

Call No. RISA-01-2022, Research and Innovation Systems for Africa (RISA)

Policy Brief

30th August, 2023

Technology Transfer Assistance to Enhance Knowledge Exchange and Technology Transfer between SMEs and HEIs in Nairobi Innovation Ecosystem.

Dr Pamela Mreji: PI, TTASH project, Technical University of Kenya
Prof Alfred I. Orina: Technical University of Kenya
Prof Levi N. Mbugua: Technical University of Kenya
Prof Evans. V. Sagwa: Technical University of Kenya

Executive Summary

Technology transfer and knowledge exchange between academia and industry has long been seen as a key feature of economic development strategy for countries, both in developed and developing world. Despite its potential benefits, the level of knowledge sharing and technology transfer between academia, represented by higher education institutions (HEI) and industry, represented by small and medium enterprises (SMEs) remain minimal in Kenya, constrained by a weak enabling environment and limited capabilities. This policy brief outlines the components of a technology transfer assistance (TTA) model to facilitate effective knowledge exchange and technology transfer between SMEs and HEIs operating within the Nairobi Innovation ecosystem. It outlines a set of strategic policy interventions and initiatives by the government and other stakeholders that can enhance research, technological advancement and commercialization of new innovations through a set of collaborative and cooperative practices. These proposed strategies are aimed at promoting a dynamic innovation ecosystem that can boost entrepreneurial growth and competitiveness towards sustainable development.

Introduction

Kenya's economic development agenda, including its technological development is currently defined under the Vision 2030 economic blueprint, whose objective is to transform Kenya into a middle income, industrialized nation by the year 2030; through accelerated GDP growth, driven by innovation and investments in entrepreneurship and industrial development (GOK,2010).The country's micro small and medium enterprises (SMEs) sector is a vibrant component of its economy, making up to 98% of businesses in the country and contributing significantly to job creation, GDP growth and poverty reduction(CBK,2020). On the other hand, higher education institutions (HEIs) are recognized

worldwide as the primary sources of new knowledge creation through research, inventions and innovation. Facilitating technology transfer between SMEs and HEIs can lead to valuable partnerships in commercialization of new research findings and the development of valuable new products, services and processes that can transform markets and the society at large. A major challenge facing Kenya, specifically is the low capability of SMEs to adopt and assimilate potential transformative knowledge capital; which remained underutilized in knowledge based institutions like universities and research institutes..... Most SMEs in the country suffer structural weakness such as inability to manage technology as a strategic weapon (Were, 2016), as well as low access to funding (Chege and Wang, 2020; Mgendi, shipping and Xiang, 2019), among other barriers that lead to a vicious cycle of unsustainable, low -tech firms that hardly realize their full potential in growth and competitiveness. The RISA project at the Technical University of Kenya sought to champion a Technology Transfer Assistance (TTA) model, based on a quadruple helix approach, to enhance the level of interaction and collaboration between SMEs and HEIs within the Nairobi Innovation Ecosystem (NIE). The project begun with a research phase that mapped out the technology bases of SMEs and HEIs operating within the target innovation ecosystem and explored the main barriers to knowledge exchange and technology transfer between the two entities. The findings were disseminated in a series of stakeholder sessions that culminated in a policy review workshop in Naivasha, whose outcome are contained in this policy brief.

Policy Barriers to Technology transfer in NIE

Barrier #1: Limited interaction and Collaboration between industry and HEIs: SMEs, representing the industry and HEIs often face barriers in initiating collaborations and partnerships due to myths of connecting on the same plain, differences in organizational structures, communication gaps, and lack of understanding for each other's needs.

Barrier #2: Regulatory and institutional Bottlenecks: Cumbersome bureaucratic processes and regulations hinder the smooth transfer of technology and knowledge between HEIs and SMEs.

Barrier #3: Intellectual Property Concerns & Funding: Institutional ambiguity surrounding intellectual property rights discourage SMEs from engaging in collaborative projects with HEIs. Also, the lack of adequate funding for research and development projects has hampered potentials for technology transfer initiatives and commercialization of novelties.

The policy question, its origin and intricacy

The main aim of this policy brief is to disseminate novel policy recommendations to enhance technology transfer and knowledge sharing between SMEs and HEIs in Kenya, based on the findings of the RISA TTASH project at TUK. The main question was how the government and other stakeholders can undertake effective policy implementation in order to promote knowledge sharing and technology transfer between HEIs and SMEs in Kenya. This policy question arises from the recognition that HEIs in Kenya have a wealth of knowledge from research and technological expertise that can be used to support the growth of the industry, including SMEs. However, there is lack of coordinated efforts to create viable interactive and

collaboration frameworks between these two entities, and consequently, SMEs are not able to benefit from technology frontiers and innovation generated in HEIs.



Figure 1: 1st TTASH dissemination workshop in Nairobi

Given that SMEs are the backbone of the Kenyan economy, making up over 98% of businesses, their access to novel technologies is and should be a critical policy focus. The intricacy of this policy question also lies in the fact that there are a number of challenges realized in implementation of current policies that guide Science Innovation and Technology (STI) in the country, that need to be addressed. These include but not limited to the percentage of gross domestic expenditure on research and development (GERD), which currently stands at a meager 0.8% against the global standard of 2% (KIPPRA, 2015), low absorptive capacity of the country in general, poor technological infrastructure, as well as the generally high cost of doing business (GEM report 2018).

Status of Knowledge Exchange and Technology Transfer between SMEs and HEIs within the Nairobi Innovation Ecosystem

Kenya is renowned as one of Africa's most resilient innovation hubs, with technological innovation setups that are greatly attractive to venture capitalists and Angel investors (Ndemo & Weiss, 2013). In particular, the Nairobi Innovation Ecosystem has grown to be a network of individuals, micro small and medium enterprises (MSMEs), corporate organizations, and HEIs that are supporting the development and growth of technology startups across the region; driving some of the recent transformative innovations recognized worldwide such as Mpesa and UShahidi. The ecosystem includes a range of technology hubs, incubators, accelerators, makerspaces, science parks etc. supported by a thriving network of microfinance institutions, venture capitalists, angel investors and more; currently home to over 300 startups, half of which are considered hi-technology and have produced several successful exits.

This success story is however only confined within about 2.6 % of the ecosystem, with the remaining 97.4% being necessity driven MSMEs operating largely in the informal sector, with low



1. technological capabilities and high mortality rates (Chege and Wang, 2020; Muturi, Gesimba and Kithinji, 2014; Cunningham, Cunningham and Ekenberg 2014). The TTASH project at TUK exposed critical gaps in interaction and collaboration between SMEs and HEIs, with the former reporting being more likely (up to 88%) to interact and network with other SMEs and NGOs, than with HEIs. Majority of the SMEs sampled had not had any interaction with any HEIs for the more than 3 years they had been in operation (98%), with many expressing the view that they had nothing in common to discuss with the HEIs. The HEI personnel interviewed in this study on the other hand felt that the SMEs would not understand the level of research and technology they deal with and thus found it easier to deal with larger corporates in the private sector, who were more ‘receptive’ to their ideas

Figure 2: Metal welder in Nairobi’s Dandora Estate

The RISA research was conducted within the eight sub-counties that forge the Nairobi innovation Ecosystem as shown below.

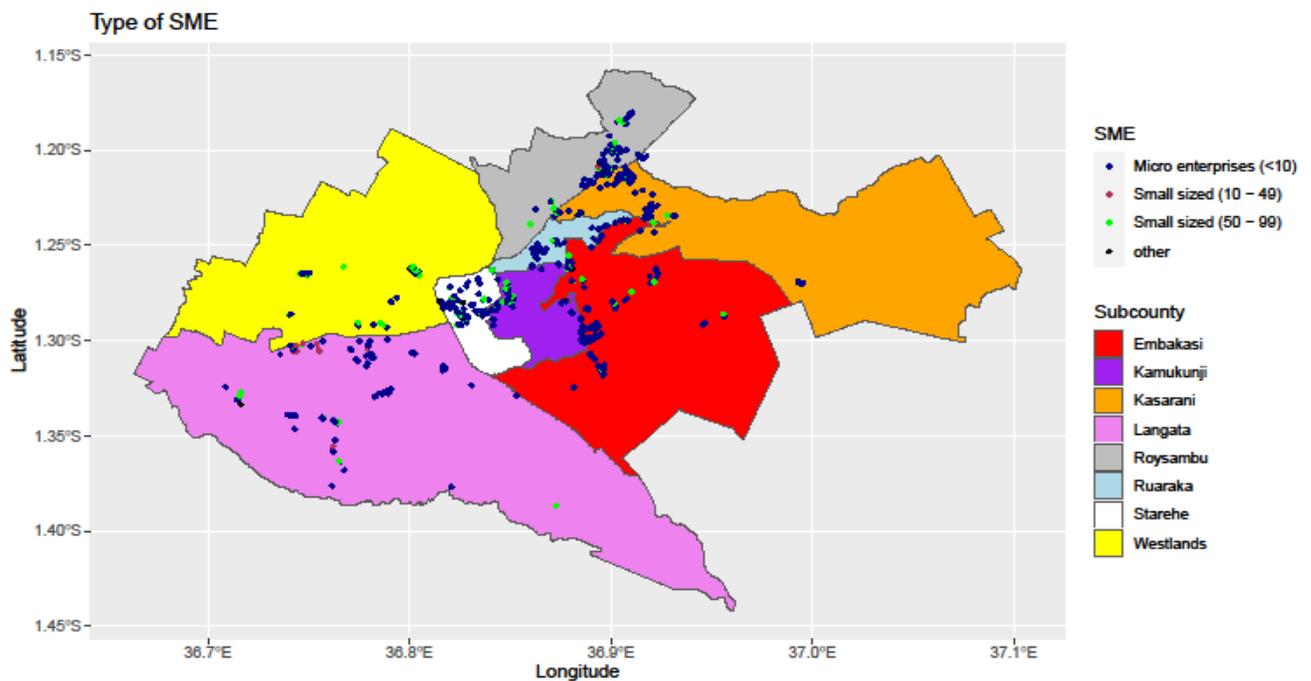


Fig 3: Map showing distinctive localization of MSMEs types and distributions within the NIE

NB: The dots represent the grading of the MSMEs according size while the colors represent sub-county cluster distribution

The distribution of MSMEs clusters across the Nairobi Innovation Ecosystem gave an indication of economic activities that occur in different constituencies; ranging from retail agriculture, metal works, woodworks and light industry manufacturing, among others, that were predominantly using very low to low technologies, despite being located in the neighborhood of some of the most technology driven HEIs in the city e.g. the Technical University of Kenya. This conveys the need for aggressive pursuit of cooperative and collaborative frameworks to enhance the level of interaction between these entities towards overall technological upgrading in the ecosystem. While these claims exist in literature, the research evidence in this study indicate major barriers in implementing existing policies for technology transfer within this innovation ecosystem; clearly demarcated into organizational, institutional and regulatory barriers, which if not urgently addressed could hamper realization of the country's economic development agenda; enshrined in the Vision 2030 Economic blueprint.

Understanding and mitigating these 3 set of barriers implies creating a number of opportunities for not only the government of Kenya in realization of its economic development goals, but to a wide range of stakeholders including academia; in getting opportunities for commercialization of research and inventions; in collaborative partnerships with SMEs as spin off ventures and licensees, as well as corporate organisations; in access to techno savvy employees from the HEI and for MSMEs in easier access to funding, business development support, intellectual property protection and government intervention to provide an overall enabling business environment .

Key barriers to Technology Transfer in NIE and their implications

The current landscape of technology transfers between SMEs and HEIs in Kenya is characterized by a mixed bag of opportunities and challenges. On one hand, there is a growing recognition of the potential benefits that innovation driven SMEs and HEIs can offer the country through collaboration and cooperatives partnership between them; in terms of innovation, research, and skill development; which is well documented in policy documents retrieved from a range of sources (Muturi and Kithinji, 2014; Moyi and Gitonga 2013; KIPPRA, 2015). However, with 73% of the SMEs sampled in the RISA study reporting not to have developed any new products with a technological base in the past 3 years, while over 68% could not describe the technologies they require to move their businesses to the next level, there exists a clear gap in technology transfer in the NIE. Over 80% of the HEIs sampled did not have any program for interaction with surrounding SMEs and despite a majority of them reporting the presence of technology hubs, these were mostly reported as incubators for students use. Other institutional barriers reported in the study include poor access to finance by over 68% of the SME respondents, bureaucratic procedures in government support agencies, language barriers between SMEs and HEIs as well as mismatch between the skills developed in graduates and the industry needs. In addition, they were reported regulatory barriers in management of quality standards, intellectual property protection, punitive taxation regime and poor licensing procedures among others.

To mitigate some of these challenges, about 320 SMEs who were part of the respondents were taken through a six-day technology based training at the Technical University of Kenya, in order to help them set a base for technology upgrading to the next level. These SMEs were part of the 61% who reported willingness to collaborate with HEIs in their next phase of growth; through innovation and technology uptake.

Recommended Policy interventions for Technology Transfer Assistance

Technology Transfer Assistance (TTA) aims to facilitate the flow of knowledge and technologies between economic players including HEIs and SMEs in an innovation ecosystem, through assisted interventions rather than leaving it to natural spillovers. In Kenya, TTA can be implemented as a potential tool to harness indigenous innovations, encourage researches in HEIs to be market-driven, and bolster the competitiveness of SMEs by upgrading their internal operations to be more technology driven.



Figure 5: Participant of the TTASH policy workshop in Naivasha, Kenya

However, the current policy scenario in the country presents a mix of opportunities and challenges:

1. Leveraging opportunities that reside in the National Systems of Innovation in Kenya

- a) **Innovation Ecosystem Strengthening:** The policy emphasizes the importance of fostering a systemic approach by facilitating not only collaboration between SMEs and HEIs, but also with a other stakeholders in a quadruple helix approach that gives maximum access to economic externalities. This approach has the potential to spark innovation, promote product development, and address industry challenges through research and technology exchange.
- b) **Technological upgrading towards enhanced growth and competitiveness:** Successful assisted technology transfers and knowledge sharing would contribute to Kenya's economic growth by enabling more SMEs to develop a technology base that allows them to readily attract and assimilate

new emerging technologies in order to develop new products and services with higher value in the market. This can lead to increased revenue, job creation, and improved competitiveness in both local and global markets.

- c) **Skills Enhancement:** The policy's focus on capacity building and training would enhance the technological skill sets of SMEs and researchers at HEIs, thereby increasing the overall absorptive capacity in the country. This not only supports technological development in country but also cultivates a skilled workforce capable of driving innovation across various sectors in the global arena.

2. Main challenges highlighted by stakeholders in the policy review workshop

- a) **Funding Shortages:** One of the primary challenges is the limited funding available for research in HEI and technology commercialization by SMEs. Without adequate financial support, SMEs and HEIs struggle continuously to initiate and sustain meaningful collaborations and partnerships in innovation
- b) **Bureaucratic hurdles:** Cumbersome bureaucratic processes and regulatory bottlenecks continue to impede the efficient transfer of knowledge and technology across different players. Simplification of these processes is crucial for encouraging timely and productive collaborations.
- c) **Intellectual Property Concerns:** Ambiguities surrounding intellectual property rights have deterred SMEs from participating in joint projects with HEIs. Lack of clear guidelines and policies may lead to disputes over ownership and benefits from commercialized innovations. Most SMEs also lack knowledge on processing and owning intellectual property rights for their novelties.
- d) **Awareness and Outreach:** There is a lack of awareness among both SMEs and HEIs about the potential benefits of collaboration and technology transfer partnerships. Effective communication and outreach efforts are therefore necessary to ensure stakeholders understand the value proposition and opportunities available.
- e) **Coordination Challenges:** Effective collaboration between SMEs and HEIs requires close coordination, which are challenging due to differing organizational cultures, structures, goals, and timelines.
- f) **Evaluation and Measurement:** Measuring the impact of assisted technology transfer initiatives is complex. Establishing meaningful metrics to assess the success of these initiatives and their contribution to economic and societal outcomes is vital.

3. Sustainability and Long-Term Impact:

The success of the TTA policy in Kenya would be hinged on its sustainability and long-term impact. Ensuring continued funding, consistent implementation, and periodic evaluations are critical for monitoring progress and identifying areas for improvement. In general, the current policy on technology transfer and knowledge exchange between SMEs and HEIs in Kenya holds significant promise for fostering innovation and economic growth. However, challenges related to funding, bureaucracy, intellectual property, and awareness necessitate a change in tact in order to maximize the positive impact of such initiatives. Essentially, there should be continuous collaborations, stakeholders' engagements, and adaptive policy adjustments in order to harness the potential of the current policy and drive Kenya's journey toward a knowledge-based economy.

Policy recommendations from the Naivasha workshop

Arising from the August 2023 TTASH policy review workshop, key strategies were identified for policy action – strategies that can counter barriers which hinder knowledge exchange and technology transfer between SMEs and HEIs and also with other stakeholders. The TTA strategies below are aimed at proffering solutions toward the promotion of a dynamic innovation ecosystem that can unlock the full potential of SMEs and HEIs in commercializing new innovations that contribute to Kenya’s socioeconomic development towards realization of the vision 2030 economic blueprint. These strategic interventions are proffered under three perspectives – organizational, institutional and regulatory recommendations.

1: Curbing Regulatory Barriers to Technology Transfer and Knowledge Exchange in NIE

Regulatory barriers refer to government legislations, regulations, and policies that affect the development, maintenance, improvement, availability, and/or cost of running SMEs or HEIs. Some of the key issues with government regulatory agencies were identified and their mitigating strategies were proffered by stakeholders at the workshop. The course of policy action is presented as follow:

S/N	Regulatory Barriers	Actions
i.	Lack of information and sensitization.	Educate and sensitize the SMEs, and the public in general
ii.	Expensive services from HEIs and government organs	Government should provide subsidies, including tax exemption & rebates, to SMEs
iii.	Bureaucracy	Streamline and simplify the processes undergone by SMEs in dealing with government
iv.	Accessibility of regulatory bodies	Devolve services to handle SMEs as cradle business that need to survive over time
v.	Lack of technological know-how and skills	Offer trainings through periodic capacity building in SMEs
vi.	Lack of access to ICT infrastructure.	Capability building on ICT is a necessity - E.g. through the Huduma Centre
vii.	Low literacy level.	Use conventional media and gradually transition to digital in assessing local technology and indigenous knowledge from SMEs
viii.	Language barriers – The language of communication is too legal/formal for the SMEs	Domesticate the communicational channel to include local languages and minimize or expunge threats in documentations
ix.	Corruption dealings from regulators	Provide accountability channels in dealing with SMEs
x.	Intellectual property rights bottlenecks hindering registration	Government should sensitize SMEs on IP rights and ease the process therein for registration of their novelties
xi.	Inadequate on infrastructure to cater for SMEs operated by PWDs.	Initiate and create an enabling environment in innovation ecosystem take cater for inclusivity of PWD and others.
xii.	Insufficient lobbying and advocacy for SMEs policy friendly framework.	Effective, consistent and constructive lobbying and advocacy by regulators to SMEs would pave a niche for an inclusive and implementable police framework
xiii.	Several requirements, registration, licensing in formalizing and recognizing an SME	Harmonizing and collapse the requirements for business registration for the SMEs
xiv.	Ineffective policies on tax exemption	A need for policy review to cater for local needs that would provide incentives, tax rebates and exemption for SMEs to thrive.
xv.	High interest rates on loans	Government should compel the banking sector on the need to review their interest rates low (to 1 digit) in order to attract customize loans for production in SMEs
xvi.	SMEs that at risk of closure	Government should provide measures to mitigate or cushion business risks; Create clusters for the SMEs to reduce risk severity; Provision of insurance by government
xvii.	Lack of cooperation from SMEs in a cluster	Formation of associations and cooperatives would help in pulling resources together to get loans and other funds for SMEs
xviii.	Lack of access to credit	Government need to create special banks or a policy to existing banks to create the enablement in accessing specific credits to SMEs
xix.	Lack of publicity by the network of relevant agencies	Relevant institutions need to cooperate and create sensitization for SMEs while working together to achieve their mandates.

2: Mitigating Organizational barriers to Technology Transfer and Knowledge Exchange in NIE

Organizational Barriers are internal challenges including poor managerial and technical competencies, and lack of capabilities that hinder effective operations within firms, leading to failures in key areas including innovation. Issues with organizational structures and cultures and strategies to curb the barriers therein were equally given for policy action as follow:

S/N	Organizational Barriers	Actions
i.	Inadequacy in the dissemination of information among SMEs	Publicizing information on SMEs activities to improve visibility and public participation; Updating market curriculum for SMEs
ii.	Poor implementation of SMEs policies	Periodic evaluation of the SMEs policies is need to strengthen the sector and gain substantive gains from implemented strategies
iii.	Inadequate participation in policy formulation for the SMEs	Holding policy reviews (or forums) to address gaps and implementation challenges at the instance of concern SMEs organizations, as well as providing equitable ground in an inclusive stakeholder forum.
iv.	Disregard of stakeholder opinion(s) during policy promotion	Establish and enforce a formidable framework as stipulated in legislations (constitution) on matters of public participation and inclusivity, thereby giving equal participatory opportunity to every stakeholder.
v.	Poor networks among the organizations	Promoting collaborations among organizations, to promote sharing of resources including skilled workforce and technical expertise
vi.	Inadequate financial and other resources to run SMEs in terms of recruiting skilled workforce	Commitment to funding of SMEs and deploying a skilled workforce are a necessity to grow the sector.
vii.	Limited skilled workforce and technical expertise for SMEs sector	Establishing more innovation, business support, and information hubs and parks for skill acquisition and assisting with technical expertise; Protecting SME owners and innovators hosted in the hub
viii.	Spatial dissemination of information for SMEs	Providing information on standardization processes and regulations in the SMEs sector

Strategy 3: Handling Institutional Barriers to Technology Transfer and Knowledge Exchange in NIE

Institutional barriers are basically operations; procedures and process that occur in support institutions for business processes such as standardization, intellectual property protecting, licensing, research, funding etc. These institutions were reported to disadvantage SMEs through their burecratic and mismanaged operations that often do not add value. Strategies proffered to curb these barriers were as follow:

S/N	Institutional Barriers	Actions
i.	Lack of awareness and sensitization on key issues	More advocacy and use of social media and internet e.g. have websites with proper communication on procedures and processes, for easy access by SMEs. HEIs should continuously reach out to the SMEs sector by sensitizing them on available research collaboration opportunities , as well as training opportunities
ii.	Technology developed not relevant and need based.	HEIs should provide expertise to SMEs on technology resilience by availing their infrastructure to SMEs to research and innovate
iii.	The institutions do not effectively serve their roles as enablers due to corruption and lack of ethics	Institutions, including the HEIs should develop SME support programs and create awareness to recruit more SMEs and serve them more ethically. Banks were applauded for having set the pace on this
iv.	Change the culture in both HEIs and SMEs towards each other in order to break the walls	It is pertinent to demystify the myth hinging research activities with those at the bottom ladder (SMEs), to remove the silo mentality and sensitize them that they need each other in a symbiotic relationship .
v.	Conduct local needs based research	HEIs and other research institutes to focus on identifying projects and Programmes that meet local needs for research collaboration and innovation
vi.	Language used to disseminate research findings is not user-friendly e.g. in journals, magazines and dissemination in high impact journals and conferences is not very helpful. The rest are kept in university libraries	HEIs should conduct their research more openly and disseminate findings in more user-friendly ways eg ready available channels like daily newspapers and magazines and even have debates about the findings on radio and TV
vii.	Current curriculum in schools and HEIs does not reflect current societal and market needs	The curriculum of HEIs should be reviewed to incorporated innovations and entrepreneurship from basic levels and make it a way of life
viii.	Reduce the bureaucracy in the institutions.	HEIs and other support institutions need to find novel ways to reduce bureaucracy
ix.	Poor government support for SMEs in general	Government to find new ways to provide an enabling environment for SMEs esp. with regard to training and easy access to financial resources eg by providing security for debt capital
x.	Increase media coverage in research in relation to SMEs.	The research partnership between SMEs and HEIs and others need to be promoted on both mainstream and social media for wider reach

Conclusions

In summary, while there are challenges, the status of knowledge exchange and technology transfer between SMEs and HEIs in Kenya is gradually evolving toward greater collaboration and synergy. With continued support and concerted efforts from the various stakeholders, the potential for meaningful assisted technology transfer and innovation-driven growth would remain promising in the country. The suggested technology transfer assisted model in this project could be escalated to various innovation ecosystems in the country, apart from the NIE, in order to enhance overall innovation and entrepreneurial growth towards sustainable development. By implementing the three policy action features outlined in this brief, Kenya can unlock the potential of its SMEs and HEIs in research, innovation and commercialization of new ideas and inventions; leading to increased competitiveness, job creation, and social economic progress. A collaborative effort from all stakeholders is essential to realize the envisioned benefits and propel Kenya towards a knowledge-based economy. In view of the comparative evidence, government should establish a monitoring and evaluation framework to assess the impact of technology transfer assistance programmes and regularly review the effectiveness of technology transfer policies, adjusting them based on outcomes and feedback from stakeholders.

References

- Chege, S. M. and Wang D. (2020) Information technology innovation and its impact on job creation by SMEs in developing countries. *Administrative Science Quarterly* 35:128-152
- Cohen W. M. and Leventhal D. A. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly* 35:128-152 DOI: 10.2307/2393553
- Government of Kenya (2010), Research, Innovation and Technology Sector, midterm expenditure framework report.
- Kenya Institute for Public Policy Research and Analysis (KIPPRA),2013
- Moyi E. and Njiraini P. (2005) Towards Technology Model for MSEs in Kenya: Common Principles and Best Practices, KIPPRA Discussion Paper No. 57
- Muturi P, Gesimba, P.O and Kithinji M. (2014) Analysis of Factors Influencing Transfer of Technology among Micro and Small Enterprises in Kenya. *International Journal of Business and Social Science* Vol. 4 No. 17
- Ndemo B. and Weiss T, (2016) *Digital Kenya: An Entrepreneurial Revolution in the Making* Palgrave MacMillan
- CBK (2020) Survey Report on MSMEs Access to Bank Credit in Kenya