


# Crafting Innovativeness for Graduate Entrepreneurship Development in East Africa: Are Graduates Innovators or Imitators?

Paschal B. Nade<sup>1</sup> 

<sup>1</sup>Lecturer in Entrepreneurship Education, Department of Business Studies and Humanities, Nelson Mandela African Institution of Science and Technology (Tanzania)

✉ [pascal.nade@nm-aist.ac.tz](mailto:pascal.nade@nm-aist.ac.tz)

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## Abstract:

Innovation is a central determinant that contributes to entrepreneurs' pursuits of opportunities. The vehicle carries the means to concur the market and successfully establish an enterprise. This study assessed graduates' innovativeness for entrepreneurship development by employing a cross-sectional research design. The study involved 124 respondents selected from a population of Master's students specialising in science subjects originating from East African countries. Objectives one and two were analysed descriptively via per cent and frequencies. In contrast, objective three was analysed through inferential statistics where one sample T-test was employed for assessing the difference between innovation developed and innovation advanced to markets. The findings indicate that the level of innovation is relatively low for all forms of innovation since all the ratings were below 40

✦ **Corresponding author:** Department of Business Studies and Humanities, Nelson Mandela African Institution of Science and Technology (Tanzania).

✉ [pascal.nade@nm-aist.ac.tz](mailto:pascal.nade@nm-aist.ac.tz)

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per cent. Similarly, the innovation advanced to the markets was respectively low compared to the innovation developed. It is concluded that the level of innovation is limited among first-degree graduates specialising in science subjects in East African countries and the number of innovations advanced to the market for entrepreneurship development is relatively low compared to innovation developed. This calls for a review of the innovation process development in the higher learning education system. In addition, the recasting of enabling environment for innovation development is needed.

**Keywords:** Innovation, Graduates, Higher Learning Institution, Entrepreneurship.

**JEL Codes:** L26, O30.

## 1. Introduction

Innovation is a key to any successful start-up, growth and sustainability of an enterprise as it identifies new business approaches, new processes and the introduction of facilities and related creations. Innovation bridges the gap in a stiff competitive business environment by providing associated social, physical, economic and market solutions. Okpara (2007) argued that businesses face change, especially caused by increasing operation costs due to unstable energy and raw material prices, stiff international competition due to the opening of borders, emerging technological inventions, and self-driving machines. In this regard, the business world needs people with creative and critical thinking minds, risk-taking behaviour, opportunity-seeking, positive attitude, knowledge, and skills for doing business. All these entrepreneurship characteristics form an important part of individual innovation capabilities.

This study, therefore, focused on analysing the graduates' innovative capabilities in connection with entrepreneurship development. The researcher scrutinised this research dimension to explore the environmental and process drivers of graduates' innovativeness that support entrepreneurship growth; in this case, the number of innovations developed by the graduates has been studied in their course of first-degree learning. In addition, the extent to which innovations have been commercialised for entrepreneurial development is also studied.

Various scholars have conceptualised the term innovation; however, the following are the selected definitions for situating this study. According to Brenan et al. (2014), innovation covers newness or a slight change in objects or creations, production processes or management approaches with an additional value. Clayton et al. (2011), as quoted in (Swange, 2016), expanded the definition of innovation by breaking it into two categories. The

first category is sustaining innovation, which mainly focuses on advancing the values of existing substances for better use or change than the current form. The definition mainly focused on better outputs of creations in all development sectors. The second category is named disruptive innovation, which focuses mainly on simplified ways of doing things so that the cost involved in the production is minimised for better access. Therefore, in this study, innovation involves successfully exploiting a business idea, developing a new product/service/process and adding value to an existing product or process.

Innovation and entrepreneurship are two important drivers of economic development. Depending on the context and time, the terms correlate with each other. At one point, innovation drives entrepreneurship. Once the firms or enterprises grow up, then it again drives innovation. The study specifically looks at how the graduates' innovativeness impact entrepreneurship growth. Thus, the review centred on that dimension. Braunerhjelm (2010) characterised the firms with innovation elements and those with not. The findings indicate that the firms that engaged in patenting had more skilled labour, a large profit margin and better bank loans. In addition, those firms have links with multination enterprises, unlike non-patenting firms.

The analysis of the impact of innovation as per the development stage indicates that in the factor-driven economy dominated by the informal sector, with high rates of startups and resource-based production, innovation accounts only for five per cent. In the efficiency stage of economic development, characterised by large economies of scale and the decline of a startup, innovation accounts for ten per cent of economic activities. The final stage (innovation stage) of economic development is where knowledge becomes the driver of growth; innovation accounts for thirty per cent of economic activities (Naude, Szirmai and Goedhuys, 2011).

According to Dabic and Potocan (2012), innovation involving technology and competencies is among the key forces forming an enterprise's competition structure. These characteristics help an enterprise to have a competitive advantage which fosters sustainability and growth momentum. Similarly, it has been found that innovation influences business operations, increase productivity and brings under-utilised resources into use, contributing to small and medium enterprises' growth and job creation. It empowers small and medium enterprises to utilise internal resources and leverage the external sources of ideas and paths to the market (Padoan et al., 2010).

Further, innovation supports organisational improvement and reconfiguring resources, thus enhancing a portfolio for entrepreneurial opportunity. In addition, it determines political intermediation where fixed capital requirements are substantial and provides room for credit networks, thereby forming an important trait for entrepreneurial opportunity (Toms, Wilson and Wright, 2020). Furthermore, innovation capabilities have been correlated with small and medium performance and are considered the basis for advancing the small and medium financial indicators. For instance, the study by Adam and Alarif (2021) indicated that innovation practices such as SMEs' work information sharing among workers increase the chances of enterprise growth in a difficult situation.

Nevertheless, findings indicate that the firms that consider new creations and employ new ways of work undertakings place themselves in the position of achieving their goals of development.). In addition, they found that introducing novel products and market innovations appears to be associated with using more or less freely accessible information sources (Varis & Littunen, 2010). Carvalho and Madeira (2021) noted that innovation help entrepreneurs exploit change as a business opportunity, apply the idea and make it successful in the market. Innovation contributes to entrepreneurship development depending on the level of development, forms of innovation, size of the enterprise and the environment in which companies operate or were established.

## **2. Literature review**

### **2.1. Theoretical framework**

Schumpeter's theory of economic development, as cited in (Śledzik, 2015), is employed to guide the assessment of the forms of innovation because it provides the foundations of the forms of innovation. It explains key forces of development whereby among other factors, innovation is a central factor that pushes development. There are various forms of innovation which are clearly stated in it as follows:

- Launch of a new product or a new species of an already-known product.
- Application of new methods of production or sales of a product.
- Opening a new market (the market for which a branch of the industry was not yet represented).
- Acquiring new sources of supply of raw materials or semi-finished goods.

Entrepreneurship is among the drivers of economic development, driven by innovation, as explained in the above theory, thus making fitness of the theory for this study. The forms of innovation categorised in theory need re-assessment in the context of higher learning institutions by the graduates and how innovations are turned into business via commercialisation.

In situating the theory to this study, various reviews have been made, especially those that employed a similar theory. It has been generally found that the innovative process of an individual or enterprise is determined by several factors, including the context or environment where the entity exists. Pachura (2012), for instance, noted endogenous (a close environment where the firm is located) and exogenous (global economic and technological development) as key determinants for innovation growth. This implies that the enterprise may require innovation through interaction with close individuals or institutions that produce inventions, such as academic institutions or research centres. Alternatively, an enterprise may require innovation by importing products or services driven by their market demands.

Darroch and Miles (2015) analysed demand and supply sources of innovation. They noted that innovations occur when enterprise owners or managers identify emerging tests and preferences due to social, technological and regulatory changes. The test and preferences manifest as unmet needs where managers and owners develop new products or services. In the case of a supply-side source, a new product or service is first developed, and then the consumers are guided to use them. In most cases, this happens when the existing products are modified or improved.

Ideas coming from workers, customers, and universities have been found by Demircioglu, Audretsch and Slaper (2019) as a critical source of innovation as it is positively associated with the product, process marketing and innovation activities. This finding does not clearly state how products and services can be generated from those ideas.

This study will theoretically contribute because the current (fourth industrial revolution) frame of innovation is not well established to the extent that it does not capture the contextual dynamics of the innovation processes with its forward and backward linkage to enterprise development. The link between graduate innovation and enterprise development concerns scholars since most graduates focus on employment and not commercialising innovations. Therefore, studying higher learning institution graduates helps to provide a picture of the role played by these institutions in innovation development and entrepreneurship growth. In addition, the study will help

develop the key policy issue which will support the enabling environment for graduates to make innovations and commercialise innovation.

## **2.2. Graduate environment for higher education and innovation development**

Higher education systems, including universities and colleges, are acknowledged globally to nurture innovative behaviours among students. Tierney and Lanford (2016) stated that universities and related institutions are forced to change their teaching and research methodologies that will provide solutions to the present world's technological and knowledge demands. According to them, scholarly-based innovations significantly contribute to the field of medicine and related development sectors. Thus, it helps improve the lives of many people residing in underdeveloped nations. This means that graduates from these higher learning institutions are expected to possess innovative entrepreneurial behaviours that may help to solve work-related problems, including unemployment.

There are several channels through which higher learning contributes to innovation processes. It has been found that integrating teaching and learning activities with business activities, academic commercialisation of innovations, participation in hands-on business-based programs, and participation in research and public business-based events or exhibitions contribute to innovative behaviour. Other channels are higher learning–industry collaborations, higher learning institution-centred clusters and higher learning -industry research centres (Kaloudis et al., 2019). Similarly, it has been found that higher learning institutions contribute to innovation through assigned key-based activities such as teaching and learning, participation in development projects and sharing potential opportunities with the respective society. However, it has been further found that patents and licenses emerging from higher learning institutions have more contributions than other core activities undertaken by those institutions (Vidican, 2009).

In addition, higher learning institutions stimulate innovative behaviour through a partnership with local and international networks. Reichert (2019) noted that with the development dynamics in the business sector driven by technological change, most firms had changed their innovation approaches by attracting collaborations with research-based institutions and related higher-learning institutions to produce more innovations that support development. The collaboration with such institutions focused mainly on activities that intend to produce innovations. For instance, the university of Columbia made a partnership with some Taiwanese companies whereby they both participate in innovation processes

and their outcomes (commercialisation patents/licensing technological solutions). This higher learning institution has generated income from this partnership apart from generating innovative behaviour. Similarly, the Imperial College of London, through its technology transfer office, has generated over 60 startups companies and over 74 active technology licensing (Lundqvist & Williams, 2006)

Moreover, higher learning institutions have continued changing the available campus spaces for innovative research and commercialising the innovation that supports graduates' innovative development. Graduates are involved in the management and running of the incubator, science, and innovation parks, not just in the role of the landlord but as active partners in activities (Taylor, 2016). According to Kaloudis et al. (2019), higher learning institution graduates represent an essential part of the population that drives innovation via teaching and learning activities or their business endeavours. However, all those innovation outcomes depend on how strong the university is, as noted by Pogodaeva et al. (2015) econometric analysis, which indicated that the presence of a strong higher learning institution as an anchor increases the influence of innovation factors on the region's socio-economic development.

Since higher learning institutions are not equal in terms of investment in infrastructure, human resources, level of technology, program structure, quality of curricula and geographical location, it is anticipated that the graduates' quality in innovation will vary, respectively. Similarly, the stimulus for innovation varies depending on local or regional spatial characteristics with respective individual and organisational attributes. Next is the review of the tracer study in higher learning (universities) with regard to graduates' innovative behaviours for enterprise development. Given the limited studies on graduates' innovation, the researcher has selected studies from different regions.

Avvisati et al. 2013 assessed the contribution of higher education graduates to innovative economies based in Europe, Asia, and Latin America. Their findings were categorised into professional participation by sector (manufacturing and service industry). More than fifty per cent of workers with higher education degrees involved in innovation in the manufacturing industry have an engineering field of education, forty-two per cent in other social-related professional backgrounds, and seven per cent have a science degree. The situation was different in the case of service industries, whereby the sector was dominated by non-engineering and science workforces. The findings reflect innovation as a context-based phenomenon where every profession seems to dominate the inventions in their respective fields. This

further indicates that the kind of innovation graduates make depends on the production sector and the graduates' profession.

The tracer study by Gines (2014), which indirectly affect graduates' innovation, identified the graduates' application of what they learnt in classes during the pursuit of their studies as useful in their life as per sector of development. The ratings of applications vary depending on their respective career and employment. Generally, they found that the study domain was applied in their life course. The less-graded domains received gradings of below fifty per cent. Since the study does not specify the graduates' innovation, applying that knowledge and skills may impact innovations.

Similarly, the study by Winters (2014) found that students who graduated in Science, Technology, Engineering and Maths have higher innovations than those who graduated in other subjects. The innovation levels were measured in terms of the patents number acquired. The study was conducted around the United States' major urban areas. The findings further indicated the positive relationship between the patents produced and economic growth for both United States and non-United State-born students. The difference in innovation by subject studied is not detailed by the study, thus leaving questions unanswered as to why the difference exists.

A study by Diamond et al. (2014) on the impact of doctoral careers on innovation with a sample size of 1839 in England and Wales indicated that ninety per cent of them are engaging in competencies relating to inventions during their studies. Nevertheless, after completing their studies, over seventy-one per cent have made inventions, including products and processes. The produced inventions were mainly in the health sector, human management sector, electronic facilities, information sector, agriculture sector, mechanics entertainment and related sectors. All the innovations were significant in the growth of individuals and respective countries.

The study by Thomas (2011) conducted in Dar es Salaam revealed that enterprises owned by VETA entrepreneurs and those owned by non-VETA entrepreneurs had no new product innovation. However, a slight difference exists in adopting new products and their respective modifications where VETA entrepreneurs were better than non-VETA entrepreneurs. Kenya and Tanzania are ranked second and third, respectively, after South Africa for Sub-Saharan countries with regard to regional innovation levels (WIPO, 2021).

Concerning commercialised innovation in East Africa, Ayisi et al. (2016) study found that the higher learning institutions in the region have basic soft and hard infrastructures that support innovations. Soft infrastructure noted includes guidelines such as policies and manuals. The hard



infrastructure includes spaces such as offices, stores and information facilities like the internet. Some higher learning institutions have established programs that deal with innovation. Some students went far by producing notable innovations recognised by responsible authorities by giving them awards and certificates. Most of those innovations were centred on agriculture and related sectors. This implies the contextual opportunities in most developing nations where economies rely on those sectors. A similar study conducted in Ghana, Kenya, and Uganda by Otieno (2013) shows that universities and related institutions are far behind in innovation infrastructures. This can be attributed to little investment by governments and stakeholders in such domains and a workforce shortage responsible for bringing forward useful innovations for regional development.

The reviewed studies indicated that graduate innovation varies with the field of profession attained (type of degree admitted) in higher learning institutions. The forms of innovation made also vary by sector of production. For instance, those with a science background seemed more innovative than those with other subject backgrounds. Graduates from developed countries seem to be more innovative, unlike developing countries. This is attributed to innovation-enabling infrastructure and related financial investment. Also, graduates with PhD seem to be more innovative, unlike lower-level graduates.

Despite the huge investment of the government and private sector in higher learning institutions in East African countries, it is not clear to what extent these graduates contribute to innovation and how the innovations developed have been commercialised or advanced to the markets. The study will involve three specific objectives: First, identify the innovations developed by graduates. Second, assess the status of innovation advanced to the markets. Third, assess the difference between the innovations developed and those advanced to the market. This study dimension is embarked on because entrepreneurship and innovation complement each other and form an integral part of a successful business addressing graduate employment.

### **3. Methodology**

The time convenience, type of data collected and descriptive analysis were used to select a cross-sectional design to guide this research work. Nelson Mandela African Institution of Science and Technology (NM-AIST) has been purposively selected because, over the years, it has experience in enrolling students from East African countries on its Master's and PhD programs specialising in science and information technology.

The target population was all graduate students currently at NM-AIST whose nationality is in selected East African countries. Four (Tanzania,

Kenya, Uganda, and Rwanda.) countries were purposefully selected based on the number of students at the institution. The number of admitted students was consecutively higher than in other East African Countries. A total of 181 Master's students from four selected countries of East Africa was obtained from the admission book for the year 2018/2019, 2019/2020 and 2021/2022 (Masters Students).

A sample size of 124 was selected by a formula developed by Cochran, as quoted in Israel (2013):

$$n = N / (1 + N (e^2)) \quad (1)$$

Where  $n$  is the sample size,  $N$  population size  $e$  is the level of precision. The formula assumes that  $p = 0.05$  (maximum variability). The desired confidence level is 95%, and the degree of precision/sampling error accepted is  $\pm 5\%$ . Therefore  $n = 181 / [1 + 181(0.005^2)] = 124$ . Having determined the sample size, and to ensure equal representation, 69% of Master's students in each country for the selected years were selected proportionately, as presented in Table 1.

Table 1. Sample size distribution by East African countries

	Name of the country	Masters' population	Selected sample
1	Tanzania	123	84
2	Kenya	29	20
3	Uganda	17	11
4	Rwanda	12	9
	Total	181	124

Questionnaires were developed to collect data from the respondents. The content of the questionnaire covered the basic information that answered specific objectives. Pretesting of the questionnaire was done before actual data collection. No major changes were made except that the difficult terms were replaced with the simple ones. One hundred twenty-four questionnaire copies were administered to the respondents, and 94 were filled correctly and utilised for data analysis. The content of the questionnaire involved a section with a question that assessed forms of innovation made and innovations advanced to markets.

Specific objectives one and two were analysed descriptively, where percentages and frequencies were employed to analyse the forms of innovation made by graduates and the innovations advanced to the markets. The difference between innovations advanced to the markets and those not

advanced were analysed using inferential statistics whereby one sample T-test was employed. The findings were presented in informed tables. The discussion and implication of the findings were thematically presented.

The reliability of the data was ensured by assessing the internal consistency of the items through the Cronbach test, whereby the items with an alpha coefficient greater than 0.5 were utilised for further analysis. Content validity was employed to ensure the questionnaire covered what was supposed to be collected from the respondents by reviewing the theories and similar studies. Also, permission for collecting data was obtained from the institutional authority for ethical clearance. Each consent of the respondents was first requested before administering the questionnaire.

#### 4. Results and discussion

Graduates' innovations during the first degree were assessed through four forms. The findings indicate a slight difference as performs of innovation made by graduates. The bases of the four forms were derived from the theoretical framework that guides the study. The forms range from products, methods and activities, such as developing new methods of producing goods and services and introducing new or improved support activities. The findings are presented in Table 2 below.

Table 2. Innovation made during first-degree studies

Type of Innovation	Respondents' response		
	With innovation %	With no innovation %	N
Development of new or improved products.	28.7	71.3	94
Development of new or improved service.	35.1	64.9	94
Development of new methods of producing goods and services.	14.9	85.1	94
Introduction of new or improved support activities.	7.4	92.6	94

Table 2 indicates that graduates did more in the service innovation category. Some of the service items innovated include customer alert apps, new teaching techniques, food services training, online reporting of garbage piles up and the introduction of new businesses such as tourism camping sites and the establishment of educational conferences. The service innovation category is followed by product innovation which was rated 28.7 per cent by the respondents. Some of the products innovated by the graduates during their first degree mainly were the application of information and communication technologies in different sectors, for instance, house security systems, product

monitoring systems, automated inhaler Deoxyribonucleic acid (DNA) selection systems and billing tax systems.

Some graduates developed new or improved methods of production. Some of the production methods include the introduction of improved teaching aids such as animation used in online training, early detection of *Mycobacterium tuberculosis* (MTB) in sodium samples and electronic fabrication. Some graduates introduced or improved support activities as part of their innovation. Some of the support activities introduced include quick assembling procedures in mechanical hardware and quality control systems used in the industry.

The findings concur with the study by Avvisati et al. (2013), who found that graduates based on their respective fields of study, thus contributing to the current technological change. This entails innovations made by graduates bringing positive change from individual to respective countries' development. In addition, the forms of innovation concur with the study done by Diamond et al. (2014); however, the only difference is in the extent of innovation, whereby graduates with higher levels of degree have more inventions or creations. This difference is supported by the fact that learning objectives differ as the hierarchy of learning increases. For instance, doctor of philosophy students' learning is mainly research-intensive, bringing more innovations than first-degree students.

The findings in Table 2 have several implications. First, considering the rating score, the level of innovation among graduates during the first-degree study is low. This raises the question that their training programs lack some important aspects of innovation. First-degree graduates need to add value to the development of society via innovation. Second, the majority of innovations were done in service. This may imply a service gap in the surrounding society that necessitated the graduates to have more innovation in that sector. It has further implications that the environment is not favourable for products and other forms of innovation. The innovation assessment made by graduates during the first-degree studies was followed by the assessment to identify the innovation advanced to the market for commercialisation. The benefits of innovation are gained when the innovation is advanced to the market for commercialisation. The findings are presented in Table 3 below.

Table 3. Innovations introduced to the market, enterprise, or organisation

Type of innovation	Respondents' response		N
	Introduced innovation %	Innovations not introduced %	
Introduction of new goods to enterprise or organisation or market.	13.8	86.2	94
Introduction of new service to the organisation or enterprise, or market.	25.5	74.5	94
Introduction of new or significantly improved logistics, delivery and distribution.	4.3	95.7	94
Introduction of new or improved support activities to the organisation, enterprise, or market.	25.5	75.5	94

The findings in Table 3 indicate that service innovation was further introduced to the market for commercialisation. This indicates that the higher the innovation, the higher the number of innovations advanced to the market for commercialisation. The next category of innovation that advanced to markets for commercialisation was the introduction of support activities, as indicated by the findings. The support and innovation activities seem to tally with service activities in ratings; this can be attributed to the understanding of the two types of innovation with the interpretation that the graduates consider the two terms interchangeably. The fact is that the two terms used in innovations refer to different meanings.

The findings also show that the product innovation advanced to the market for commercialisation was only 13.8 per cent. In contrast, innovation advanced to the market in the logistics, delivery and distribution category was only 4.3 per cent. This may be attributed to the level of social-economic development of the graduates because this form of innovation requires economic investment and time. Also, it may be attributed to stiff external competition for innovation introduced to the market. Some products introduced to markets include a delivery system for retail stores, a biometric system for quality control, a tax billing system, a human management system and mobile up services.

The finding concurs with the studies by Ayisi et al. (2016), who found the success stories of graduates' certification of products whereby several products have been certified by respective authorities such as the Kenya Bureau of Standards. They also found that the startups for the innovative products were concentrated on low-hanging fruits such as agro-based or from the biological/physical sciences to serve small to medium-scale firms producing for local markets and require low technology application.

The findings in Table 3 imply the following. First, not all innovations made by graduates during their first-year studies reach the market for application or commercialisation. That means the innovation that did not

reach the market did not gain any economic benefit. Some reasons innovation does not reach the market include less value to the end-users, incomplete development of the innovation, lack of funds to market the innovation and innovators' perception and awareness of the viable and available commercial opportunities. Second, product innovation lags compared to other forms of innovation. This may be attributed to enabling environment for product innovation development since it requires a joint effort from stakeholders for the product innovation to reach the market—for instance, supportive intellectual property rights and related supportive policies.

The difference between product innovations made and introduced or advanced products to the market was analysed using one sample T-test. The assessment aims to understand if the innovation made by graduates reaches the market for commercialisation. The results of the analysis are presented in Table 4.

The findings in Table 4 indicate that there is a significant difference between product innovation made by graduates and innovations advanced to the market. This suggests that there exists a gap between innovation made by graduates and innovation which is commercialised. This implies that the graduates benefit less from their innovation, and the impact of their innovation can help society's development.

Table 4. The difference between product innovation made and product innovation advanced to the market

	t	df	Sig. (2-tailed)	Test value = 0		
				Mean difference	95% Confidence interval of the difference	
				Lower	Upper	
Development of new or improved products.	36.505	93	0.000	1.713	1.620	1.806
Introduction of new goods to the enterprise, organisation, or market.	52.007	93	0.000	1.862	1.791	1.933

Furthermore, the difference between service innovation made and service innovation advanced to the market was analysed using a One-Sample T-test. The purpose is to understand if this innovation reaches the commercialisation market. The results are presented in Table 5 below.

Table 5. The difference in service innovation made and advanced innovation service to the market

	t	df	Sig. (2-tailed)	Test value = 0	95% Confidence interval of the difference	
				Mean difference	Lower	Upper
Development of new or improved service.	33.316	93	0.000	1.649	1.551	1.747
Introduction of new service to the organisation, enterprise, or market.	38.586	93	0.000	1.745	1.6549	1.835

The findings in Table 5 indicate a significant difference between service innovation made and advanced service innovation to the market. This implies that most of our graduates' service innovations do not reach the market for commercialisation. This means their innovation has less impact on them and their society's social-economic development.

Generally, the findings in Tables 4 and 5 imply that most of the innovations done by graduates do not reach the market for commercialisation. In other words, the invested efforts in their training program have less impact on society and respective countries' development. Thorough program evaluation and impact assessment are needed to identify the existing gaps in their programs and associated innovation-enabling environments.

## 5. Conclusion and recommendations

It is concluded that the graduates developed some innovations during their first-degree studies. The extent of innovation varies by the form of innovation. Most innovations were made in the service form, followed by the product form of innovation. The overall level or extent of innovation is low since all forms of innovation range below 40 per cent. Similarly, the extent of innovation advanced to the markets for entrepreneurship is low compared to innovation-developed graduates since the results displayed a significant difference.

An urgent review of the graduate crafting innovation process is needed in higher learning institutions based in East Africa. The review should consider the relevancy and capacity of the training programs offered by those institutions. This should seek to assess the presence of competency and solution-based curricula with the respective research undertaking capacities. In addition, an innovation-enabling environment needs recasting in Eastern Africa especially industry-based collaborations with higher learning

institutions and government and private-based innovation support stakeholders.

### Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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