

Exploring the Challenges Facing the ICT Industry Innovation Processes in Tanzania

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ABSTRACT

One strategic area in research and development is to promote innovation for economic development and technology transfer. In a knowledge-based economy, innovation is omnipresent, and its significance is never disputed. Tanzania is aware that information and communication technology (ICT) is the major enabler of socio-economic growth; hence, it needs more ICT innovations, which has shown a slow growth due to many challenges. ICT innovation has significantly impacted private sectors compared to public sectors. The main challenge is mainly in public sectors and individuals. The study explores ICT innovation challenges towards effective participation in innovation actors. The methodology includes a systematic literature review and the primary data collected from the case study area on Tanzania's public and private sectors. The study revealed that though funding and capital to Innovation factors are the major challenges, more challenges have been explored. The study comes up with best practices to persuade ICT innovation participation from the grassroots to the university.

KEYWORDS

ICT Industry Innovation, ICT innovation, ICT Innovation Challenges, Innovation, Innovation Ecosystem, Innovation Participation, Public and Private Sectors

INTRODUCTION

Information and Communication Technologies ICT is a major factor influencing economic change (Okeleke, 2019). Governments operate to influence the growth of the socio-economy. Among other countries, Tanzania aspires to become a middle-income country by 2025 (NICT Implementation Strategic Plan, 2016). The National ICT aims to promote local manufacturing of ICTs and enhance Research and Development (R&D), innovation, and entrepreneurship for the ICT innovation Policy (NICTP, 2016). The Government has involved several public organizations promoting ICT innovations:

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the Tanzania Commission for Science and Technology (COSTECH) through Dar Teknohama Business Incubator (DTBi) and learning institutions to generate ICT professionals. The Tanzania Government has also formulated the Ministry of Information and Communications Technology in order. Tanzania established the ICT Commission in 2015 to coordinate and facilitate policy implementation (ICT Commission, 2021). Tanzania also formulated The Ministry of Information, Communication, and Technology in September 2021 to monitor the implementation of ICT and Postal services policies. It is envisaged to drive the digital transformation agenda in Tanzania amongst the global fourth phase of the industrial revolution (MICT, 2022). ICT innovations have also been increasing in the private sector, specifically in mobile money, facilitating the financial inclusion of most Tanzanians and creating job avenues. It is believed that inclusive ICT innovation can be a driving force for development through innovative ICT solutions. However, its start-up and implementation have been facing many challenges. Other coordinating agencies are hosted by higher learning institutions such as the University of Dar es Salaam through the University of Dar es Salaam ICT Centre (UDICTI), The University of Dar es Salaam Innovation and Entrepreneurship Centre (UDIEC), and the University of Dodoma through newly established Innovation Spaces and Incubation Centres (UDOISIC).

According to a study done by Danish International Development Agency DANIDA (2012), ICT policies from different countries and institutions have the following expectations on ICT issues:

- Canada - recognizes the value of using ICTs to support its five thematic; (Continue government spending on innovation, improving technology adoption and use, creating healthy business ecosystems, preparing Canadians for automation, and providing access to digital services.
- Priorities - Canada encourages and supports greater access to innovation and emerging technologies, such as social media, to build the conditions for secure, equitable development and to promote good governance.
- Finland – has given particular focus to information- and knowledge-society as well as innovation systems as part of the transformation of the green and inclusive economy
- Germany – indicates that the important and sustainable development impacts of ICT rely to a large extent on private sector-driven innovation, implementation, and distribution of ICT services
- The United States for International Development (USAID) - has numerous ICT-focused initiatives, including the Global Broadband and Innovations program and the Mobile Solutions team
- The World Bank Group – the strategy is to use ICT to transform, innovate and connect: Using ICT to transform service delivery across sectors; supporting ICT innovation for jobs and competitiveness across industries; and scale-up connectivity – affordable access to broadband internet.

Tanzania as well needs to emphasize ICT-based innovation for its development. Hence, the paper explores existing ICT industry innovation challenges in Tanzania and proposes appropriate strategies to address them. The paper also recommends several critical areas for tackling these challenges to the ICT industry innovation towards persuading ICT innovation to the growing youth population in Tanzania.

LITERATURE REVIEW

Innovation

Innovation is a term used to signify the values added to a product or services to solve problems, adapt to specific new changes, face the competition, or adapt to customers' requests, changes, and preferences (De Vries et al., 2016). The innovation ecosystem describes the key players and resources to enable innovation (Still et al., 2014). The players include; Academia, Technology companies, cluster suppliers, end-users, the Government, the Financial sector, legal systems, development

agencies, and innovation hubs(NICTP, 2016). Deshmukh (2012) describes the innovation process as the path through which value is added to a product or service in a specific industry. On the other hand, Feshchuk (2017) defines the innovation process as patches on which knowledge is transferred. With this study, the innovation process will mean the innovative processes taken by an individual, group, business, or industry towards new or improved business operations aimed at improving the quality of goods and services and the model of operations.

Hartono & Rafik (2021) state that innovation, as shown in Figure 1, involves the path taken by an industry that begins with idea generation, advocacy, screening, experimentation, commercialization, Diffusion, and implementation. The innovation process actualizes an idea into an actual concept. Innovation processes fall into different categories, marketing, ideation, technology, co-creation, social innovation, entrepreneurship, open innovation, and business model innovation (Kahn, 2018). The marketing innovation process focuses on customers' experience, while the ideation process involves product ideas and concept innovation. Unlike the other types above, the Technology innovation process relates to product functionality, while co-creation innovation processes let the customer be part and parcel of the innovation processes. Other innovation process categories are social innovation related to corporate culture, Entrepreneurship, open innovation, and business model innovation.

The innovation processes framework is key to sustainable collaboration and re-engineering, and innovation actors facilitate innovation (Ukaid, 2018) and (Battistella et al., 2017). As these actors do not guarantee sustainable innovation, there is a demand for collaboration with other actors to improve business processes, products, and services cross-cutting (Spinoglio, 2015). While the government establishes policies and regulations to facilitate collaboration, the industry explores innovation opportunities for research institutions (academia) to work on identified opportunities (Awasthy et al., 2020).

Categories of Innovation

In terms of classifications, innovation comes in several forms: new products, new methods of production; new sources of supply; and exploitation of new markets. It also involves new ways of organizing business. On the other hand, Edwards-Schachter, (2018) and Das et al. (2018) classified innovation into a different perspective: a technological innovation that focuses on products and services with intensive research and development-oriented. With this study, innovation will be referred to as adding value to services and products. Various types of innovation exist. Such innovation types are the results of the change and application of technology. The typical type of innovation is based on product innovation, resulting from significant products that include new products for users. Process innovation is another type of innovation based on the improvement of operations. Other innovation types include service, business model, disruptive, radical, design-driven, social, and responsible innovation (Marcellis-warin, 2016).

As shown in Figure 2, innovation begins with inputs from ideas, the problem at the end, or from research. Such inputs could come from different collaborating entities; they are transformed by adding value or transforming an input that might need collaboration from the same entities. Such transformation leads to product innovation, process innovation, and service innovation. Like the previous two steps, the output step can also involve collaboration.

Figure1. Innovation process

(Source: Du Preez & Louw, 2008: Pg 3)

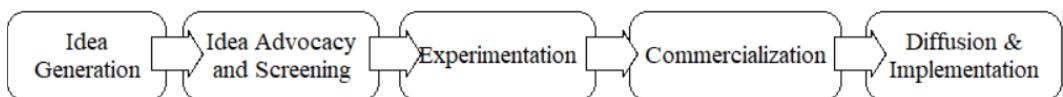
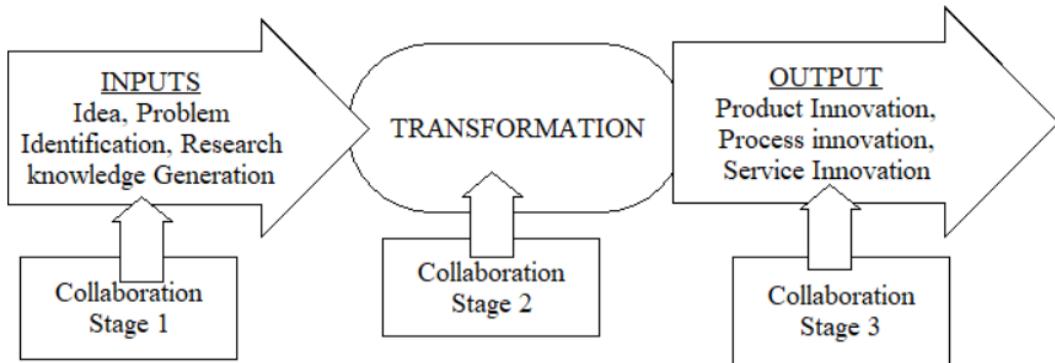


Figure 2. Innovation process and collaboration stages
(Source: Ozcan, 2016: Pg 448)



ICT Industry Innovation

The Information and Communications Technology (ICT) industry is the convergence of the telecommunication industry with the computing and broadcasting industries. The term encompasses all technical means for information processing and transmission. It also encompasses various technologies for processing information and facilitating the communication of such information (John et al., 2017). It far refers to equipment and services related to computing and telecommunication. ICT is an important enabler of digital transformation that adds value to the modern economy's products and services (Anatory, 2017).

The ICT industry supports other industries, such as manufacturing, medical, and mining, in their day-to-day business. The ICT industry includes various IT industries – hardware and software companies, telecommunication industries, and broadcasting industries. Technology has become part of human development in the modern world regardless of the industry in which it is applied. The ICT sector plays a significant role; in reducing costs, increasing productivity, and positioning the business strategically (Neirotti & Pesce, 2019) and (Lappi & Aaltonen, 2019). ICT must be invested to realize such roles, which involve purchasing ICT equipment and training. The ICT industry faces various challenges, including but not limited to inadequate governance and management of ICT resources.

Regardless of the type of innovation, technology is a fundamental tool for the success of such an innovation. Technological innovation involves; products, processes, and services. The emerging technologies are classified based on the technology used, including digital data and communications involving technologies such as the Internet of Things (IoT) and big data. Other emerging technologies include energy and environment, Biotechnology, and Advanced materials. Among the emerging technologies, digital data and communication are the areas of interest concerning ICT innovation in a collaborative environment.

ICT Innovation Ecosystem

Information and Communications Technology innovation is a product or process related to technology, including new processes, products, and improved ICT products (Feshchuk, 2017). In contrast, an ICT process innovation involves improved production methods or delivered service. The ICT innovation comprises key players referred to as the ICT innovation ecosystem. The ecosystem is composed of different processes and players to facilitate innovation. The main players include the following but are not limited to *network platforms*. The players can be summarized as *ICT equipment providers, Network operators, Platforms, Contents, application providers*, and finally, the *innovative products*

or services consumer. The ICT innovation ecosystem is influenced by actors from ICT suppliers' and users' perspectives; industry, government, research institutions, and individuals supported by the underlying infrastructure such as finance, learning, and co-creation (Wintjes, 2016).

The platform providers supply users with content and search platforms in the third relationship. The users pay the network operator for the network connection. The relationship between the network element providers and consumers is important as consumers choose the element they perceive relevant to them. ICT equipment providers (e.g., Cisco, Microsoft) supply ICT network equipment to the network operators (e.g., Telecom) to construct the networks. The network operators provide the network services critical to the platform for content and application providers (e.g., Google) to deliver services and products. Finally, consumers use or buy the output of the ICT innovation ecosystem (Fransman, 2010).

Gachara & Munjuri (2018) conducted a study based on Kenyan Small and Medium Enterprises (SMEs) innovation challenges. The study identified several challenges: knowledge, resources, technology, legal and policy, and environmental difficulties. Another work related to innovation challenges is based on Ruanda's (Aubert, 2018) research on innovation challenges in the context of Ruanda, one of the developing countries. The methodology involved the review of the Science and technology industry towards supporting other industries. As per Albert's study, the fewer efforts in Research and Development (R&D), the less effort to attract Foreign Direct Investment (FDI), and government support were major success factors.

The Direction of Innovation in Developing Countries and Its Driving Forces (Xiaolan Fu, 2019) The study is related to developing countries taking Ghana and Tanzania as examples of developing countries looking at an overview of what innovation is all about and what should be done to move the developing countries where there are, among the challenges identified included; capital and high-skilled labor, and country policies.

Another study of the same nature was taken in Columbia based on manufacturing companies titled, The Challenges of Strategic Innovation: Achieving Operational Effectiveness in Developing Countries (Tegethoff et al., 2021). The study focuses on the innovation challenges facing developing countries, specifically Columbia; insufficient local support to organizations, high tax imposition to innovators, and inadequate knowledge sharing among players are other challenges.

The results of these studies identified the need to conduct more detailed research on the general ICT innovation challenges in developing countries. The previous studies are specific to a particular industry segment support while leaving aside the other part of the industry, such as ICT industry innovation diffusion and commercialization.

STUDY METHODOLOGY

The study involved a systematic literature review that searched relevant literature from different sources. A contextual analysis was used to investigate data from the literature. The focus is reviewing the innovation challenges in developing countries, taking Tanzania as a case study.

Innovation Challenges as per Literature Review

Matsunga (2019) states that innovation in developing countries is characterized by weak innovation featured by key elements, including knowledge-based economies, poor business environments, and inadequate information infrastructure. The same developing countries' significant barriers include how the countries diffuse innovation. Another feature of developing countries includes a poor business environment and poor governance. The developing countries are also featured with a lack of financial transparency and bureaucracy in reaching critical decisions.

Innovation processes work better in a collaborative environment (Abbas et al., 2019). The collaboration environment is featured with common shared interests, agreed on vision and goals, and willingness of the stakeholders to contribute resources and knowledge, whether on a long-

term or a short-term basis. The collaboration among innovation actors is crucial as it facilitates exploring new ventures to collaborate. It is also important as it influences the Government policy related to innovation.

Innovation in developing countries, particularly Tanzania faces several challenges:

- (a) Technology infrastructure is one challenge in influencing the innovation ecosystem in developing countries. The Technology infrastructure elements consist of Databases, platforms, communication, network devices, and Human resources to support innovation. The absence of reliable infrastructure can influence innovation processes, hindering general innovation.
- (b) Government, apart from being an innovation actor, supports the innovation environment. The government influences innovation through imposed regulations that can either support innovation or hinder such innovation. Such regulations are essential to control the environment in all innovation spheres. The same regulations can positively and negatively impact the innovation being practiced. The regulation can be imposed to regulate research and innovation, and the same innovation can act as a barrier to developing a new product or production process.
- (c) Likewise, Foreign Direct Investment (FDI) is among the driving forces of developing countries to promote innovation. Foreign Direct Investment (FDI) is the tendency of the business to invest in another country. The FDI is there to promote domestic industries through foreign technology. Foreign Direct Investments come with new technology that ultimately influences innovation; the same Foreign Direct Investment (FDI) increases productivity. The less Foreign Direct Investment, the less the technology transfer, and vice versa.
- (d) Intellectual Property Rights (IPR) is another challenge. It is argued that intellectual property prevents the Diffusion of new technologies as the technology to be diffused is protected by the inventor. It is a challenge to most developed countries, although it might have an advantage for some industries and an incentive to innovation stakeholders. The IPR, such as patents copyright, can ultimately influence the cost of inventions and research and development.

Unlike in developed countries, innovation in developing countries takes different forms and features. Developing countries' innovation is characterized by less capital investment and less research and development (R & D) (Ghazal & Zulkhibri, 2015).

According to Omid et al., (2018), innovation is one of the crucial components that can pioneer development, and the innovation process is the one that determines the best path the country could take. When comparing developed and developing countries, in relation to innovation, it can be noted that:

- Innovation in developing countries is characterized by industrial cluster formulation (Zhong & Tang, 2018). The innovation clusters are organized communities that deal with innovation issues, commonly known as innovation networks. Regardless of the innovation type, innovation in developing countries also features demand, supply, and structural factors (Dhewanto1 et al., 2015).
- Additionally, innovation in developing countries is accompanied by less investment in technology, consultancy support, inadequate infrastructure, and unfavourable innovation policies that hinder innovation activities (Matsunga, 2019).
- Innovation in developing countries is also featured with huge costs and insufficient funds for research and innovation.
- Innovation in developing countries is also hindered by less institutional support and a weak research industry (Omid et al., 2018).
- As per UNCTAD (2021), the changes to ICT innovation indicate more challenges as the new technologies come with both positive and negative challenges. The changes in technologies could affect most developing countries since the rate of redness to adopt technologies is very low compared to developed countries.

Unlike innovation in developed countries, innovation in developed countries is characterized by active and robust innovation in developed countries, with accessible technology adoption, high scientific training, massive investment in high technology, and strong Intellectual Property (IP) laws. Innovation in developed countries is featured a structured market, strong domestic market, and high technology (Egbetokun et al., 2017).

Actors' Participation in Innovation

Innovation participation begins with individual or group initiatives. The initiatives begin with an idea to be accepted, followed by the review mechanisms through different stages, assess the challenges, and finally put into action. Innovation participation is subjected to several difficulties; the individual understanding idea is one of the challenges, frustration, and losing interest in innovation. Innovation actors' involvement is influenced mainly by the institution structures – universities, research training, norms, and financial organization, and secondary is the motivation – the incentive of the country, the skills, and creativity of innovation and economic status of the country to innovation (Warnke et al., 2016).

Sources of Innovation Ideas

According to (Lalic et al. (2017), innovation ideas can originate from internal and external sources, mainly from customers, research institutions, research, and the development industry, as indicated in Table 1. Lalic et al. (2017) also show that the same innovation idea can be worked in a collaborative environment in different forms. Table 2 shows that most innovation actors collaborate on new products, new technical production processes, and new related product services.

INNOVATION BEST PRACTICES

Innovation Participation

The literature provides best practices on how the innovation actors can participate in innovation, either direct or indirect. Sustainable innovation and a stable environment in which the innovation occurs are essential. Innovation actors are primarily grouped into three categories: an economic and

Table 1. Sources of innovation from theory

Source of Innovation		New products		New technical production process		New product-related services		New organization concepts		Total	
		N	%	N	%	N	%	N	%	N	%
Internal source of innovation	R &D Engineering	36	39%	27	29%	9	10%	21	23%	93	100%
	Production	27	23.5%	49	43%	14	12%	25	22%	115	100%
	Customer service	13	22%	6	10%	36	61%	4	7%	59	100%
	CEO/ Management	32	22%	38	26%	24	16%	52	36%	146	100%
External source of innovation	Customer	60	41%	21	14%	51	35%	16	11%	148	100%
	Supplier	11	24%	18	40%	12	27%	4	9%	45	100%
	Research institutions, Universities	5	16%	10	32%	3	10%	13	42%	31	100%
	Organisation consultancy	8	22%	10	27%	7	19%	12	33%	37	100%
Total		192	28%	179	27%	156	23%	147	22%	674	100%

(Source: Lalic et al., 2017: Pg 116)

Table 2. Collaborating partners and methods

Collaboration with / Collaboration in	Customers		Suppliers		Competitors		Service organization		Research Institutions & Universities		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
New products	68	45%	38	25%	8	5%	14	9%	22	15%	150	100%
New Technical production processes	14	14%	42	43%	6	6%	20	20%	16	16%	98	100%
New product-related services	38	40%	24	26%	5	5%	19	20%	8	9%	94	100%
New organizational concepts	11	18%	10	16%	6	9%	23	38%	11	18%	61	100%
Total	131	33%	114	28%	25	6%	76	19%	57	14%	403	100%

(Sources: Lalic et al., 2017: Pg 117)

social activity outside the Government (private sector), academia, and the Government in a triple helix model. According to Egbetokun et al., (2017):

- The government worldwide plays a significant to provide conducive policies to promote innovation in the economy.
- The private sector supports innovation by pioneering new products and services through research and development. Hence their involvement and participation do differ based on the nature of the group.
- Academia involve themselves in education, research, and training to equip students with innovation skills and innovation entrepreneurship

It is essential to align industry strategies with the existing environment for management innovation challenges. Such innovation management can be attained by looking at the current business strategies that decide on the type of technology to invest in and adopt while taking care of government policies and organizational barriers and reassessing organization performance.

Actors' Participation in ICT Innovation

Involving citizens in policy and decision-making is essential for attaining organizational objectives. Involvement comes in two ways; physical and electronic Participation (e-participation). While physical participation refers to engaging actors in policy and decision-making, e-participation uses ICT services to engage actors in policy and decision-making (Zheng, 2017). Several technological tools are used to facilitate e-participation. Such technologies include; email, e-forums, and web portals to enable users to participate in decisions since they are the most affected actors (Naranjo Zolotov et al., 2018). Unlike participation, e-participation focuses on customers, citizens, and businesses to provide models with technologies and tools for effective and efficient public administration (Tan & Saragih, 2018) and (Kim & Lee, 2012).

Individual Participation in Innovation

Individuals can participate in various ways in a collaborative environment that includes information. It can be a movement of information from the government to citizens or through consultations; where necessary, the information could be both ways (Active Participation). Different models are used to engage diverse actors to participate on different levels. The participation models depend on the group's

nature and the application area. According to Soonhee & Jooho (2012) and Pina et al. (2007), all participation models seem to have the same features, such as degree of participation, participation level, and how participants interact with the web services. Participation goes with accountability and a commitment to respond to and balance actors' needs in decision-making (Guerin et al., 2018). Accountability covers governance aspects, such as transparency, democracy, efficiency, responsibility, and integrity (Guerin et al., 2018) and (Keping, 2017).

The innovation actor's participation depends on the type of innovation engaged, while product innovation is meant for new products, services, or programs. The process innovation involves the changes model to achieve efficiency, facilitate cost reduction, and improve service delivery. Apart from process innovation, organization innovation addresses changes within a particular industry. Other innovations include marketing innovation that is changing marketing techniques, business models, and organizational innovation. Kahn (2018) had a similar view on innovation, including technological, process, product, service, and business model innovation.

Innovation actors involve the research institutions in knowledge creation and Diffusion, incubators for start-up innovators who are technical advisors and mentors to provide guidance. Government is another innovative actor in creating policies and promoting an innovative environment (NICTP, 2016). Venture capital provides capital to start-up innovators. The other actors include investors, civil society, development agencies, and professionals (Hou et al., 2019). The study focuses on the main innovation actors; Government, Academician, and research institutions in Tanzania.

DISCUSSION

ICT Innovation challenges, especially in developing countries, can be viewed from different viewpoints: Technological aspect due to inadequate infrastructure, insufficient support from the government, less Direct Foreign investment, and lack of knowledge on Intellectual Property Rights (IPR). Innovations need data centers places to host innovative data and network bandwidth, which are affordable to local innovators. Young innovators see cloud hosting as more chipper than data centers within their countries. Young innovators lack the skills to convert their ideas into reality and impact the community. Those who have succeeded do not know how to protect/secure their innovations; hence, they end up frustrated that their ideas are stolen. Collaborative innovations between local people and foreigners usually have the advantage of interchanging knowledge and technology.

ICT innovation in many developing countries is featured with less investment in research and development and shows less involvement in innovation from the grassroots. It is time to involve Innovation actors from the grassroots to impact them with an innovation culture while setting aside enough budgets to support innovative start-ups. Innovation participation is crucial for effective and sustainable ICT innovation. The more the actors are effectively involved, the more knowledge is shared among innovation actors. The study shows that the actors face challenges that hinder them from full participation in innovation processes among the revealed challenges; less incentive from the countries, frustration, and less financial support from the financiers.

Innovation works better in a collaborative environment, whether from the individual, group, or corporate level. Such collaboration can be formal or informal. The collaboration enhances knowledge sharing and knowledge transfer among the involving parties. The study finding reveals less collaboration among innovation actors. The existing collaboration is largely initiated by the central government and its agencies and foreign agencies. It is the right time to empower the private sector to collaborate with other institutions in innovation processes. The major players in the innovation ecosystem are academia, government, and industry. The study shows that the predominant innovation actor is government, which sets the innovation environment to support the other innovation actors. The industry is an innovation pioneer for new services and products, while academia invests in research activities. The research signifies the weak relationship among the innovation actors resulting in duplication of efforts.

Generally, finance is a significant challenge for innovation industries. A large number of operational costs and a lack of local markets for innovative products subject the whole matter of innovation to fewer actors' participation. Inadequate ICT infrastructure and less collaboration hinder the ICT innovation processes.

CONCLUSION

The growth of ICT innovations relies on the innovation environment, actors, processes, and funding mechanisms. All three: environment, actors, and funding items do not support ICT innovation processes, hence the weak innovations in countries. Governments, the main player in the whole innovation process, should be the pioneer in ensuring that funds are available to support innovations. Innovations are the sources of employment for local people and the source of small-scale industries (SMEs) for increasing the economy. Funding should not be left to only donors from foreign countries. Central and Local Governments and their agencies should fund Research and Development activities, create a link with local higher learning institutions and private sectors, and empower them to let them participate in innovation processes from the bottom up. Finally, the identified best practices for the sustainability of ICT innovations need to be enforced, i.e., innovation actors should actively play their role toward sustainable ICT innovation, including mentoring process from the grassroots. A collaborative working environment between the Government, private sector, and academia can lead to a successful implementation of innovations. The Government should trust local institutions that produce expert human resources and private sectors to be engaged more and supported during innovation processes. The Government establishes mechanisms to secure locally developed innovations and assist in making them grow for the country's benefit. The government must acknowledge the creativity shown by local experts and be willing to financially support the innovation.

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