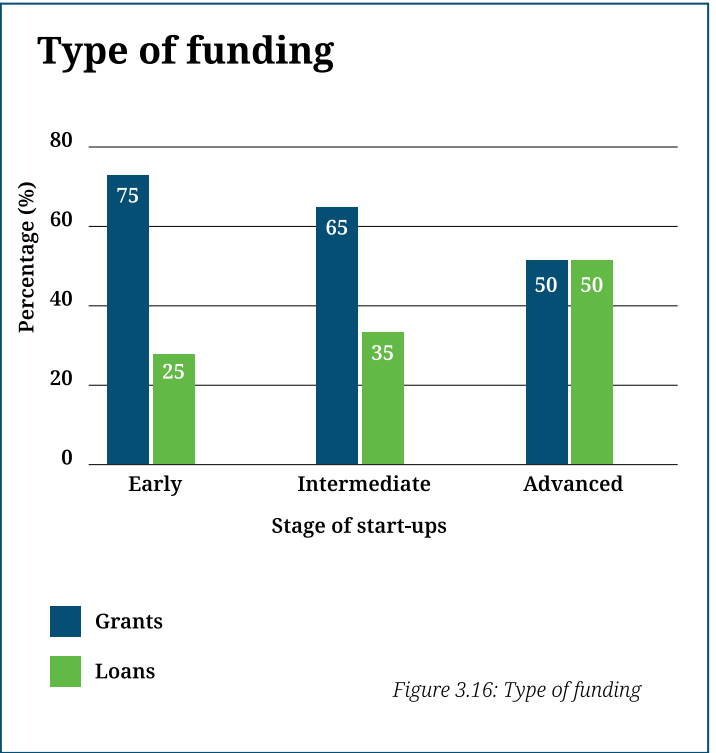
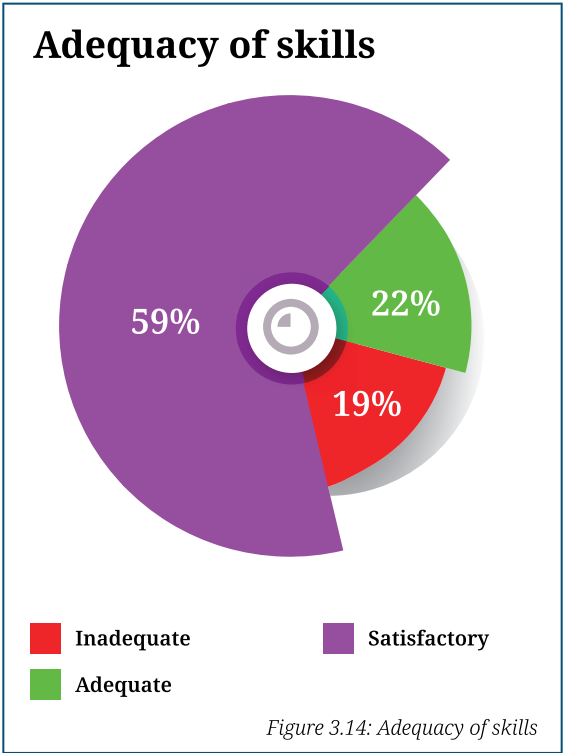
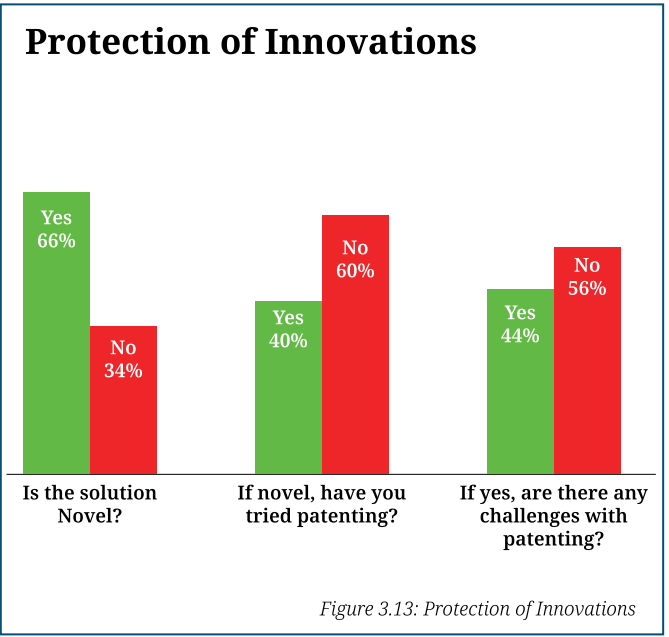
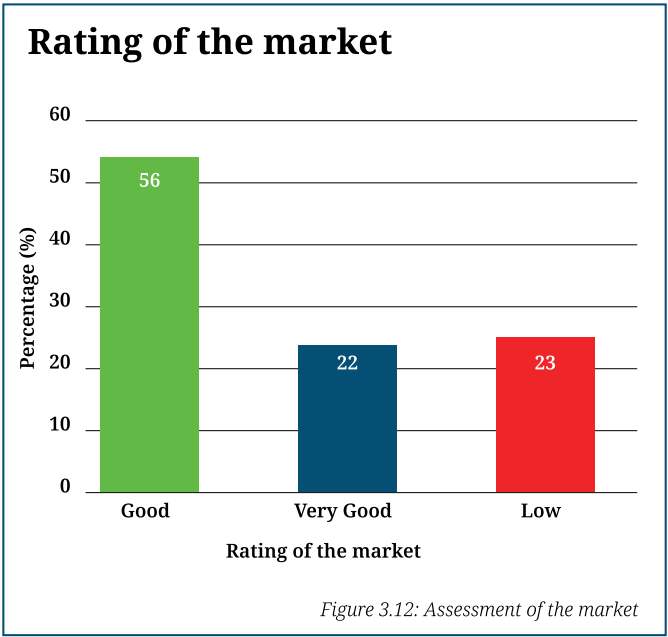
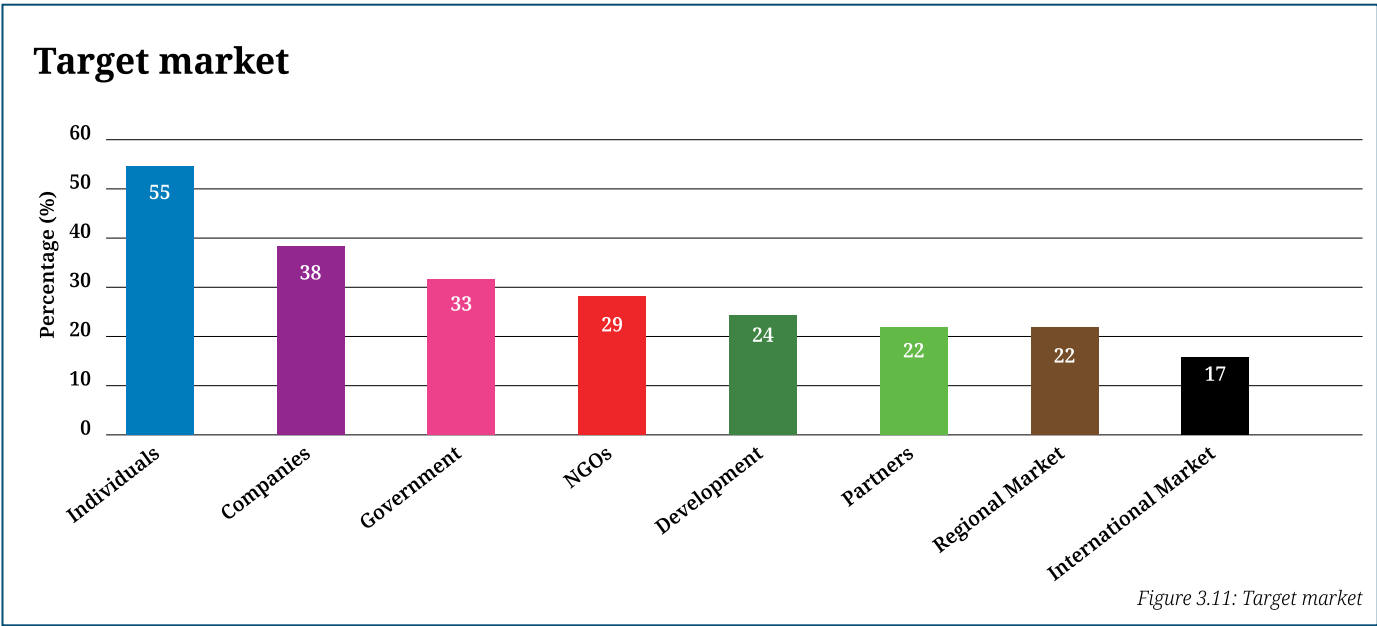
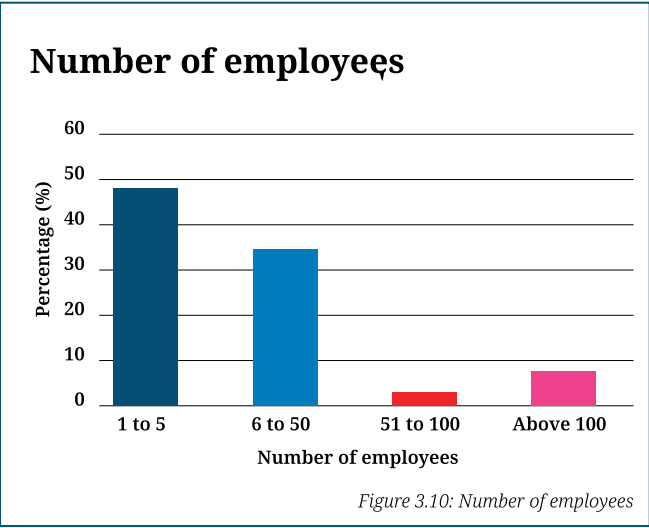
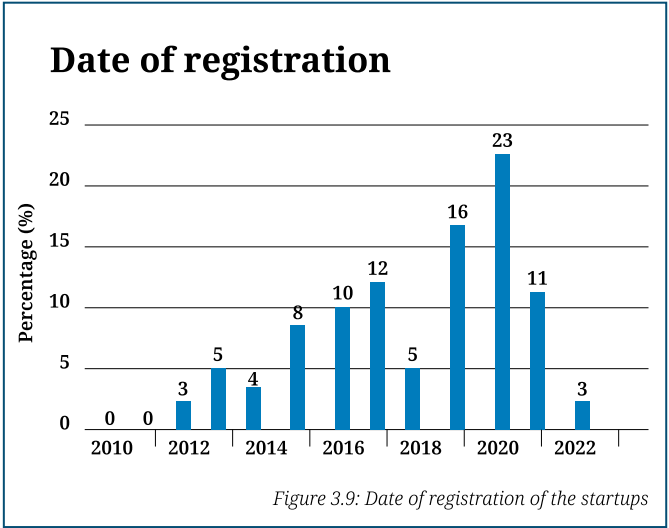


• **Afyaboost Care Limited.** The start-up developed nutritional products for children below 12 years, maternal health. There is a ready market that has influenced the steady growth of Afyaboost Care Limited. This is a clear indication that deployment

of these innovations to scale can have a positive impact on the economy.



In terms of skills of the employees, 85% of the start-ups consider the level of the skills of their staff as inadequate (16%) and satisfactory (69%).



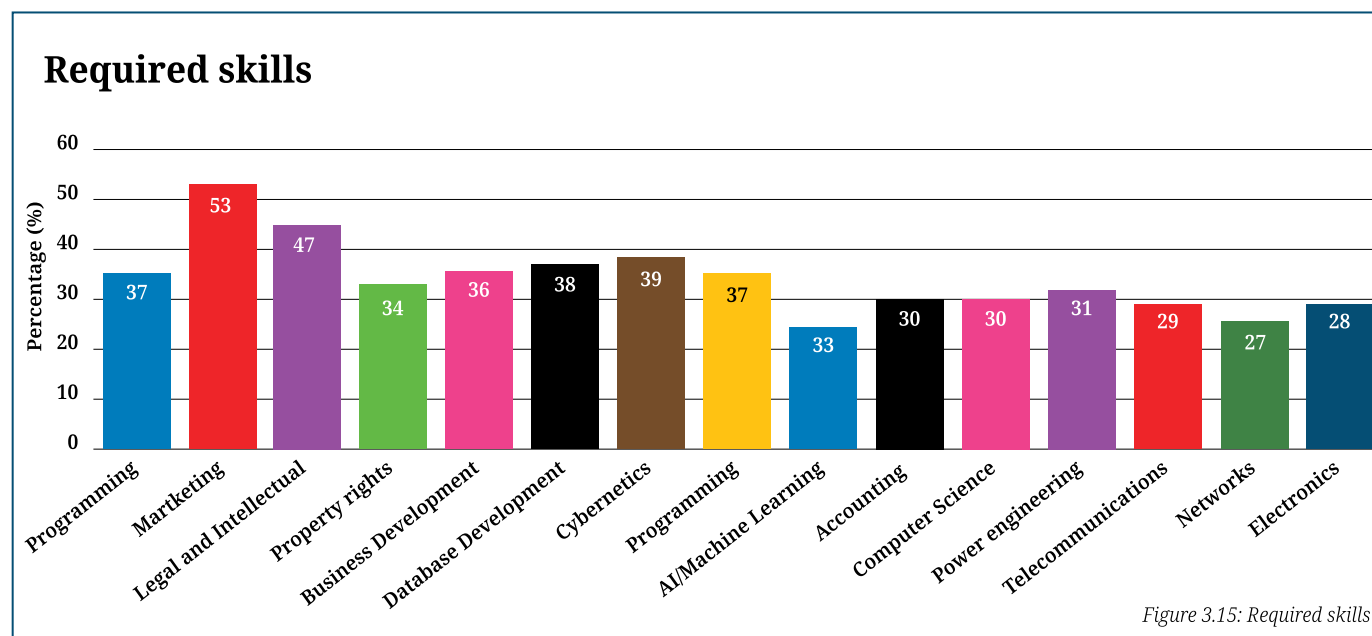


Table 3.3:
Sources of funding for innovators

Government agencies	NGOS	Private Entities	UN Agencies
Ministry of Public Service and Gender	WIDU Africa	CISCO	UNIDO
NETFUND, Ministry of Environment	USAID – KNHP	SACCO	UNDP
National/County Governments	ENI through E4Impact accelerator	Banks	
Konza Technopolis	ISHOW	Media Council of Kenya	
	World Vision		
	UKAID		

Most of the innovators rated the demand for their innovations as very good (23%) and good (56%). Only 21% rated the demand as low (Figure 3.12). This is a clear indication that these innovations are providing solutions...



3.3.3. Age of start-ups, number of employees And technical capacity

The status of the start-ups was analysed in terms of their age, size, number of employees, and technical skills of the innovators and the employees (Figures 3.9 and 3.10). 50% of the start-ups were registered between 2019-2022. These start-ups are, in theory, vulnerable, given the fact that the majority of Kenyan MSMEs do not celebrate their 3rd birthday.

The other 50% which were registered between 2011 and 2019, may be considered to have passed the valley of death. Despite 2020 being a difficult year, it was surprising that the year recorded the highest number of registered start-ups, which was followed by a drop in 2021. In terms of number of employees, 49% of the start-ups may be considered as Micro Enterprise (1-5 people), 35% small (5-49), 2% medium (51-100) and 6% large (100 and above).

Technical Capacity of the employees of the start-ups

- In terms of skills of the employees, 85% of the start-ups consider the level of the skills of their staff as inadequate (16%) and satisfactory (69%). Only 15% of the start-up rate the level of the skills of their staff as adequate.
- The topmost mentioned skills required by the employees of the start-ups are: (a) marketing (38%), (b) legal and intellectual property management (35%), (c) Business development (29%), and (d) Data base management (29%).

3.3.4. Market for the innovations

The market analysis covered the target market and demand for the innovations.

- The top target market for the start-ups/innovators are individuals (55%), companies (38%), and Government (33%). Others are NGOs, and Development partners. Regional market and internal market are less targeted (Figure 3.11).
- Most of the innovators rated the demand for their innovations as very good (23%) and good (56%). Only 21% rated the demand as low (Figure 3.12). This is a clear indication that these innovations are providing solutions that are missing and therefore demand driven.

3.3.5. Influence of the market on innovation

Analysis showed that most of the innovations were driven by a gap in the market. For example:

- **Alphajiri Limited.** The start-up developed a Fintech solution to address lack of trust, and low transparency in the informal table- banking sector. Agricity Foods. The start-up has developed a technology for household urban farming, to address urban food security.
- **CRESNET.** The start-up has developed a 'virtual reality' learning solution targeting children with learning disability.
- **Emoji Technologies.** The start-up has developed Micro USB cables. There are very few locally made USB in the current market.
- **Giomerc.** The start-up has developed a low-cost feed production innovation to meet the increasing demand for fish feed due to expansion of aquaculture.
- **The Circular List.** The start-up has developed a software solution that documents the real effect of industrial manufacturers to the environment and promote circular economy.
- **Savanna Circuit Technologies Ltd.** The start-up has developed a solar powered cold storage system to reduce electricity bills and expand access to cold storage services.
- **Nyangorora Banana processors.** The start-up had developed value added banana products to enhance income for the farmers.
- **Ikodawa Solutions Ltd.** The start-up has developed a web-based solution that helps users/ clients identify centres or places where they can access both pesticides and pharmaceutical drugs i.e., medicines.
- **Sweet potatoes Processors.** The start-up developed a process solution for making bread from sweet potatoes. There was need in the market for the sweet potato bread.



• **Afyaboost Care Limited.** The start-up developed nutritional products for children below 12 years, maternal health. There is a ready market that has influenced the steady growth of Afyaboost Care Limited

This is a clear indication that deployment of these innovations to scale can have a positive impact on the economy.

3.3.5. Intellectual property and standards

The study wanted to establish the novelty of the innovations, whether the innovations were protected and whether the innovators had acquired KEBS certifications for their products. The study also wanted to document the challenges innovators experience with regard to the protection of innovations and

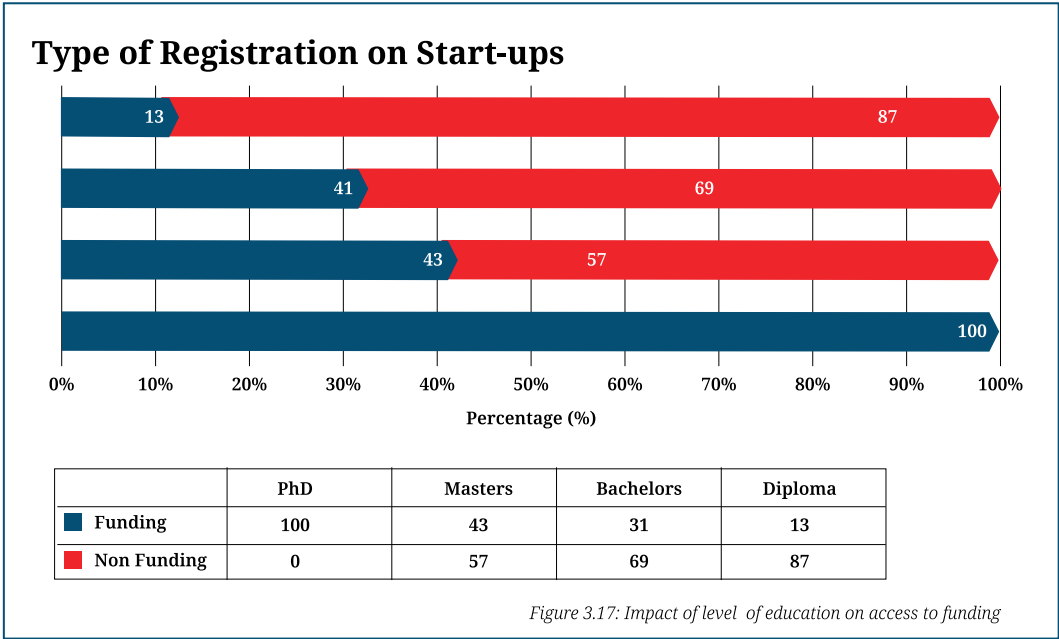


Figure 3.19: Sectors funded

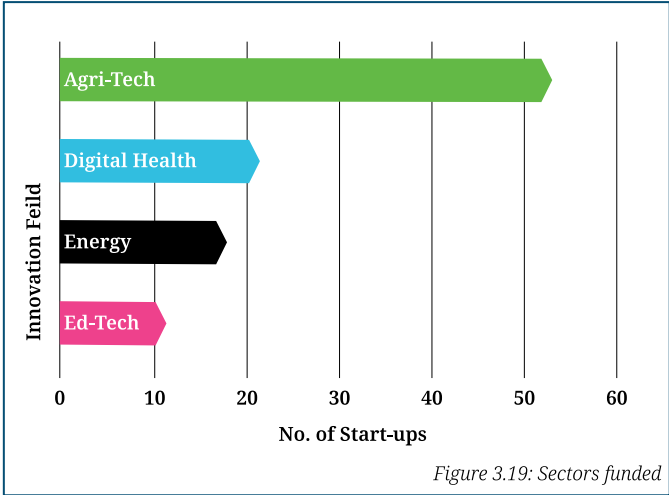


Figure 3.20: Money raised in million US\$

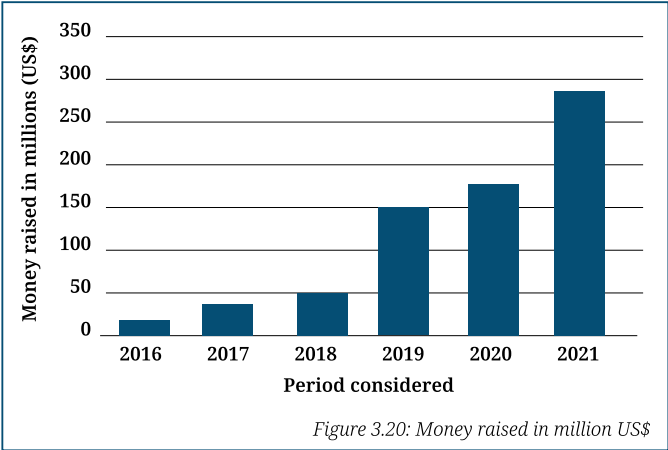


Figure 3: 21: Number of startups that raised the money

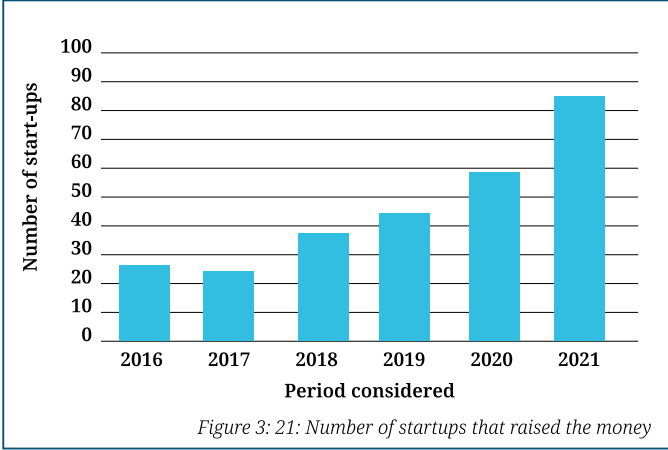


Figure 3.22: Money raised in million US\$

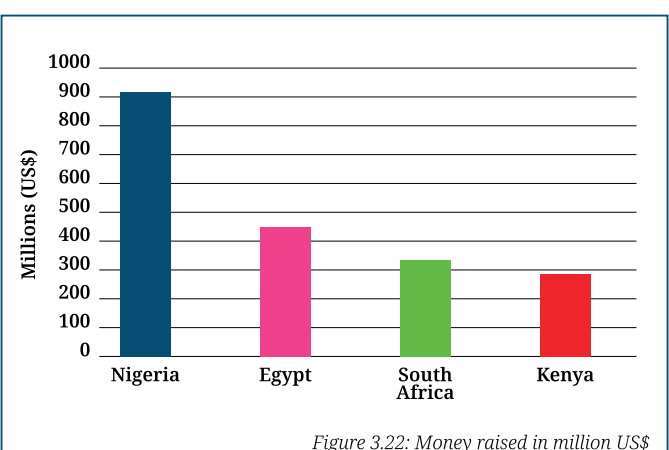
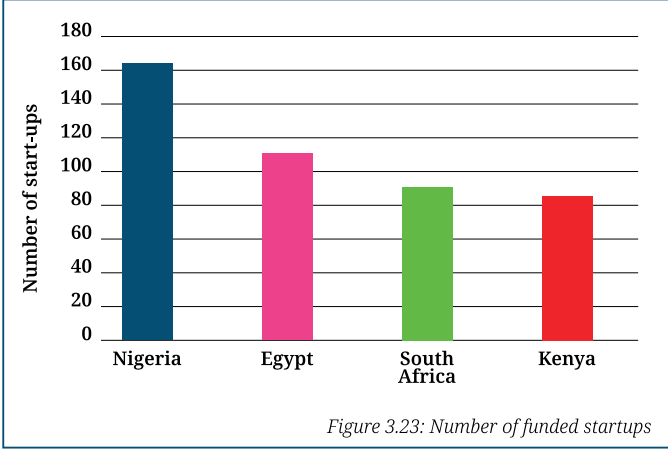
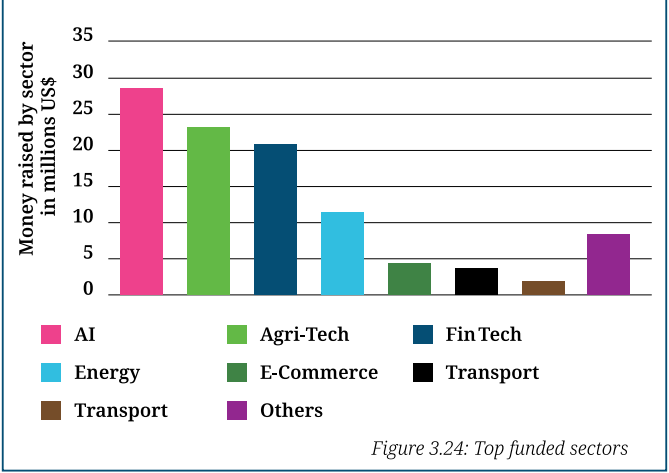


Figure 3.23: Number of funded startups



Top funded sectors



Type of Founders

32.2 %
Percentage of funded start-ups having at least a female founder:

42.5 %
Percentage of funded start-ups having at least an international founder:

72.4 %
Percentage of funded start-ups having at least a local founder:



3.5.3. Top Kenyan start-ups attractive for investors

The top ten Kenyan start-ups in terms of volume of money raised are M-Kopa, Twiga Foods, Copia Global AZA Finance, Sendy, Lendable, Little Cab, African Talking, PayGo, and Gro Intelligence. Between them they have raised around USD 550 million during the period 2008-2021 (Table 3.4) .

Table 3.4:
The top start-ups in Kenya in terms of funding raised.

No	Start-Up	Funding	Founders	Sector
1	M-Kopa	USD188.6 million	Chad Larson, Jesse Moore and Nick Hughes	Energy
2	Twiga Foods	USD101.7 million	Grant Brooke and Peter Njonjo	Agriculture e-commerce start-up
3	Copia Global	USD 53 million	Jonathan Lewis and Tracey Turner.	E-Commerce
4	AZA Finance	USD 55 million	Amy Ludlum, Charlene Chen and Elizabeth Rossiello.	Fin-Tech
5	Sendy	USD 26.5 million	Don Okoth, Evanson Biwott, Malaika Judd and Meshack Alloys.	B2B
6	Lendable	USD 12 million	Arjun Batra, Daniel Goldfarb and Dylan Fried.	Fintech
7	Little Cab	USD 10 million	Kamal Budhabhatti,	Transport
8	Africa’s Talking	USD 8.6 million	Eston Kimani and Samuel Gikandi.	Telecommunications
9	PayGo	USD 8.5 million	Fausto Masigot, Mike Hahn and Nick Quintong.	Energy
10	Gro Intelligence	USD 85 Million		AI
11	Ajua	USD 3.5 million	Kenfried Griffith and Louis Majanja	Computing
12	CredRails	USD 2.85 million		FinTech
13	Kune	USD 1,22 million	Robin Reeckt	AgriTech
14	Paylend	USD 2 million	Eliutherius Juma	Fintech
15	AfyaRekod	USD 2 million	John Camara	HealthTech



Table 3.5:
Specific Funding Entities for start-ups in Kenya

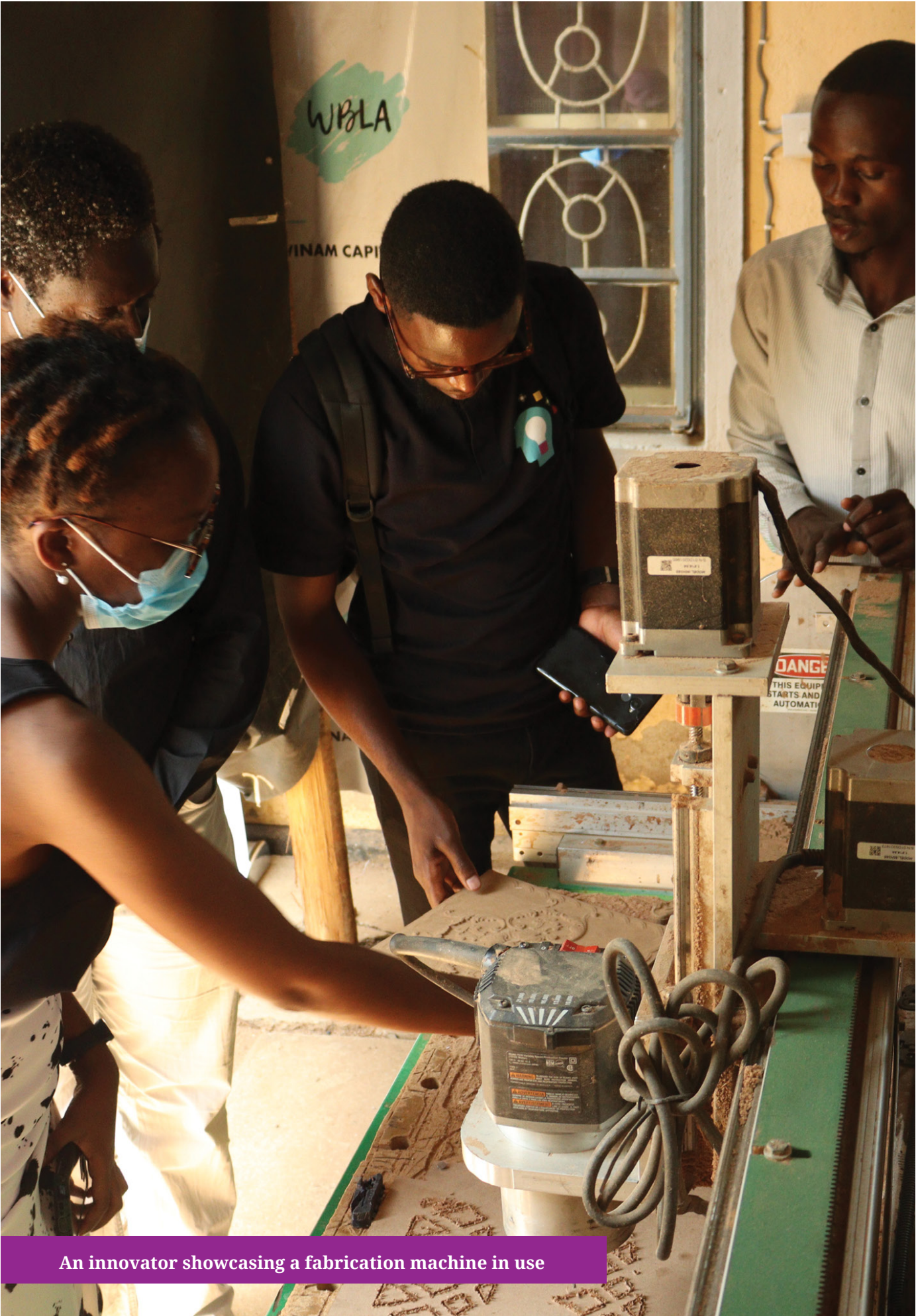
No.	Funding Agency	Purpose	Level of Funding
1	Ajira youth Innovation Fund	Provides seed capital and business development incubation to top innovative ideas. A total of Kenya shillings five hundred million (500,000,000/-) will be disbursed in three phases spread within a 5-year period from 2020	
2	National Research Fund (NRF)	Targets to mobilize 2% of the GDP to finance research and innovation. In 2021, the Fund disbursed a total of Kes. 74,111,479 to 4 COVID 19 Research Consortia as part of the Kes. 131,037,479 research funding on the corona virus disease. In 2020, the Fund provided grants to 13 research consortia on three strategic areas of COVID 19, cancer incidences and the desert locust menace.	
3	Youth Enterprise Development Fund	Provides easy and affordable financial and business development support to youth who are keen on starting or expanding businesses.	
4	REACT SSA INNOVATION FUND	Provides funds for innovations in clean cooking and productive use of energy technologies and services. Successful applicants receive between USD100,000-USD 200,000 per company	
5	The AgriFI Kenya Challenge Fund	Builds capacity of smallholder farmers/pastoralists to practice environmentally sustainable and climate-smart agriculture in inclusive value chains. Provides grant financing of KES 2.4 billion to 37 Kenyan Agri-enterprises	
6	ACP-AIRTEA Innovation fund	Strengthening Agricultural Knowledge and Innovation Ecosystem for inclusive rural transformation and livelihoods in Eastern Africa	
8	Youth Agri Enterprise Awards	A program to promote innovation and entrepreneurship in the Agricultural industry in Kenya. Provides up to USD15,000 funding for youth Agri-innovations in Kenya	
9	The Kenya National Innovation Agency	Focus on financing innovation development and start-ups.	
10	Spark fund (Safaricom)	Invests in and supports start-ups with a presence in Kenya, while leveraging Safaricom assets to enable the companies to scale. In 2020, Safaricom allocated an additional USD 5 million to the fund to invest up to USD 500, 000 into tech-enabled start-ups that are strategically aligned with Safaricom’s purpose.	
11	DeveloPPP Ventures	Empowers local Kenyan start-ups by providing an entrepreneurial support program with grants of up to EUR 100,000.	
12	Accion Venture Lab	Provides flexible financial and post-investment support. Invests USD 300,000-USD 500,000 in seed stage start-up.	



13	Acumen Fund Kenya	Funds companies that provide solar energy, anti-malaria bed nets and agricultural inputs. It has invested over USD 28 million in East African companies
14	Africa Tech Ventures	Invests in high growth start-upswwhich increase access to essential goods and services. Funds between USD 100,000 to USD 5 Million and takes a significant minority equity stake and the ability to participate in the follow-on financing rounds
15	Bamboo Capital Partners	A commercial private equity firm that is expert in energy, healthcare, and financial services. Has close to USD 400 Million under management with a portfolio of companies in over 30 countries
16	DOB Equity	Invests in innovative, scalable and impactful start-ups in East Africa. It has an USD 11 Million fund for African start-ups.
17	Google47	Invests in African early- and growth-stage start-ups. 9 Kenyan start-ups to get USD 100,000 in equity-free funding, access to its employees, network, and technologies including Google Ad Grants and Cloud credit
18	Kepple Africa	Fostering growth of start-ups by facilitating cross-border expansion, and catalysing mergers and acquisitions.
19	Combinator	Provides seed funding for start-ups. Invests up to USD 500,000 twice a year
20	LoftyInc Capital Management, LLC	Capitalizes on the strength of its local networks in Sub-Saharan Africa to identify, support and drive the growth of next generation of Frontier Market Unicorns.
21	Partnerships for funding innovations	Several organisations have partnered to fund start-ups through innovation challenges. A good is example is Konza Technopolis, which has partnered with other organisations to supports start-ups through seed funding and mentorship



An innovator presenting a waste management hygiene solution



An innovator showcasing a fabrication machine in use



4.2. General Characteristics of the hubs

- **Innovation labs:** These are structures within universities and research organizations that support innovation development and commercialization.
- **An innovation hub** is a physical space that brings together researchers, creators and innovators to nurture ideas into industry-changing products and services by helping develop entrepreneurial and especially tech communities, inspire and build skills and networks among potential young entrepreneurs. There exists a distinction between accelerators and incubators.

From the field study, general characteristics of hubs were established as follows:

4.2.1. Status and Organization type

The study showed that 81% of the innovation hubs are formally registered. Out of the registered hubs, 35% are public, 35% are non-governmental organisations (NGOs) and 30% were private entities (Fig. 4.2). It can therefore be concluded that currently the Kenyan innovation enablers segment is dominated by the public entities and the NGO sector (70% of the hubs). Figure 4.2 shows examples of public, NGO, and privately managed hubs in Kenya (Figure 4.3)

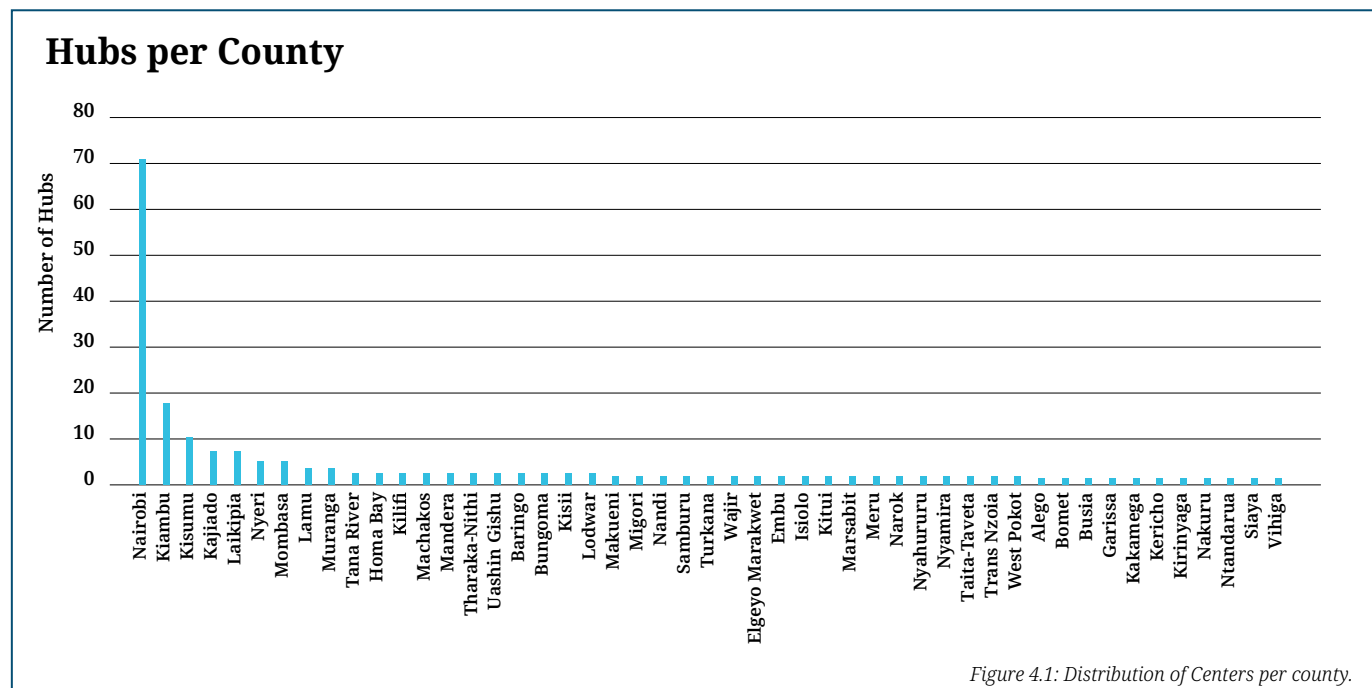
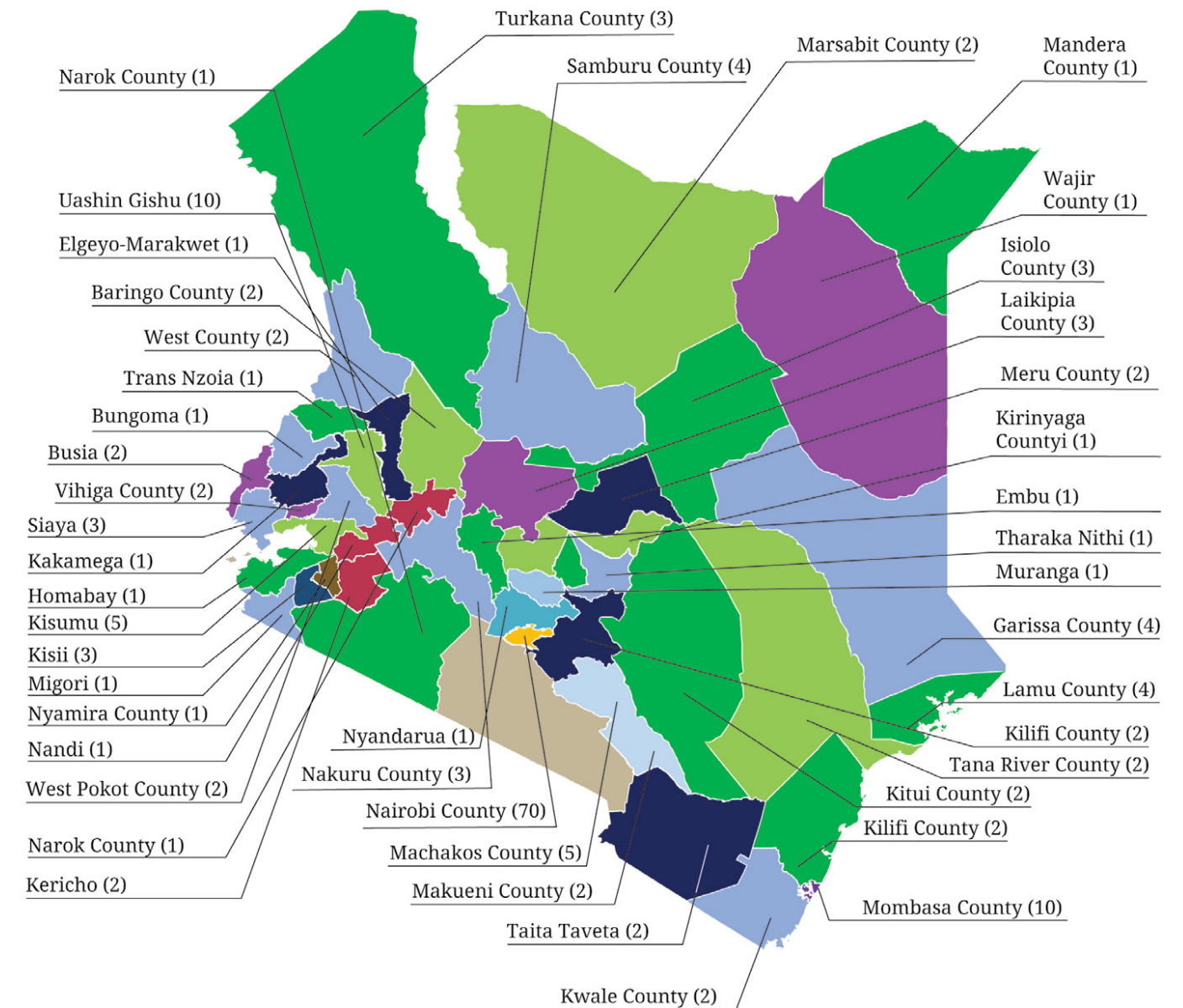


Figure 4.1: Distribution of Centers per county.

Digital Map for the Kenya Innovation Eco-system



Number of innovation centers mapped per county





Table 4.1:
Innovation hubs and other actors interviewed

Actors in the Innovation Ecosystem		Number of respondents reached
1	Hubs (Innovation hubs, Accelerators, Incubators, and co-working spaces)	68
2	Academic Innovation Labs	33
3	Government departments and Agencies	32
4	Networks and Marketing Organizations	21
5	Skills Trainers	47
6	Financing institutions	24
TOTAL		225

Table 4.2:
Difference between accelerators and incubators

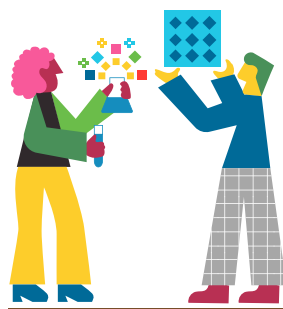
	Accelerator	Incubator
Definition	An organization that offers mentorship, capital, and connections to investors and business partners. Intensive fixed-term programmes with the aim of scaling up an established business, to help start-ups achieve a level of business growth.	Is an organization that nurtures and mentors start-ups over long periods of time providing start-ups with time and resources to design and build an efficient and sustainable business model.
Stage	Provide early-stage companies that already have a minimum viable product (MVP) with the education, resources and mentorship needed to promote what might otherwise be several slow years of growth into a few short months.	Start-up incubators help entrepreneurs refine business ideas and build their company from the ground up.
Investment	For profit. Provide capital in exchange for a percentage of your company's equity.	A significant percentage is non-profit. Usually don't require equity or put as much pressure on success as accelerators, but also don't offer capital. It's all a trade-off.
Duration	Accelerators are intense and fast-paced, taking 3-6 months to get an early-stage start up ready for market. *Some engage between 12 to 18 months	Engage for a period of 1-5 yrs.



Aim of Support	Seek external financial support	Build an efficient and sustainable business model (Self-Sustaining).
Assessment/ Selection	Extremely competitive & rigorous selection process.	Competitive especially from local start-ups.
Services	Face-to-face meetings (mentoring), matching and mentoring, facilitate connections, capacity building and business design.	Provide ad-hoc help with legal and business services, as well as help turning a concept into something with product-market fit. Provide office space and consultations with experts. Provides an environment of collaboration and support when needed.
Funding	For profit businesses designed to increase value of start-up and profit on exit.	Funded by academic, government and local ecosystem development groups.

Table 4.3:
Examples of hubs, incubators, accelerators, co-working spaces and makers spaces

Hubs	Incubators	Accelerator	Co-working spaces
<div>1. Makueni Innovation Hub: Makueni</div> <div>2. Mashinani Hub: Nyamira</div> <div>3. Mt. Kenya Hub (MHub): Nyeri</div> <div>4. iHub: Nairobi</div> <div>5. Pawa254: Nairobi</div> <div>6. Rift Valley Innovation Center: Baringo</div> <div>7. Ubunifu Hub: Nakuru</div> <div>8. Eldohub: Usain Gishu</div> <div>9. Lake Hub: Kisumu</div> <div>10. Wise Hub: Kisumu</div> <div>11. Border Hub: Busia</div> <div>12. Dlab Hub: Uasin Gishu</div> <div>13. Circular Innovation (CIH): Nairobi</div> <div>14. BitHub: Nairobi</div>	<div>1. Startup Lions- Turkana</div> <div>2. Coelib Center- Nakuru</div> <div>3. Sote Hub (Voi): Taita Taveta</div> <div>4. Mt. Kenya Hub (MHub)</div> <div>5. Innovation Incubation & Entrepreneurship Center (IIEC): Nairobi</div> <div>6. The Entrepreneurship Hub: Nairobi</div> <div>7. GrowthHub: Nairobi</div> <div>8. IBizAfrica (Strathmore University): Nairobi</div> <div>9. Nailab: Nairobi</div> <div>10. Cisco EDGE Incubation Centre (UoN): Nairobi</div> <div>11. Chandaria BII (KU)- Nairobi</div> <div>12. Kenya Country Business Incubators (KeKoBi)</div>	<div>1. Ubunifu Hub: Machakos</div> <div>2. Bay Hub: Homa Bay</div> <div>3. Pangea Accelerator: Nairobi</div> <div>4. The Entrepreneurs Hub: Nairobi</div> <div>5. Growth Hub: Nairobi</div> <div>6. mLab East Africa: Nairobi</div> <div>7. Sinapis Group: Nairobi</div> <div>8. Mara Launchpad Incubation Center</div>	<div>1. Nakuru Box: Nakuru</div> <div>2. Kikao64: Uasin Gishu</div> <div>3. Mt. Kenya Hub (MHub): Nyeri</div> <div>4. Nomad Lounges Limited: Nairobi</div> <div>5. Nairobi Garage: Nairobi</div> <div>6. Mombasa Works: Mombasa</div> <div>7. Nomadic Hub: Nairobi</div> <div>8. Totosci Holdings Ltd: Kirinyaga</div> <div>9. Coast Team Innovators (CTI): Mombasa</div> <div>10. Workable Nairobi: Nairobi</div> <div>11. IKIGAI: Nairobi</div> <div>12. The Twig: Nairobi</div>
		<div>Marker-Spaces</div> <div>1. Gearbox: Nairobi</div> <div>2. KIRDI</div> <div>3. Close the Gap</div> <div>4. Constituency Industrial Development Centers</div>	



Out of the registered hubs, 35% are public, 35% are non-governmental organisations (NGOs) and 30% were private entities

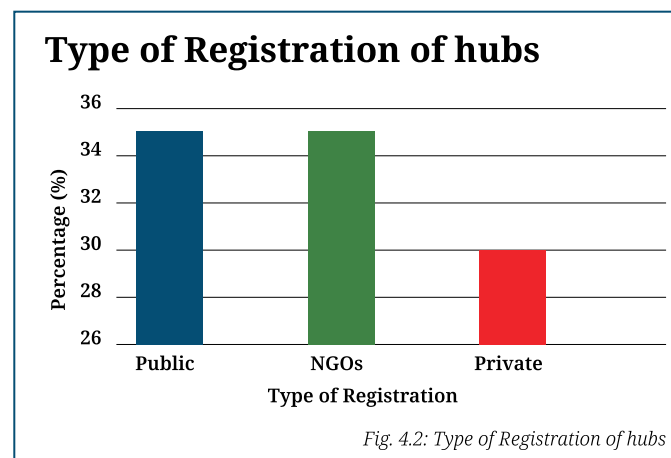


Figure 4.3: Examples of different hubs

Public managed hubs	NGO managed hubs	Private managed hubs
<div>1. Ajira Centre in Makueni</div> <div>2. Kenya Industrial Research and Development Institute, Nairobi</div> <div>3. C4D, University of Nairobi, Nairobi</div> <div>4. Agricultural Information Resource Centre, Kiambu</div> <div>5. Rift Valley Innovation Center, Baringo</div>	<div>1. Fablab in Kisumu</div> <div>2. Sote Hub, Taita Taveta</div> <div>3. Swahilipot Hub Foundation in Mombasa</div> <div>4. Eldoret Media Hub, Eldoret</div> <div>5. Leaning Lions in Turkana</div> <div>6. Kenya Red Cross Society, Lamu</div> <div>5. Maarifa Kona, Marsabit</div>	<div>1. ICONS Hub in Kisii</div> <div>2. The Hub, Homa Bay</div> <div>3. Technobridge in Mombasa</div> <div>4. Coast Team Innovators, Kilifi</div> <div>5. Northern Innovation and Employment hub in Garissa</div>

4.2.2. Female led innovation resource centres

Most of the hubs (84%) are male led and managed. However, there are a few resource centres that are led and/or managed by women. These include:

- **Bamboosa Green Living**, established in 2013. The founder is a lady who holds a BSc in supply chain management. This hub focuses on value addition to bamboo by creating bamboo-related products and provides internship opportunities to TVET students and supports entrepreneurs that are passionate about bamboo. The hub prides itself as a unique bamboo innovation Centre in the country.

- **Mukurweini Constituency Innovation Hub:** The Hub Manager has a health science related degree and technical expertise in IT. The hub supports entrepreneurs in the area of agriculture, value addition and nutrition. It was established in 2015.

- **Kenya Red Cross Society:** The hub, which is based in Narok County, specifically deals with women innovators. The hub provides mentorship, training, networking, marketing services as well as office space to innovators. The hub supports 64 innovators and entrepreneurs, who are involved in various business activities which include briquette making, energy cookstoves, beadwork, poultry, and traditional medicines. The hub manager has a Diploma in community development and well as expertise in innovation.

- **Agricultural Information Resource Centre:** This hub, which is based in Kiambu is led by a lady, a resource trainer, as one of the top management. The hub is a public organization, established in 1975. The hub provides innovators with space to develop and work on their projects and focuses on innovators who work on agriculture related projects. Currently they have six innovators, all working on Apps related to agriculture.

- **eMobilis:** The hub is based in Nairobi and has a lady as the Centre Manager. She holds a degree in social science and expertise in ICT. The hub focuses on mentorship of youth entrepreneurs.

It is clear that more needs to be done to facilitate more women to leadership roles in the Kenyan innovation ecosystem.

4.2.3. Education and age of the hub managers:

- Most of the managers of the hubs are formally educated, with 78% having first degree and above (Figure 4.4).
- Majority (64%) are below 35 years old, who can be categorised as youth in Kenya. (Figure 4.5).

We can therefore conclude that the current management of hubs in Kenya is dominated by formally educated youth.

4.2.4. Areas of specialization of the hubs manager

The analysis of the areas of specialization of the hub managers indicates that business management, entrepreneurship, ICT, project management and engineering are the top five specializations held by the hubs managers. Business management, entrepreneurship, and ICT are the top three specializations, which account for over 60% of the hub managers. It can be concluded, therefore, that these three areas of specializations are important in driving the growth of innovation hubs in the country (Figure 4.6).

The bulk of the hubs (58 %) interviewed had between 1 to 5 employees while 24% had between 5 and 10 employees; about 18% had more than 10 employees (Figure 4.7). Amongst the large hubs (with more than 10 employees) are:

- Swahilipot Hub Foundation, which has 20 employees. It was established in 2017 and it is in Mombasa.
- Learning Lions, in Turkana, which has 30 employees and was established in 2015.
- Northern Innovation and Empowerment Centre, in Garissa, which has 21 employees and was established in 2019.
- Elimu Development Project, Malindi, has 11 employees and was established in 2012.

That 58% of the hubs are small entities with less than five employees, shows micro-level of operation of majority of these hubs since they can be classified as micro-enterprises



4.2.6. Social media presence

The hubs have a very high usage of social media for communication and marketing of their services. This is attributed to the dominance of the sector by youthful and well-educated hub managers (Figure 4.8).

4.3. Services of the hubs

4.3.1. Services Offered by the hubs

The study made the following observations as regards the services offered to Innovators:

- The hubs offer innovators several services. These include training and skills development, marketing, networking, mentorships, makers spaces, and small-scale manufacturing, ideation, and prototyping, as well as market and research surveys (Figure 4.9).
- The majority (70 %) of the hubs are public and NGO managed and offer subsidized or free services to innovators. This is positive since this enhances access to these services by innovators.
- However, it is important to note that some NGOs (Sote Hub in Taita Taveta, Fablab in Kisumu, World Best Friend Kenya, ICT Centre in Elgeyo Marakwet, Swahilipot Hub Foundation in Mombasa, and Elimu Development project in Malindi) indicated that they charge fees according to space or product, while only one private hub, Northern Innovation and empowerment hub, Garissa, does not charge fees to innovators.

4.3.1. Services Offered by the hubs



Figure 4.8: Services offered by hubs to innovators

4.3.2. Number of Innovators supported and Age of the Hubs

The analysis showed that around 50% of the hubs had supported less than 10 innovators/ start-ups since their registration (Figure 4.10). This illustrates a micro-scale level of operation, compared to the possible number of start-ups that may require such services. Furthermore, 84% of the hubs are less than 10 years old. This demonstrates the projection of rapid growth of hubs in Kenya.

4.3.3. Capacity of the Hubs to Offer Services to the Innovators

In terms of meeting the needs of the innovators, the analysis showed the following:

- Only 36% of the hub managers indicated having capacity to meet the needs of the innovators/ start-ups. In addition, only 34% of the hubs rate themselves as successful in supporting the innovators.
- Majority (67%) shared that they did not believe innovators get the necessary legal and policy support they require to advance their innovations.

- Hub managers that shared capacity challenges in meeting innovators' needs, identified five skills gaps that they needed to be able to do so. These were programming, accounting, marketing, legal and intellectual property, and cybernetics (Figure 4.12). It can therefore be concluded that capacity building of hubs managers and their staff is an important intervention in strengthening the innovation ecosystem in Kenya.

4.3.4. Success Factors for Innovators in the Hubs

Hub managers shared key factors that they consider would enable innovators to convert their innovations into viable business entities:

- Access to funding is a key factor in successful commercialization of innovations. Innovators with access to sources of funding are more likely to be successful in their ventures.
- The criteria used by a hub to select innovators is key indicator of success for the latter. Identifying and supporting innovators with viable innovations and self-drive is more likely to lead to a successful start-up.
- Being flexible, passionate and persistent, and having a positive attitude are important personal attributes that determine whether an innovator can successfully convert support offered by a hub into a viable enterprise or start-up.
- Digital technology innovations have more chance of success than hardware-based innovations since hardware assistance is hardly offered by hubs.
- Innovators who peg their expectations on financial gain while joining hubs are bound to be disappointed.

- Careful market evaluation to establish the demand for the solution, and co-creation with the user community, is essential for success.
- Community culture of overdependence on aid, makes it difficult for many innovators to become self-sustainable.

4.4. Collaboration of the Hubs with Government Agencies

4.4.1. Areas of Collaboration

The study showed areas where the hubs are having meaning collaboration with the government. These include the following:

- Training of innovators and hubs in various areas
- Support, attachment, and placement
- Hackathons and events
- Government funding
- Prototyping and product development
- Policy development training
- Legal advice
- Research and development
- With KIPi for patenting and KEBS for standards

However, the hub managers mentioned that the level of collaboration among actors in the innovation ecosystem is inadequate. In addition, networking events and opportunities are not regular while collaboration with research institutions and universities is almost non-existent. Furthermore, there is little evidence of collaboration not only between the hubs themselves but also with other business entities and training providers.

Only 36% of the hub managers indicated having capacity to meet the needs of the innovators/start-ups. In addition, only 34% of the hubs rate themselves as successful in supporting the innovators.



Majority (64%) are below 35 years old, who can be categorised as youth in Kenya.

Figure 4.4: Level of Education

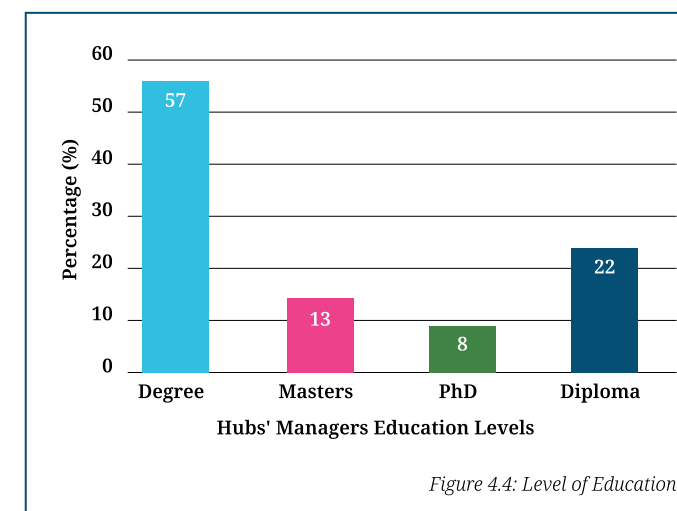
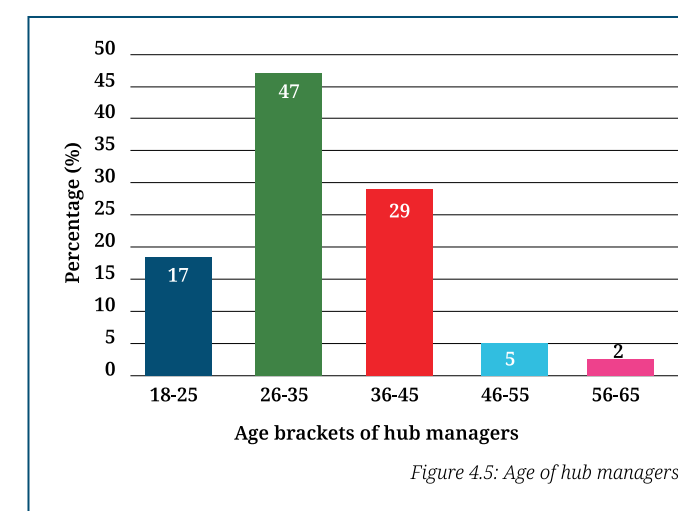


Figure 4.5: Age of hub managers



The government can fuel the development of entrepreneurial culture in Kenya by provision of subsidies, building the capacity of innovators through trainings, providing linkages with donors, supporting commercialization of innovations...

Figure 4.10: Number of innovators supported

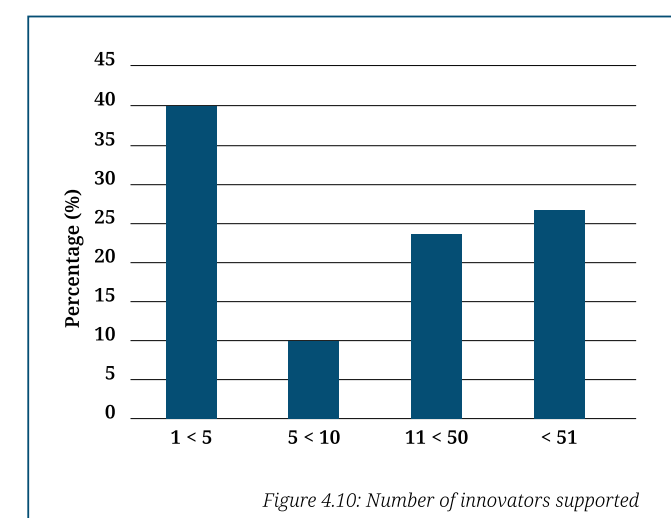


Figure 4.11: Growth of hubs in Kenya

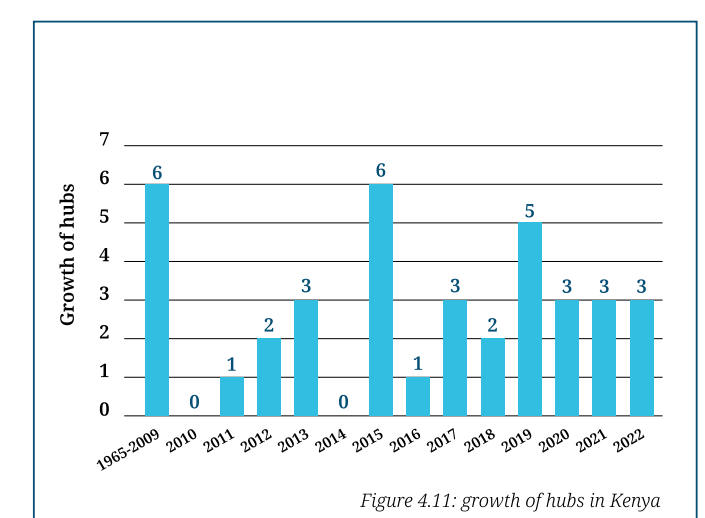


Figure 4.6: Areas of specialisation

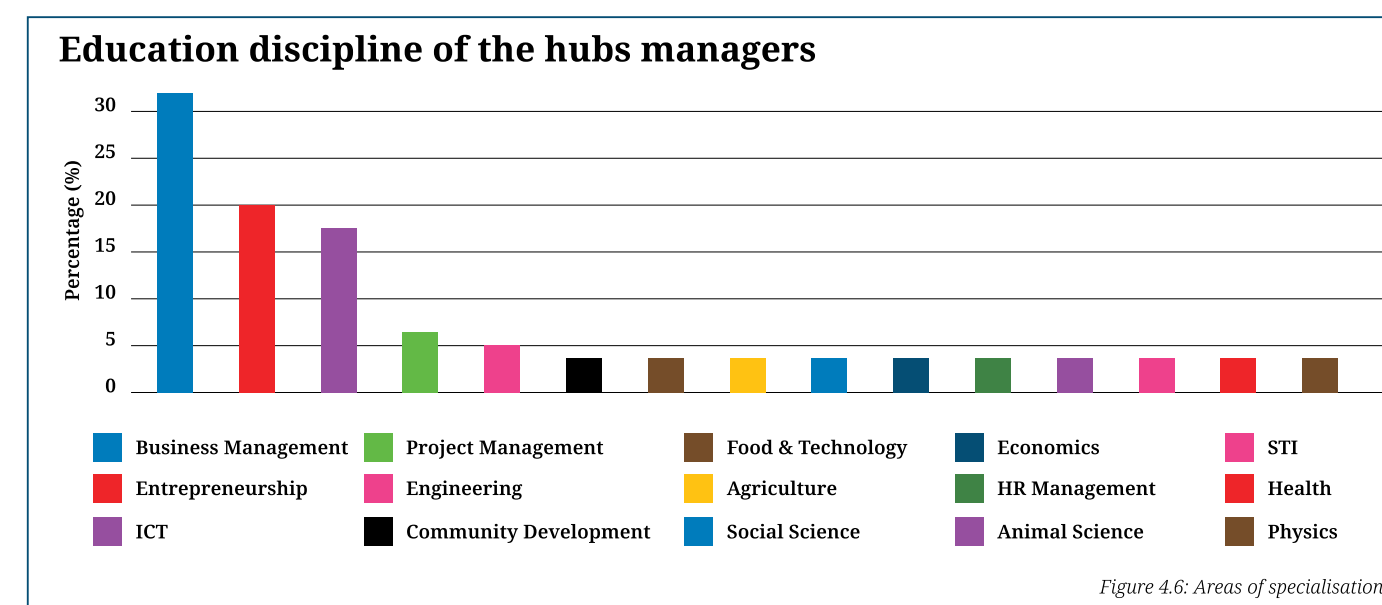


Figure 4.7: Number of employees

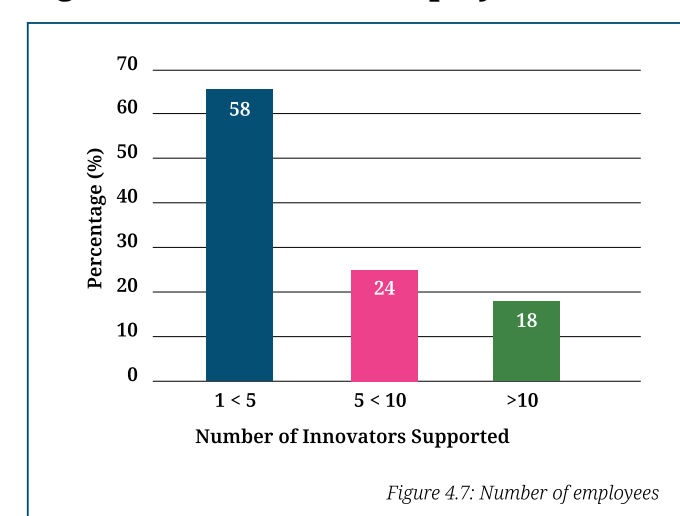


Figure 4.8: Social media presence

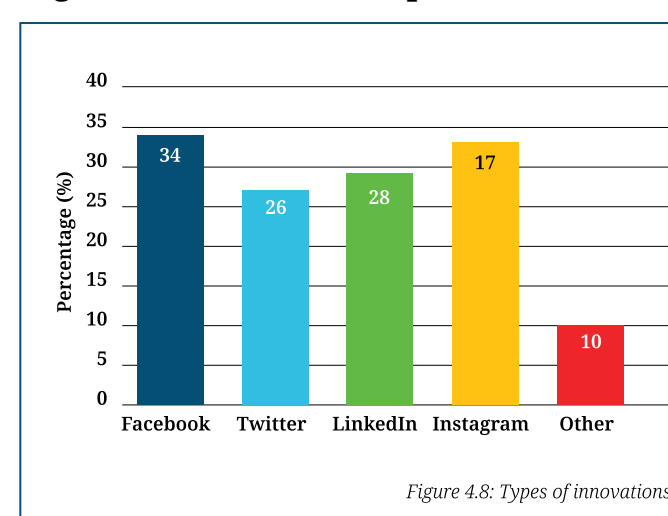
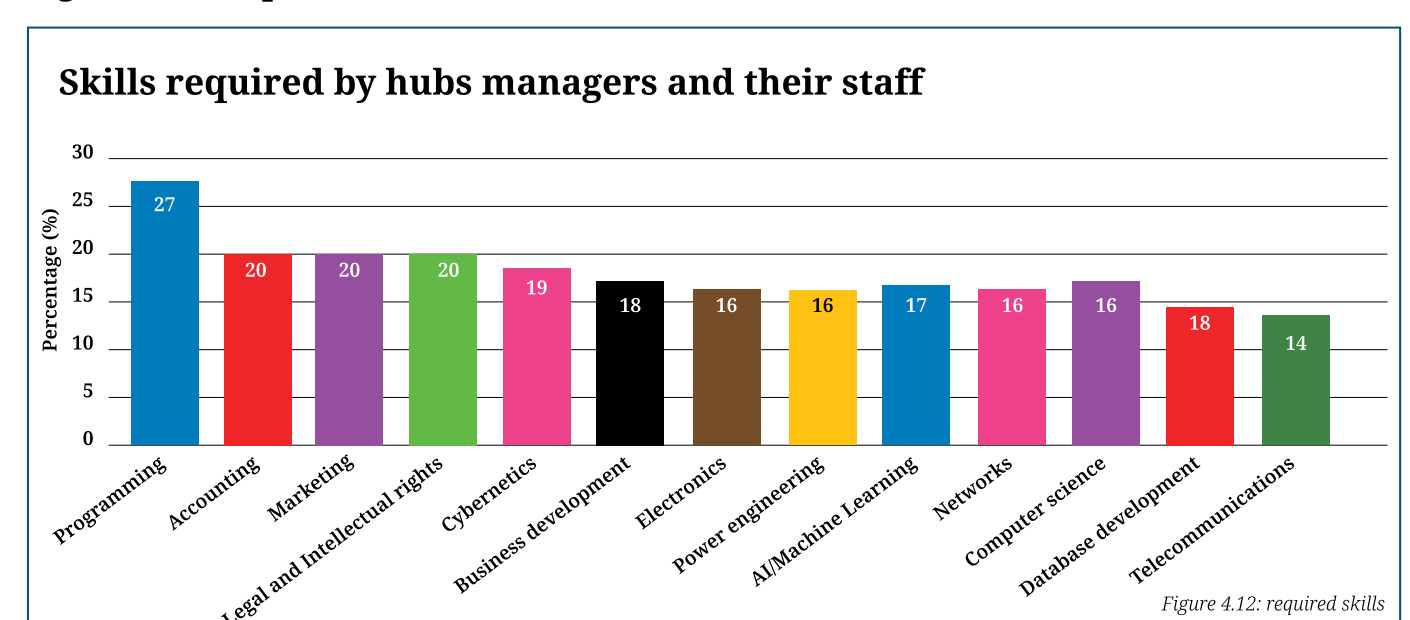


Figure 4.12: required skills





4.4.2. Benefits of collaboration

The hub managers appreciate collaborations and have listed the following benefits derived through collaborations:

- Product improvement and iteration
- Increase access to government services
- Enhanced trustworthiness and recognition of the hubs by innovators
- Closes gaps on areas of inadequacy
- Enhances service delivery
- Gives opportunity for hubs to showcase what they do
- Enhanced access to more market opportunity
- Improved services to innovators

This provides justification for investment more resources and efforts to enhance collaboration amongst the key actors in the Kenyan innovation ecosystem

4.4.3. Suggestions for strengthening collaboration

The hub managers provided the following suggestions and recommendations on how collaboration with government and other entities can be enhanced:

- Mobilize funding for more networking events and opportunities.
- Create more awareness on the importance of innovators and hubs to the innovation ecosystem and by extension the socio-economic development of the country.
- There need to be a dedicated fund for hubs and innovators in the national budget.
- More recognition by government of the important role of innovators and innovation hubs.
- Provide more opportunities for meaningful and practical collaboration between academia an innovation hub such that the former can identify projects being implemented at the hubs for further research and improvement while hubs can commercialise research outputs from the latter.
- Document, showcase and share success stories of innovators and hubs.

Traditionally, policy makers require evidence for policy and decision making. Therefore, the suggestions of documenting, showcase and share success stories on the role of the innovation hubs and their contributions to the economic growth of the country is desired. This, together with awareness creation, are important strategies that can help unlock more resources to the sector. Table below:

4.6. Enhancing support for innovators - from the perspective of hubs managers

According to the managers of the hubs, innovators face several challenges which include but not limited to lack of trainers and facilities, funding, over-dependency on handouts from humanitarian efforts over many years, lack of market and opportunities to showcase their products, inadequate infrastructure, and weak collaboration amongst the innovators. To enhance support to innovators, hub managers proposed the following recommendations: provide and/or create more awareness of existing funding avenues and how to access the funds; invest more in infrastructure that supports innovators; create more opportunities for networking and partnerships; build the capacity of innovators through training, government support, enact policies conducive for innovation, and enhance national and county-level legal and regulatory frameworks.

Based on their practical experience and lessons learned, the managers shared the following perspectives for successful support of start-ups: skills training and funding for innovators is critical, supporting more innovators - whether skilled or unskilled - is paramount, cooperation and collaboration within the industry is crucial to success, patience with innovators is necessary as different innovators require different resources and skill trainings, and communication skills is important for pitching. Figure 4.14 shows general feedback based on the experience of the hubs managers

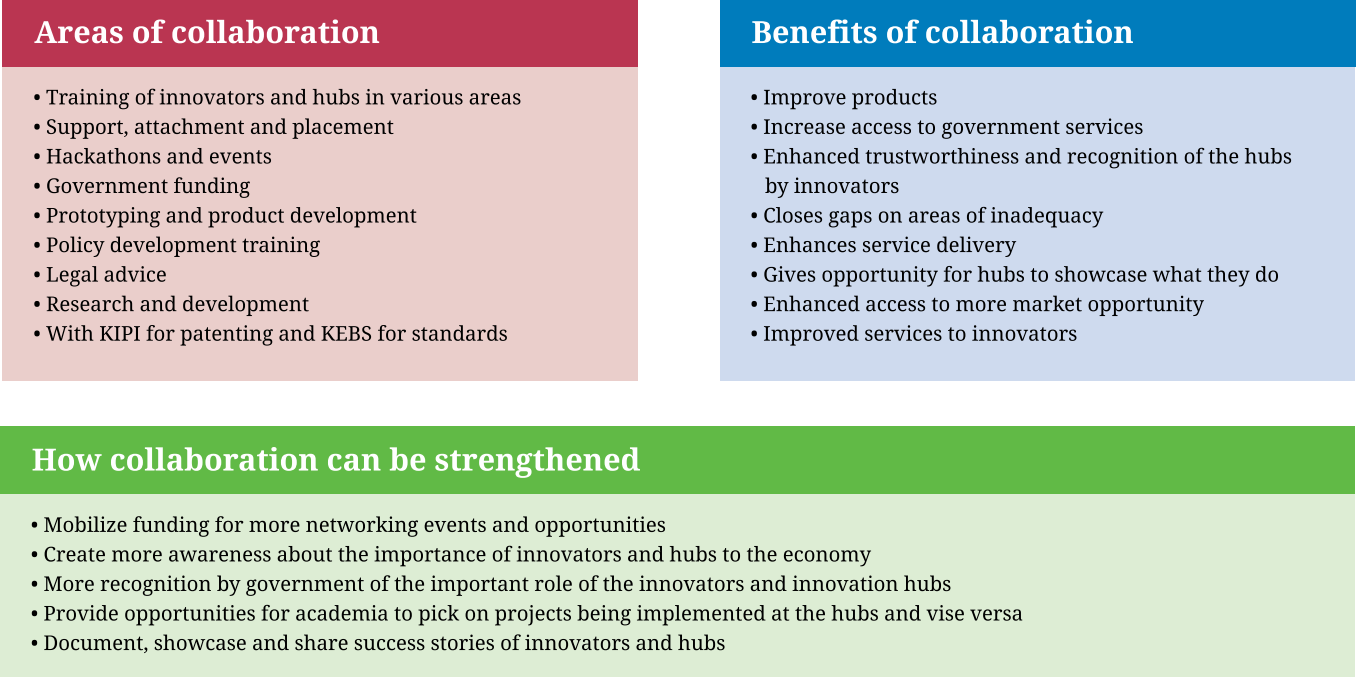


Figure 4.13: Areas and benefits of collaboration with the government entities



Figure 4.14: Experience of the hub managers with start-ups



4.7. Funding, Policy, and Legislation, and KEBS Certification

4.7.1 Funding of hubs

- About 52% of the hubs have received funding compared to 41% that have not received.
- The hubs that received funding sourced them from: The Ministry of ICT, Innovation and Youth Affairs, European Union (EU), GIZ, Slovak Aid, Google, AfriLabs, Dutch Cino, National Environment Fund (NETFUND), IFRCs (International Federation of Red Cross), Media Council of Kenya, Kenya Youth Employment Opportunities Project (KEYOP), United Nations Development Programme (UNDP), Constituency Development Fund (CDF).
- Almost 60% of the NGO-managed hubs received funding for their work, while 100% the privately managed hubs had mobilized resources from their partners, friends, and relatives.
- Majority of the hubs (85%) indicated that they did not have access to funding opportunities to expand their services to the innovators. Only one hub indicated being funded to expand its services, but which were ring-fenced to support specific innovators for specific programs.

4.7.2. Policy and legislative framework

In terms of government support, 60% of the hubs consider the regulatory framework (laws, tax incentives, policies) unsupportive to their operations. They are of the opinion that the regulatory framework is more tax-centred as opposed to incentivizing the sector. In addition, they feel that the government does not provide adequate funding for innovation and the innovation ecosystem. The hub managers therefore proposed the following changes to be made on the regulatory environment that would make their support to innovators more effective: affordable licensing regime, develop support systems at the county levels, reduce bureaucracy and legal bottlenecks to access essential services like funding and infrastructure, and initiate awareness campaigns on policies in innovation.

4.7.3. KEBS Certification

Only 37 % of innovations associated with the hubs have been certified by KEBS. The main challenges facing the hubs in getting KEBS certification for innovations associated with them include prohibitive cost of certification, lack of local KEBS offices in rural regions, long and complex process, and lack of relevant information about the process of certification.

4.7. Co-working space

Twenty-three(23) co-workingspaces were interviewed. The key findings are briefly presented in this section.

4.7.1. General characteristics of the co-working spaces

- From the field study, the general characteristics (Figure 4.16):
- a) **Organization type:** Majority (70%) are private entities.
 - b) **Gender:** 83% of the organizations are male led.
 - c) **Education:** Most of the managers (87%) of the co-working spaces have degree level of education.
 - d) **Skills:** Only 33% of the respondents rate the skills of their staff as adequate and prioritize legal expertise as well as marketing and networking skills are those required most by their staff.

4.7.2. Market analysis for co-working spaces

The bulk of the co-working spaces target individual innovators/start-ups, and 74% rate the demand for their services as good and very good. Furthermore, 83% of the respondents indicated that inability to meet all the needs of the innovators. According to the respondents, the services required most by the innovators are financial support, marketing and brandings, ICT infrastructure & Internet, legal and IP rights support, and mentorship. Furthermore, analysis will explore the 26% of the respondents who consider the demand for co-working space low.

Hubs with KEBS certifications & challenges of obtaining certification

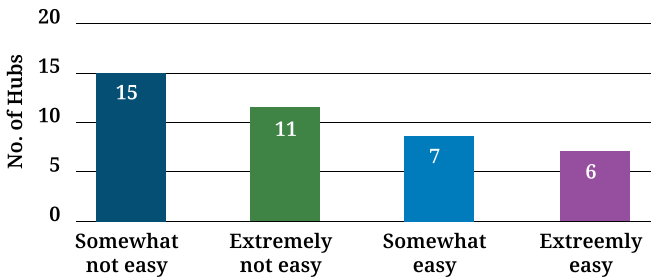
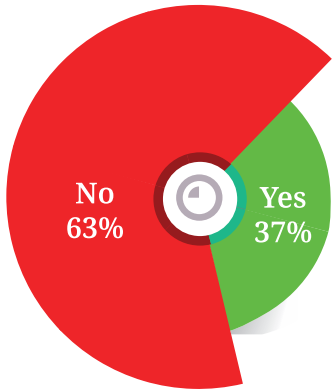


Figure 4.15: Hubs with KEBS certifications and challenges of obtaining certification

4.7.3. Collaboration

About 74% of the respondents are involved in collaboration with other partners in the innovation ecosystem and majority (72%) indicated that they receive sufficient support from partners through collaboration. Some of the support they received are financial and credit linkages, networking and training, capacity building, and access to information.

However, they listed the following challenges they face while forging collaboration and partnerships: lack of confidence in innovators and hubs by foreign investors, difficulties in aligning interests of partners, and inadequate financial resources to support collaboration activities such as workshops and mentorship programs.

4.7.4. Success Factors for Start-Ups

- The managers of co-working spaces identified the following as specific features of innovators that succeed in the co-working spaces:
- a) Innovators who have completed studies and without jobs respond better than those still in school or employed.
 - b) Those with high networking skills to link with collaborators and other networking platforms.
 - c) Innovators that have set goals and have a positive attitude tend to be more successful.

4.7.5. Challenges

Amongst the key challenges the co-working spaces face include skilled staff, limited capacity of space, funding for innovations, limited ICT infrastructure, limited business development skills.

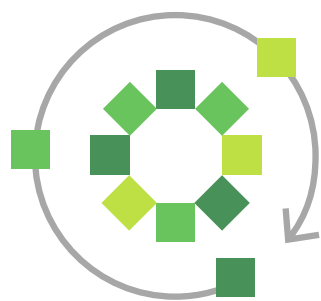
4.8. Academia Innovations Labs

Useful information has been obtained on the following: level of education and educational background of the hub managers, area of focus of the labs, adequacy of skills of the staff of the labs, services provided, target clients, and adequacy of services. The field study also documented challenges faced by the academic innovation labs. Some key observations are described in this section.

4.8.1. General Characteristics of the academia innovation labs

- From the field study, the general characteristics:
- a) Most of the managers of the academic innovation labs have PhD and MSc level of education and are drawn from the academic staff.
 - b) Most of the labs focus EdTech, Ecommerce and AgriTech.
 - c) Most of them target internal innovators although a few provide support to external innovators too.
 - d) About 72% indicated that they are not able to provide all the needs of the innovators.





Amongst the key challenges the co-working spaces face include skilled staff, limited capacity of space, funding for innovations, limited ICT infrastructure, limited business development skills.

Dominant Characteristics of Co-working spaces

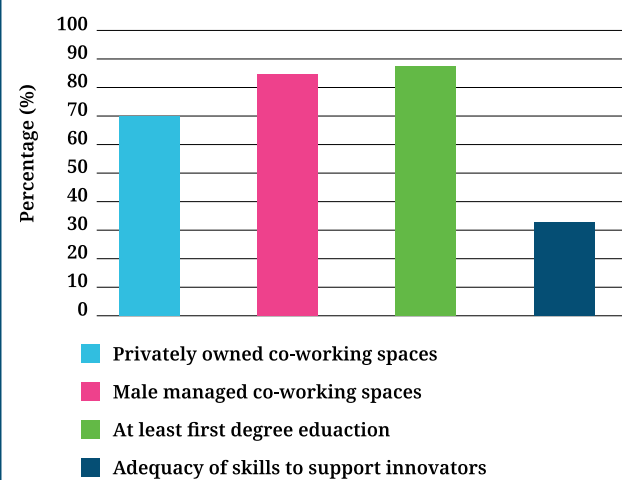


Figure 4.16: Characteristics of the hubs

Age bracket of hubs managers

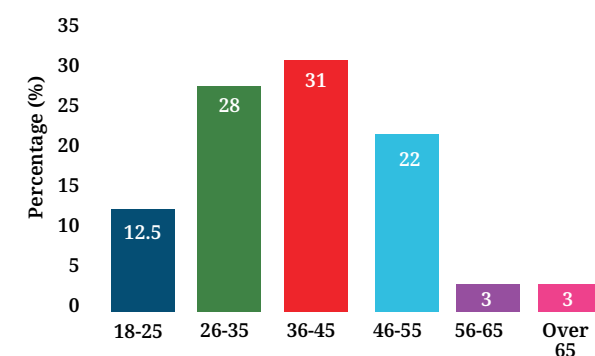


Figure 4.15: Ages of the hub managers

Level of Education of the Hubs Managers

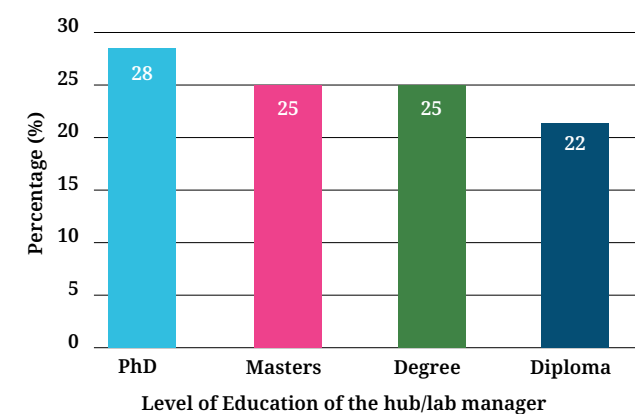


Figure 4.16: Level of Education of the Hubs Managers

4.8.3. Challenges

Among the key challenges the academic innovation labs face include low response rate, limited number of trained staff to run innovation labs, lack of innovation commercialization skills, poor uptake of innovative solutions, most of the existing legal personnel do not have experience on intellectual property rights, inadequate institutional support towards intellectual property development, and lack of enough resources to support innovation development and commercialization.

Amongst the key areas the academia innovation labs require support include funding for R&D and innovation and start-up development, forging linkages with industrial sector and within the innovation ecosystem, human capital development, opportunities for research, technology, and innovation in emerging technologies, access to market, capacity building and IP management.

4.9. Government Agencies

Various government departments at the county level were interviewed. These included county government departments such as ICT departments, trade and industry, gender, youth and social services, agriculture, education, and interior security. In total 32 such county units were reached. 29 of the respondents were University graduates. The following are the highlights of the findings and observations from the respondents.

4.9.1. Areas of innovation

They perceive agriculture, ecommerce, health, education, and finance as the five top areas where most innovations are developed. They believe that this is informed by the government's prioritization of these sectors in the recent past (including the big four agenda), as well as the rapidly growth witness in the digital sector. Majority (75%) shared that the innovation ecosystem in Kenya is still at infant stage.

4.9.2. Support to innovators and hubs

The respondents prioritized marketing, networking, legal and policy management, and financial management, as the five top skillsets required by innovators and agree that government's support to the ecosystem should target these skills. They have also listed specific ways in which the government can support innovators: skill development training, promoting their goods and services, linking them with relevant authorities for training and exhibitions, and giving support to start-ups on development through provision of internet thus making it easy for youths to access resources.

Furthermore, majority of the respondents (65%) found existing infrastructure to support innovators to be inadequate. They listed the following government infrastructure that support Kenyan innovators: Ajira digital, Kazi Mtaani, National Industrial Training Authority, National Optic Fiber backbone interconnection, the Huduma Whitebox, Konza Technopolis, and Huduma center. This existing infrastructure have contributed to the development of the innovation ecosystem in Kenya in the following ways:

- provided room and access to internet for youth who produce creative projects.
- enabled sharing of ideas and training at the centers.
- provided space and environment for innovation.
- Provided innovators an opportunity to advance their knowledge.
- Allowed government to embrace innovative approaches to service delivery.

Government officials also highlighted government support to innovators and other key actors in the innovation system as follows: infrastructure development, skills development through trainings, funding through YEDF, NEF, NGAFF and Uwezo Fund, access of loans and reduce tax rate, and the establishment of Kenya Innovation agency.





4.9.3. Policy environment

Majority of the respondents (61%) believe that the existing policies and regulations are adequate to positively impact on the innovation ecosystem. They mention, for example, the Science, Technology, and Innovation Act No. 28 of 2013, Vision 2030, Africa Agenda 63, National ICT policy, draft Digital Economy Strategy, draft STI policy (2020) and the draft Start-up bill. However, policy implementation remains a challenge. as does technical support to help innovators realize their potential, weak entrepreneurial culture, and adequate public participation. The respondents also listed enabling policies enacted by the government to support financing of innovations/start-ups in Kenya which include Economic Stimulus Initiative, Kenya Youth Employment Opportunities Program (KYEOP), Micro, Small and Medium Enterprises Development (MSMES), Kenya Youth Development Policy, the Science, Technology, and Innovation Act No. 28 of 2013, and National ICT Policy of 2019.

The respondents proposed several ways through which the gaps can be addressed. These include enforcement of the policies, engagement of policy makers, experts, influencers and stakeholders, budget allocation, and establishment of rural industrial park and innovation centres.

4.9.4. Challenges and Interventions

The government officials identified challenges facing innovators in accessing relevant infrastructure to support their ventures as follows: lack of awareness, lack of access to the available infrastructure, insufficient education, unreliable power, and inadequate mentorship programs. As a result, they proposed the following interventions to address these challenges:

- Revive and revamp constituency innovation hubs and youth empowerment centres.
- Promote and support partnership with other institutions in public engagements and trainings.
- Subsidize the cost of raw materials and other inputs for start-ups.

- Ensure consistent information flow relevant to innovation, innovators, and start-ups.
- Map and document innovations and start-ups.
- Coordinate innovation linkages.
- Raise awareness on the existence of and services offered by innovation hubs to the public.
- Provide incentives to investors supporting innovation hubs;
- Provide dedicated financial support to spur innovative efforts

In addition to the above, it would be important for the government to explore specific ways of incentivising innovators and start-ups.

They can include self-certification, income tax exemption for a period of 3 consecutive years and exemption on capital and investments above Fair Market Value, easy winding of companies, fast track patent application with up to 80% rebate in filling patents, easier public procurement norms: e.g., exemption from requirement of earnest money deposit, review prior turnover and experience requirements in government tenders .

According to the government officials, the government can fuel the development of entrepreneurial culture in Kenya by provision of subsidies, building the capacity of innovators through trainings, providing linkages with donors, supporting commercialization of innovations, organizing innovations events/competitions, facilitating access to funds for the youth and other vulnerable groups in the community, creating linkages with business partners for exchange of experiences and knowledge transfer. They also mentioned other interventions by the government to promote the development of innovation culture in Kenya: lowering taxes and offering tax reliefs to innovators, investing in trainings and skills transfer, investing in infrastructural facilities that support innovation, enhancing linkages, networking, collaboration, and funding.



4.10. Networks and Marketing Organizations

The study interviewed 24 networks and marketing organizations. The following are the highlights of the findings:

Further, the managers of the networks and marketing organizations made the following recommendations and observations:

- Having a clear marketing and pricing strategy as well as having an innovation strategy that provides a clear roadmap for commercialization, are some of the attributes that make some innovators succeed.
- Collaboration and partnership are an important source of support for these organizations. Through collaboration and partnership, they can get grants, capacity building through workshops, technical support, advice on policy issues and regulations, and extension support services

- To strengthen the Kenyan Innovation Ecosystem, the government and other support systems should intervene as follows:
- Provide funds specifically for innovators.
- Create safe and free environment for innovators.
- Provide training and coaching start up innovators.
- Develop good policy framework and legislating favourable laws that are supportive to innovators.
- Improve communication networks accessibility to national innovation institutions
- Improve communication networks accessibility.





Highlights of the findings on co-working spaces

Finding	Characteristics	Key Findings
1	Services offered to innovators	Leading services offered were training, ideation, incubation, advertisement and marketing, capital linkages and networking, prototyping, marketing, digital skills training, and product development
2	Services innovators need most	The top five services required by innovators are financial support, marketing services, technology and training, legal and IP rights services and management services
3	Staff Skillset	Majority of the Organizations (73%) rated staff skillset as inadequate and satisfactory. The main skill gaps are legal and IP training, business development, communication, and marketing
4	Age of the organizations	The bulk of the organizations (75%) were registered during the last 10 years (2011-2021).
5	Gender distribution	In terms of gender distribution, only 39% out of the 24 networks and marketing organizations are women originated or led.
6	Use of social media	The most embraced social media tool for business was Facebook (43%). Followed by Twitter (20%), Instagram (16%) and Linked In (14%).
7	Level of education	Most of the managers of the networking and marketing organizations are first degree holders (12), followed by Masters (8) and Diploma (3).
8	Type of Entity	Majority (62%) were private entities and (38%) were public.
9	Meeting Innovator needs	62% indicated that they were unable to meet innovators' needs.
10	Skills Gaps	Networking and marketing, financial support, capacity building, incubation space & legal and IP rights training.



A locally manufactured drone by Swift Lab



CHAPTER FIVE

Conclusions & Recommendations

5.1. Introduction

This study sought to generate evidence that can be used to develop interventions to strengthen the Kenyan Innovation Ecosystem. This overall objective was realised by pursuing the following specific objectives through desk study and field data collection.

- Establish the status of the Kenyan innovation ecosystem across the country: characteristics, organization (players and actors), challenges, and opportunities. Findings would be disaggregated per region, sector, and demographics.
- Identify key levers and approaches on how to stimulate the sector for more economic growth towards achieving key development agenda items (SDGs, Vision 2030), including requisite skill sets, partnerships, and resources.
- Highlight emerging themes and opportunities for collaboration, partnership, and cross-learning.

This section presents the conclusions and recommendations derived from the findings that could be pursued to strengthen the Kenyan Innovation Ecosystem

5.2. The Status of Kenyan Innovation Ecosystem

5.2.1. Key players in the Kenyan Innovation ecosystem

Conclusion 1: Kenya has a reasonably well-defined innovation ecosystem, with the key building blocks already in place. The clear identification of these building blocks provides a good foundation for interventions geared towards improving the ecosystem.

The building blocks of the Kenyan Innovation Ecosystem include: innovation producers (universities and research institutions, areas of innovation); innovation consumers (Start-ups, SMEs and large industries), innovation and business support systems (hubs, incubators), innovation governance structures (NACOSTI, KENIA, NRF, KIPi, KECOBO, Konza

Technopolis and KEBs), innovation support policies and legislations (STI Act 2013, IP ACTS 2001, STI Policy 2020, Start-up Bill, 2020) and Innovation Financing (GoK, NGO, development partners, banks and angel investors). Each of these building blocks has their own unique challenges that needs to be addressed and opportunities that needs to be tapped to improve the Kenyan innovation ecosystem. This provides a good starting point for formulation of interventions for the sector's growth.

5.2.2. Performance of the Kenyan Innovation Ecosystem

Conclusion 2: Regionally Kenya ranks amongst the best performing countries with regard to the status of her innovation ecosystem. However, globally, Kenya is lagging. This is evidence that more work needs to be done to harness the opportunities and benefits accruing from an innovation driven economy.

There is evidence that regionally the Kenyan innovation ecosystem is amongst the top in Africa. For example, the Global Start-up Index Ecosystem Index 2021 and the Global Innovation Index 2021 rank Kenya at position 3 after South Africa and Mauritius. However, globally, the two reports place Kenya at position 61 and 85 respectively. As per the Global Start-up Index Ecosystem Index 2021, Kenya compares poorly with countries it traditionally benchmarks with such as China (which is ranked number 7), India (20), Brazil (24), South Africa (48) and United Arab Emirates (25). This clearly demonstrates the opportunities ahead and the need for Kenya to put more efforts to strengthen its innovation ecosystem especially in improving existing innovation infrastructure, talents and skills, and access to investment finance.



5.2.3. Key drivers of global Innovation Ecosystem

Conclusion 3: The four key drivers of global innovation ecosystem relevant to the Kenya are: **openness and collaboration, support to start-ups, public services (infrastructure) and innovation culture.**

There are gaps in the Kenyan Innovation Ecosystem (KIE) with respect to key drivers in this space. Currently, the level of collaboration amongst the key actors in the KIE, the government's support to start-ups, availability of infrastructure, and the existence of an innovation culture is inadequate.

5.2.4. Historical perspective of the Kenya Innovation Ecosystem

Conclusion 4: The development of the Kenyan innovation ecosystem has been driven by the efforts to realize industrialization in Kenya. Therefore, adopting a whole of government approach towards innovation ecosystem development is key to the growth of the innovation ecosystem.

5.2.5. The Vision of the Kenya Innovation Ecosystem

Conclusion 5: Despite having multiple policy documents in place, Kenya does not currently have a common coherent strategy and vision for the innovation ecosystem. Nevertheless, it would appear that the Kenyan innovation ecosystem is inspired by Vision 2030. This being the case, therefore, it is important to develop a coherent stand-alone innovation policy and strategy.

5.2.7. Coordination and governance

Conclusion 6: Although there are adequate coordination and governance structures for the Kenyan innovation ecosystem, their capacities to provide effective support to the ecosystem are limited by human and financial resources. Furthermore, coordination with the other agencies like ICT Authority, which is driving digital innovations, as well as ministry of trade, industrialization and enterprise development is weak.

The STI Act (2013) has provided for the establishment of three agencies to spearhead science, technology, and innovation in Kenya. These are NACOSTI, NRF and KeNIA. These institutions are still at their early stages of establishment and have not yet build adequate human and financial resources to deliver on their mandates. Furthermore, there is inadequate collaboration with other agencies driving innovations such as those under ministries of ICT and youth as well as those of trade, industrialization, and enterprise development.

5.2.8. Talents and Skills

Conclusion 7: There are talent gaps in terms of numbers and quality in addition to the right skills for innovation development and commercialization of innovations as well as managing of innovation hubs. Strengthening of skills and talents is one of the areas that Kenya will need to invest in more to strengthen the Kenya national innovation ecosystem. Investment in skills and talent will contribute to enhanced Kenyan innovation performance in future ranking.

5.2.9. Infrastructure

Conclusion 8: Kenya has made great strides in improving its ICT infrastructure, which is a key driver of innovation and a key component for strengthening the innovation ecosystem. This includes expansion of National Fibre Optic Backbone Infrastructure across all the 47 counties, establishment of the National Data Center and increasing access to electricity.

However, 83% of the country still lacks broadband services and the quality of broadband services manifests in low-speed connections and poor reliability. Access to electricity, which is an important component for innovation and development of start-ups, was at 70% in 2019, behind China, Ghana, Morocco, Singapore, and South Africa. Rural access to electricity stands at 62 % with urban access at 91 %. Morocco, Singapore, and China are amongst the benchmark countries with almost 100% rural access to electricity.

5.2.10. Growth of the Kenyan Innovation Ecosystem

Conclusion 9: There is evidence that the Kenya innovation ecosystem is growing.

The indicators that demonstrate the growth of the Kenyan innovation ecosystem are robust labour market, market environment, hubs, activeness of the ecosystem, ICT, capital and resources, policy and regulation, university-industry linkages, economic performance, as well as technology diffusion and adoption systems. Regionally, Kenya is performing well in these indicators and is currently ranked second best after Nigeria in terms of labour market, start-ups market environment, hubs activities and attraction to start-ups investment capital.

5.2.11. Disparity in the Kenyan Innovation Ecosystem

Conclusion 10: Despite the rapid growth of the Kenyan innovation ecosystem, there is disparity in the distribution of the benefits of the innovation in the country between rural and urban centers.

This is due to existing disparity between rural and urban areas in terms of access to internet, infrastructure, digital skills high level of poverty, innovation activities. Furthermore, the participation of women in the Kenyan innovation ecosystem is low compared with men as reflected by the low number of women led start-ups and women-managed hubs.

5.2.12. The Funding Landscape in Kenya

Conclusion 11 (Funds raised and by whom): Kenya is increasingly becoming an attractive destination for investors in start-ups. During the last five years, the amount of money raised by Kenyan start-ups has increased from USD 40 million in 2017 to USD 280 million in 2021 while the number of start-ups attracting investments has increased from 40 to 86, during the same period. Regionally Kenya is amongst the top five in terms of funding attracted and the number of start-ups involved. For example, in 2021 Kenya had 86 start-ups, while Nigeria leads the pack in terms of the number of start-ups supported at 156, followed by Egypt (105), South Africa (85).

Conclusion 12 (Main players in funding and the sectors funded): The top ten Kenyan start-ups in terms of volume of money raised are M-Kopa, Twiga Foods, Copia Global AZA Finance, Sendy, Lendable, Little Cab, African Talking, PayGo, and Gro Intelligence. Most of these firms are foreign owned or joint ventures with foreign nationals. This is not necessarily a bad thing since it provides opportunities for local innovators to create diverse teams for their start-up development. It is also a useful information for developing a strategy for the innovation ecosystem. Egypt, Nigeria and South Africa provides opportunities for Kenya to benchmark with within the region. Not all sectors prioritised by Kenya, have attracted funding for start-ups. Artificial Intelligence, Agriculture, Fintech, Energy, and E-commerce were the top four best funded sectors in Kenya, while sectors like health, housing, water, and sanitation attracted less.

Conclusion 13 (Untapped funding opportunities): There are some potential sources of funding, which have not been adequately exploited by the Kenyan innovators. These include the Ajira Youth Innovation Fund; Youth Enterprise Development Fund, Acumen Fund Kenya, Africa Tech Ventures, DoB Equity. There is need to develop an information portal that can support innovators to create awareness about these opportunities. Although bonds and local angel and venture capital avenues of funding are still low, they are viable options.

Meanwhile, the government should look at the possibilities of restructuring existing funds. For example, the Youth Fund still require collaterals like Title Deeds, Logbooks, and healthy bank statements which innovators may not have. The funding ceiling is also too low at Kes 100,000 Kes to Kes 1 million. These bottlenecks should be revised.



5.3. Mapping of the innovators

5.3.1. General Characteristics of start-ups

Conclusion 14 (age and level of education): The Kenyan innovation ecosystem is driven by youthful and well-educated innovators and entrepreneurs, with formally registered start-ups. This bodes well for the sector. However, in terms of gender distribution, women are lagging with only 22% of the start-ups being women-originated or led.

Conclusion 15 (Registration status): Unlike traditional MSEs which are largely informal enterprises in Kenya, majority (74 %) of the start-ups are formally registered.

This makes it easier to identify and monitor their growth and develop targeted interventions. However, the bulk of these start-ups are early-stage business enterprises (less than 3 years old) and micro-enterprises (with less than 5 employees). Their survival and sustainability should be a cause for worry.

Conclusion 16 (role of education on innovation): There is evidence that the educational disciplines of the innovators influence the type of innovations developed and the success of commercialization. This makes it possible to develop a strategy that can support generation of innovations in prioritised sectors of the economy.

5.3.2. Market for Innovations

Conclusion 17 (sectors targeted): Most of the innovations are linked to prioritized sectors of the Kenya economy, namely e-commerce, agriculture, energy, health, education, water, and finance. However, there are few innovations addressing sectors such as manufacturing and housing.

Conclusion 18 (Market as a driver for innovation): There is evidence that most of the innovations are market driven. Most of the innovators (78%) rated the markets for their innovation as 'good and very good', a clear indication that these innovations are providing solutions that are missing and therefore demand driven. Therefore, the deployment and upscaling of some of these innovations has the potential to impact positively on the economy.

5.3.3. Challenges of Start-Ups

Conclusion 19 (Inadequate skills): Most of the start-ups do not have adequate skills to effectively manage their businesses. The top-most-rated skills required by the innovators and the employees of the start-ups are marketing, legal and intellectual property management, business development, and data base management. This points to the need for capacity building of the start-ups in the identified areas.

Conclusion 20 (Intellectual Property Rights): Protection of innovations through intellectual property rights remains a challenge for most of the start-ups. Only 40% of the innovators had tried to protect their innovations. The main reasons cited for this are: lack of proper information on intellectual property, lengthy and time-consuming patent application process, high cost of patents applications and maintenance, and infringement due to weak enforcement. There is need to provide support to innovators in this area.

Conclusion 21 (KEBS Certification): Similarly, certification of innovators product is a challenge. Only 28% of the start-ups have received KEBS Certification, mainly due to high costs associated with access to certification services. It is important to note that intellectual property rights and KEBS certifications are important tools for commercialization of innovations; interventions in this area should be encouraged and supported.

Conclusion 22 (Funding of innovation development and commercialization): Access to funding remains one of the top challenges of start-ups. Only 31% of the start-ups have received funding, mainly grants (59) and loans (41). It appears that access to equity funding is still limited and yet it is the most sustainable funding mechanism for innovation ecosystem. Furthermore, it appears that most early-stage start-ups rely on grant funding and gradually, as they grow, their capacity to attract loans increases. Meanwhile, there is indication that the higher the educational level of innovators the higher the chances of attracting funding. Agriculture, health, energy and education are the four top sectors attracting start-up financing. Interventions in start-up financing should be part of any innovation ecosystem development strategy.

Meanwhile, the government should look at the possibilities of restructuring existing funds. For example, the Youth Fund still require collaterals like Title Deeds, Logbooks, and healthy bank statements which innovators may not have. The funding ceiling is also too low at Kes 100,000 Kes to Kes 1 million. These bottlenecks should be revised.

5.4. Mapping of the innovation hubs

5.4.1. General Characteristics of Hubs

Conclusion 23 (Disparity): There is evidence of disparity in distribution of hubs in the country. Out of 148 hubs mapped, 68 (46%) are in Nairobi. Indeed, the top nine counties - Nairobi, Mombasa, Uasin Gishu, Kisumu, Nakuru, Nyeri, Machakos, Garissa and Kiambu account for 74% of the total hubs in Kenya. The remaining 30 counties have between 1 and 3 hubs. This is a disadvantage for innovators in these counties with fewer hubs.

Conclusion 24 (Differentiation of Services): The main services provided by the hubs are skills development, marketing and networking, mentorship, maker spaces and small-scale manufacturing, prototyping and ideation, research, and market analysis. Interestingly, evidence shows no clear distinction in terms of services offered by accelerators, incubators, co-working spaces, and maker spaces. For urban areas, endowed by large number of hubs, there is merit for specialization of services by accelerators, incubators, co-working spaces, and makers spaces to enhance the quality of services provided to the innovators. However, for rural areas, not well endowed with hubs, consolidation, and creation of a one-stop-shop for the innovators could make more sense.

Conclusion 25 (Public or Private led): Currently the Kenyan innovation hubs segment is dominated by the public entities and the NGO sector (70% of the hubs), while the private sector accounts for only 30%. This demonstrates government increasing support to the innovation ecosystem. However, the involvement of the private sector is important for long term sustainability.

Conclusion 26 (Age, gender, and level of education): The current management of hubs in Kenya is dominated by well-educated youth, with 78% having at least a degree level of education, while 64% are less than 35 years old. This is positive since it is in line with Kenya government's efforts of promoting job creation through youth innovativeness and creativity. Most of the managers of the hubs (84%) are male, which points to gender disparity in the innovation ecosystem.

Conclusion 27 (Specializations of hubs managers): Business management, entrepreneurship, ICT, project management and engineering are the top five specializations held by the hub managers. It can be concluded, therefore, that these five areas of specializations are important in driving the growth of innovation hubs in the country. This can form the basis for developing a growth strategy for innovation ecosystem.

5.4.2. Capacity of The Hubs to Offer the Services to Innovators

Conclusion 28 (Level of operation): Data analysis showed that around 50% of the hubs had supported less than 10 innovators/ start-ups since their registration. This illustrates a micro-scale level of operation, compared to the possible number of start-ups that may require such services. Scaling up the operations of these hubs will be necessary to enhance outreach.

Conclusion 29 (Capacity to provide services): There is evidence that most of the hubs do not have adequate capacity to meet all the needs of the innovators. The five top skills gaps for the managers of the hubs include are: programming, accounting, marketing, legal and intellectual property and cybernetics. It can therefore be concluded that capacity building of hub managers and their staff is an important intervention in strengthening the innovation ecosystem in Kenya.





5.4.3. Collaboration and impact of hubs

Conclusion 30 (Collaboration with other agencies): There is evidence of collaboration of the hubs with other government agencies and that such collaborations bring benefits to the hubs. However, the level of collaboration is inadequate. Networking events and opportunities are not regular while collaboration with research institutions and universities are almost non-existent. Furthermore, there is little evidence of collaboration not only between the hubs themselves but also with other business entities.

Conclusion 31 (Impact of innovation hubs): Traditionally, policy makers require evidence for policy and decision making. Therefore, documenting, showcasing, and sharing success stories on the role of the innovation hubs and their contributions to the economic growth of the country is desirable. This, together with awareness creation, are important strategies that can help unlock more resources to the sector.

5.4.4. Support to Innovators and Success Factors

Conclusion 32 (Support to innovators): As per the hub managers, innovators face several challenges, and they need to be supported to address these challenges. The key challenges are lack of trainers and facilities, funding, over-dependency on handouts from humanitarian efforts over many years, lack of market and opportunities to showcase their products, inadequate infrastructure, and weak collaboration amongst the innovators. To enhance support to innovators, it is important to provide and/or create more awareness of existing funding avenues and how to access the funds; invest more on infrastructure that support innovators; create more opportunities for networking and partnerships; build the capacity of innovators through training, government support, enact policies conducive for innovation, and enhance national and county-level legal and regulatory frameworks. As indicated in the Start-up Bill, 2021, other ways of supporting start-ups can include subsidising the formalisation of start-ups; facilitating the protection of the intellectual property of innovations by start-ups in Kenya and with international organisations; providing fiscal and non-fiscal support to start-ups admitted into incubation programmes under this Act; and providing support in the form of research and development activities.

Conclusion 33 (Success factors): Based on their practical experience and lessons learned, the hub managers shared their perspectives on how to successful support of start-ups: skills training and funding for innovators is critical while supporting more innovators is paramount; cooperation and collaboration within the industry is crucial; patience with innovators is necessary as different innovators require different resources and skill trainings; and finally, communication skills is important for pitching.

Conclusion 34 (Policy and legislative framework): The current regulatory framework (laws, tax incentives, policies) are considered not be supportive to the operations of the hubs as they are more tax-centered as opposed to incentivizing the sector. In addition, innovators and hub managers feel the government does not provide adequate funding for innovations and the ecosystem.

- 1. Development of an innovation strategy
- 2. Coordination and governance
- 3. Talents and skills
- 4. Infrastructure
- 5. Funding
- 6. Openness and collaboration
- 7. Support to start-ups
- 8. Innovation culture
- 9. Policy and legal framework
- 10. Intellectual property and standards
- 11. Disparity within the innovation ecosystem



5.5. Recommendations

Based on the findings and conclusions presented above, recommendations for the strengthening of the Kenyan innovation ecosystem have been proposed based on the following emerging themes:

5.5.1. Development of an Innovation Strategy.

The Kenyan innovation ecosystem currently does not have a stand-alone vision since there is no innovation strategy in the country (Conclusion 5). There is need in the long term for Kenya to develop an innovation policy and strategy to drive the Kenyan innovation ecosystem towards becoming a global leader in the sector (Conclusions 2 and 3). Therefore, the following recommendation is proposed.

Recommendation 1: The Government of Kenya, through the relevant ministries (the Ministry of Education, the Ministry of ICT and the Ministry of Industrialisation) should develop a stand-alone innovation strategy to drive the country from a regional leader to a key player in the global innovation ecosystem. The strategy should provide a clear vision for the Kenyan innovation ecosystem, taking into consideration the existing strengths and opportunities as well as the identified challenges and gaps.

5.5.2. Coordination and Governance

The current capacities of government ministries and agencies responsible for spearheading science, technology, and innovation in Kenya are not adequate to enable them deliver on their mandates (Conclusion 4) and coordination with other agencies driving innovations is weak. To address this situation the following two recommendations are proposed.

Recommendation 2: The Kenya Government in collaboration with partners, should allocate adequate resources to strengthen Agencies and institutions responsible for innovation to enhance service delivery to the Kenya innovation ecosystem.

Recommendation 3: The relevant government ministries and agencies should develop a framework to enhance collaboration amongst all the entities involved in innovation activities to enhance service delivery to the Kenya innovation ecosystem.

5.5.3. Talent and Skills

There is evidence indicating that the available talent and skills is still inadequate drive the Kenyan innovation ecosystem to a globally competitive level. (Conclusions 7, 19 and 29). To meet this gap and ensure that capacity building is undertaken in a coordinated manner, there is need to develop a strategy for talent and skills cultivation for the Kenyan innovation ecosystem. Therefore, the following recommendation is proposed

Recommendation 4: The Government of Kenya through the relevant ministries and agencies in collaboration with other partners should develop a talent and capacity building strategy for the Kenyan innovation ecosystem. The strategy should outline ways and means of building the capacity of innovators and hub managers as well as developing the required pipelines of talents and skilled entrepreneurs.

5.5.4. Infrastructure

Infrastructure, which includes the speed of broadband connection, access to internet and electricity, number of data centers, ICT capabilities, test centers, labs, and other facilities, is a key driver for the innovation ecosystem (conclusions 2, 3, 8, and 9). Therefore, the following recommendation is proposed.



Recommendation 5: The Government of Kenya, through the Ministry of ICT, the Ministry of Industrialization, the ministry of education and the Ministry of Energy, in collaboration with other partners, should continue investing more resources in the development of infrastructure to drive knowledge economy and strengthen the Kenyan the Kenyan innovation ecosystem.

5.5.5. Funding of Innovation Development and Commercialization.

Funding has been identified as a major challenge for the Kenyan innovation ecosystem (conclusions 2, 3, 10-13, and 22). Therefore, the following recommendation is proposed.

Recommendation 6: The relevant Government Ministries and Agencies should develop a funding strategy for Kenyan innovation ecosystem. Such strategy should include the following:

- Establishment of an innovation fund.
- Developing mechanisms for increasing the number of local start-ups that access investment funding.
- Developing an information platform on funding opportunities.
- Developing a mechanism for mobilization of local investors to finance start-ups.
- Providing policy incentives for financing women led start-ups and hubs.
- Restructuring the existing government funding mechanisms for youth, women and SMEs to fund start-ups
- Promoting certification of start-ups through Technology Readiness Levels for the purpose of accessing loan and equity
- Establish a mechanism for equity stake by universities and research organizations as well as hubs in spinoffs and start-ups

- Explore PPP framework for equipping and managing existing government own innovation support infrastructure.

- Financing of IP protection

5.5.6. Partnerships and Collaboration

Collaboration and partnership are important drivers of the innovation ecosystem (Conclusions 3, 24, and 30). In this respect, therefore, the following recommendation is proposed.

Recommendation 7: The relevant Government Ministries and Agencies should develop a mechanism to strengthen partnerships and collaboration of actors within the Kenyan innovation ecosystem.

Such mechanism should include the following:

- Strengthening partnership between start-ups and well-established businesses through sub-contracting.
- Funding partnerships between start-ups, hubs and various government Agencies.
- Strengthening existing networks of hubs.
- Promoting start-ups to start-up business relationships.
- Promoting business and start-ups forums.
- Access to testing and product development laboratories
- Promoting county innovation weeks.

5.5.7. Innovation and Entrepreneurship Culture

An ebullient innovation and entrepreneurship culture is key in driving innovation ecosystem. And although there such culture exists in Kenya; it is not at the level that would drive the county's innovation ecosystem to be globally competitive. (Conclusions 3, 19, 29, and 32). Therefore, the following recommendation is proposed.

Recommendation 8: The Government, through the relevant Ministries should protect and support the existing vibrancy in the innovation ecosystem and promote its continued growth through the relevant government ministries and agencies.

5.5.8. Support for Start-ups

There is need for more support by government and development partners to enable start-ups to grow and compete with their international counterparts. (Conclusions 3 and 32, and 33). Therefore, the following recommendation is proposed.

Recommendation 8: The Government, through the relevant Ministries and agencies in collaboration with other partners should develop a support programme to start-ups.

Such mechanism should include the following:

- Capacity building in areas of skills gaps such as marketing, intellectual property, business development and database management.
- Innovation protection through intellectual property rights.
- Product certifications and standards through KEBS.
- Mentorships and handholding of early stage start-ups.
- Resource mobilization.

5.5.9. Policy and Legal Framework

As alluded to above, the policy and regulatory environment is not conducive for the growth and development of start-ups in Kenya. Policy incentives and conducive legal framework are required to support the Kenyan innovation ecosystem (Conclusions 3 and 34). Therefore, the following recommendation is proposed.

Recommendation 9: The Government, through the relevant Ministries, should review the existing policy and legal framework for business in general and start-ups and hubs in particularly to support the Kenyan innovation ecosystem.

These may include:

- More sponsorship programmes,
- Affordable licensing regime,
- Develop support systems at the county levels,
- Reduce bureaucracy and legal bottlenecks to access essential services like funding and infrastructure, and
- Initiate awareness campaigns on policies in innovation.

5.5.10. Protection of Intellectual Property

Both the start-ups and hub managers have shown that innovators face difficulties in protecting their innovations (conclusions 19, 20, and 29). Therefore, the following recommendation is proposed:

Recommendation 10: The Government, through the relevant Ministries and Agencies, should develop a programme or playbook to support innovators to protect their innovations.

Such Programme should include

- Creation of awareness on the benefits of intellectual property to innovators.
- Supporting with the preparation of patent applications.
- Hand-holding the innovators during the IP process.
- Reduction of fees for protection and maintenance.
- Capacity building on various methods of commercialization of innovation.
- Support the innovators with licensing process.
- Enabling KIPi to speed process by recruiting a larger and more diverse team of researchers



5.5.11. Certification of Innovation Products

Similarly, innovators and hub managers indicated that innovators face challenges in obtaining KEBS standards of quality certification (Conclusion 21). Therefore, the following recommendation is proposed.

Recommendation 11: Develop a programme/ playbook to support start-ups on Certification of innovation products

- a. Creation of awareness on the benefits of standards in accessing markets.
- b. Capacity building on certification processes and procedures.
- c. Hand-holding the innovators during the certification process.
- d. Reviewing the certification fees for start-ups.

5.5.12. Disparity between Urban and Rural Areas

The existing disparity between urban and rural as well as male and female with regard to facilities and opportunities relating to the innovation ecosystem is a concern that must be addressed (conclusions 9 and 23). Therefore, the following recommendation is proposed

Recommendation 12: The relevant Government Ministries should develop a programme to promote the growth of the county-based innovation ecosystem.

The programme should enhance the role of the county government on the following:

- a. Promote innovations in selected country priority sectors.
- b. Work with county-based universities and TVETs to form county-based innovation clusters;
- c. Promote establishment of county innovation weeks.

- d. Ring-fence certain quotas of tenders for local innovators and hubs from the counties. This will create local demand for services/goods of the innovators and make them competitive at national and global level.
- e. Strengthen coordination of existing national innovation Programmes such as Ajira centres; constituency innovation centres and constituency industrial development centers, and county technology development centers;
- f. Development of county innovation plans.

5.5.13. Impact of Innovation Ecosystem

There is need for evidence on the impact and contribution of innovation ecosystem to the Kenya economy to inform decisions by policy makers in favour of the sector (conclusion 31). In this respect, the following recommendation is proposed.

Recommendation 13: a study on the impact and contribution of hubs to national development and use the evidence to lobby for more support for the sector.

5.6. Opportunities for Further Studies

In the post-data collection analytics, and post-study validation processes, the following opportunities for further studies were apparent and may need to be explored.

1. Reasons for women's exclusion from management of hubs
2. The problem of perennial start-ups
3. Activities of start-ups in the post-hub periods
4. Database of all existing innovators
5. Reasons for prevalence of innovations in some economic sectors, away from others



6. Reasons behind non-registration of some start-ups
7. Valley of death and factors behind it
8. Demographic of individual users that most innovations target
9. The role that co-creation plays in development of innovations
10. What need to be done to attract more equity than grants toward innovations; the qualities of an innovation that funders prefer; the tools to rank an innovation according to the qualities.
11. What is the size of the markets for the various types of innovations
12. What is the quantity and quality of maker-space outputs?



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