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Effect of Determinants of Entrepreneurial Innovation on Businesses Innovation Capacity in Sub-Saharan Africa

Odhiambo Norbert Omuga, Robert Moracha Ogeto & Xiongying Niu

Abstract:
Global and local challenges and changes in the structure of knowledge production and usage, have led to very many different types of innovations. Thus, recognizing and classifying such innovations is more complex, fragmented, and geographically dispersed academic and social venture. This study provides a quantitative longitudinal study of the determinants of innovation, their role in entrepreneurship innovation capacity and how they collectively add value to economic growth in sub-Saharan Africa. The study used fixed effects with country dummies in the analysis where Stata software was used. The results generated are expected to use in enabling both other researchers and practitioners to navigate the complex web of innovation definitions and typologies and they collectively impact on economic growth in the poor world. The results indicated that the extent of staff training, brain drain, absence of excessive bureaucracy and red tape, intellectual property protection, venture capital availability and intensity of local competition among firms were positively and significantly correlated with entrepreneurial innovation capacity in SSA. On the other hand, government procurement of advanced technologies was negatively and significantly correlated with entrepreneurial innovation capacity in SSA. It is recommended that respective countries should put in mechanisms to capitalize from the positive benefits of brain drain, absence of excessive bureaucracy and red tape, venture capital availability, intensity of local competition among firms and tertiary education gross enrolment on the economy. This could be through increased investments in tertiary institutions and reduction of bureaucracy and corruption that will not only increase high quality production through increased labour productivity, but will also foster fair competition in the markets. The governments should also increase mechanisms that facilitate increased savings for investment and where possible adopt strategies that will encourage increased inflow of foreign direct investment.

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About Author (s)

Odhiambo Norbert Omuga (corresponding author), Business school, University of International Business and Economics, Chaoyang District, Beijing, P.R. China 100029. Email: norbertomuga@yahoo.com

Robert Moracha Ogeto, Business school, University of International Business and Economics, Chaoyang District, Beijing, P.R. China 100029. Email:

Professor Xiongying Niu, Business school, University of International Business and Economics, Chaoyang District, Beijing, P.R. China 100029.

Introduction

Most of the business ventures in sub-Saharan Africa are involved in innovation and knowledge-based ventures though at small scales. Most of the new ventures are formed to exploit poverty, absence of competition, coming up with solutions to challenging situations and self-defeating political governance. This means that most of the entrepreneurs and intrapreneurs are involved a variety of businesses under varying conditions with most of them coming up with innovations to either start new businesses to address certain situations or as a way of making ends meet. This is however done under different conditions which establish the achievement or collapse of the innovations and the rate at which they are developed. Success and the rate at which the innovative ideas are put into play has far reaching contributions to the economies of nations involved. However, despite the likely benefits of entrepreneurial innovation on economic growth, little effort has been made to determine the relationship between entrepreneurial innovation, its determinants and how they relate to Sub-Saharan's Africa economic growth. This study therefore carried out an investigation on the relationship between entrepreneurial innovation and economic growth in sub-Saharan Africa, how the various determinants of entrepreneurial innovation affects economic growth and the innovation capacity of businesses in sub-Saharan Africa.

Sustainable growth is the best method to fight poverty and innovation is main key to achieving sustainable growth. Unfortunately, small enterprises in countries such as Kenya, South Africa, Indonesia and Vietnam are only growing at a snail's pace Vermeulen and Knoben (2019). The duo also goes ahead to make more arguments that Innovation done in most parts of Sub-Saharan Africa is strongly linked to the economic growth in the region. They argue that the larger the innovation by an entrepreneur the larger the amount of work offered to more people, and hence more knowledge, more development opportunities and more economic influence. Most business ventures in sub-Saharan Africa are involved in small scale innovation and knowledge-based ventures. Majority of the new ventures are formed to address poverty, absence of competition and coming up with solutions to solve specific issues. However, this is done under different environments and this determines the success or failure of the innovations and the rate at which they are developed. The success and the speed at which the innovations are is however affected by a number of determinants. Despite the likely effects of determinants of entrepreneurial innovation on innovation capacity, little effort has been made to determine the relationship between entrepreneurial innovation affects the innovation capacity in sub-Saharan Africa. This paper therefore carried out an investigation on how the various determinants of entrepreneurial innovation affects the innovation capacity of businesses in sub-Saharan Africa.

Literature Review

Lam (2015) and Gault (2018) have both made several observations about the role of organizational establishment by considering the fact that it may be a necessary requirement for the development of technologies that are only possible through the organization or as a business or commercial effort. New business innovations emphasize on factors that develop organizational composition, learning process, and their adaptability to the surroundings including institutional and market structures. The array of new businesses, technically linked, affecting organizational skills and quality and competence of work, enhances the exchange of information. Innovation also enhances the organization's aptitude to learn and apply new ideas and technologies. The concept of entrepreneurship is widely borrowed from the study. Tidd et al. (2015) came up with the idea of 4Ps for new blends. This includes traditional aspects of product and process, with the exception of position and paradigm. Design-based design refers to a change in the way a process or product is symbolically perceived and how

the product or process is used. It involves re-branding an already suspended product or product, for example, gaining a reputation through a new Corporate Social Responsibility (CSR) practice. It could also be a negative concept, for example in the event of a re-creation of the Volkswagen company which introduced the Jetta compact car following the embarrassment of the Volkswagen company (Jung, Chilton, and Valero, 2017). The paradigm-based novelty on the other hand is about rational or cognitive models that reform what a business or company is all about in terms of their actions in relation to major challenge and /or a noble development program. While the first two types of invention are technically natural, some new things can be solved technically or not.

Designs done under business ideas often focus on Product. Product design is a unique and popular type of innovation. According to Gault (2018) a new product innovation as an item available to potential users, that is novel or considerably modified in terms of its features or intended use. Gault (2018) also went on to consider that depending on organizational processes, decision-making processes and relationships with the environment, new approaches may follow sequential processes, planned or integrated into closed or open settings. But right now, a common trend is the use of new ideas in products that increase their number of firms economically or socially. In his book Democratizing Innovation Hippel (2015) he notes that even individual consumers are increasingly being able to innovate. Hippel (2015) emphasizes the existence of great advantages of design processes that focus on the use and guidance of the user in addition to the creative processes developed by the manufacturer for centuries. Hippel (2015) also comes up with three types of business innovations as user-driven, consumer-focused, or technology led by the user connects with the selling environment and social needs, growing gradually as allowing computer and communication technologies to improve and enhance social interests. Hippel (2015) also notes that, involving consumers in the design of products and services is not new. Several studies demonstrate the benefits of user or customer views and their incorporation into new processes. Reichstein and Salter (2016) came up with the idea of organizing an organization known as a new process which they described as new things introduced in the production or operation of an organization. That being said, the introduction of new or enhanced production techniques and processes could mean a change in the equipment or production organization or both. Marketing strategies to grow the organization's productivity are also part of a new process in the business sector. The organizational innovation of the business is now largely influenced by the growing trend associated with improving new processes in companies and initiatives with the start of design thinking and reliable thinking. This includes the use of a large number of new material processing technologies as well as new operational communication skills. Reliable thinking and dependent approaches are a systematic approach that helps to create ideas in the first stage and become marketable products, processes, or services (Taj and Morosan 2016). This is the reason why many industries are facing paradigm shifts from limited, large-scale production to dynamic and low-volume production or to quickly adapt to market demand. Overall, the new design and production process is a new approach that organizations can use to create limited resources in the context of accelerating technological development. The dependency approach is related to other innovative ways and this includes open production and innovation and is often used by leading companies or companies to deliver products and services quickly to market with fewer resources and reduce risk while increasing customer numbers simultaneously (Hieber, 2016). The most amazing thing about a new organization or business is the creation of a new service. The design of the app was adopted by Goldstein et al. (2016) as a service concept that incorporates a service delivery strategy of what should be delivered and how the service delivery system will be structured.

Hippel (2015) also noted that the debate over new services affects not only service companies but also traditional manufacturing companies, which have begun to recognize the role of services that have the potential to differentiate their products for competitive purposes. As a result, development services have become a new industrial strategy in various industries and new services have emerged as strategies for achieving sustainable competitive advantage. These types of innovations are often associated with innovations that attract staff and researchers as tools to promote new business models. Tucci (2016) added to this concept by preventing business entities from operating on a business model, which means that they traditionally follow the same common concepts of an industrial company producing products or services using products from its suppliers and delivering goods or services to customers. These functions are transformed by new business models that come from firms directly and, indirectly, from community organizations. Strong power to establish correlates with the different functions of their business model, consisting of various features or components: price proposition that identifies a market segment and a monetary mechanism similar to the use and purpose of technology; the formation of the value chain required to construct and distribute the supply and related goods; financial means of payment provided; property value estimates and potential benefits of a given property value and price; a strong position within the network that supply providers and customers, as well as the development of a competitive strategy (Chesbrough, 2015).

A new type of business is a well-known variation of an existing business model or the creation of a new business model that enhances its functions and satisfies customer needs better than existing business models. Organizational planning and marketing in this regard are essential to the introduction of diversity into business models. Gault (2018) defines the establishment of an organization as the implementation of new or stronger organizational mechanisms in the operation of a business, workplace organization or external institutional relationship. Joyce & Paquin (2016) demonstrates, figuratively speaking, a well-known business plan between firms and other organizations as a textile business model that is useful in building a business plan and exploring new opportunities of various sizes or components (Joyce & Paquin, 2016). Hippel (2015) pointed out that the most widely accepted interpretation is in line with the concept of "youth" in the creation and successful implementation of ideas that have been transformed into tangible and technical or non-technical products and services. Aside from the differences between IS communities, especially those between business and common founders, design allows for a vision of change in people (minds), organizations, and systems in general. Establish ways in which organizations can bring about change in order to survive and prosper in times of uncertainty and conflict. The term organization refers to various profit and non-profit firms that may be private or public and may be third parties or hybrid firms. Hippel (2015) also pointed out that by looking at history, change is considered important for innovation, by being part of the dynamics of human origins and context in which people produce knowledge, and change and “make” their social practices over time. A new design introduces a “new something” that reflects a change, but a new designation means a “process” or method) in which the change occurs over time. The design includes flexible changes such as the Internet and small dynamic changes. Other issues that require research on innovation include many new disruptive issues presented by new economic sectors such as social economics, green and blue economy, silver economics, and gig economics. The gig economy includes a variety of business platforms, called markets that create and support transactions between private and private stakeholders; these species oppose not only production systems, but also macroeconomic and social laws and policies (Greenwood, 2018). A new hallmark of the ability to innovate a new kind of innovation is a striking diversity due to its culture of reliance on multi-sectoral

collaboration. On the other hand, there is a growing trend of new hybrids (OECD, 2017) and hybrid renewal that is transforming markets and blurring the boundaries between technology, society and culture. On the other hand, the rapidly changing areas of digital technology and innovation are emerging from the fourth industrial revolution and changes that form the basis of science and technology for systems and knowledge. The ideal situation is, to design a complex social and cultural process involving various actors and sources of information. Innovation not only promotes and sustains the competitive advantage of firms and organizations but also addresses major social challenges of the 21st century. In addressing these challenges, a variety of innovations continue to emerge from innovation to economic production to sustainable development and innovation to new social systems. It continues to emerge from small ideas to expanding social and technological ideas and new cultures. The field of innovation faces the crucial challenge of capturing a complete picture of a well-defined construction with the right metrics, overcoming the differences in goals and the diversity of the new field. To select independent variables used, this paper classified the independent variables based on the classification adopted by Valliere and Peterson (2009). The variables were classified into three sets, that is based on the new economic geography, endogenous growth theory and national systems of innovation classes. However, due to data unavailability for the endogenous class, it was omitted and in its place the administrative burden of start-ups class introduced which was split from the national systems of innovation class as it can stand alone. Based on the the classifications of Valliere and Peterson (2009), the variables whose data was available are as in Table 2 in the appendix section. The variable on administrative burden for start-ups has been broken down into various components and treated on its own instead of being treated as a variable in the national systems of innovation.

Methodology

Data for this study was sourced from a number of data sets. The data covered the period from 2010 to 2016 which was largely determined by data on determinants of entrepreneurial innovation and other entrepreneurial variables whose data was available only for this period. 30 countries were selected for this study based on their belonging to SSA region and hence very comparable. This was out of the 48 SSA countries. The countries included in the study were; Benin, Cameroon, Cape Verde, Chad, , Botswana, Burkina Faso, Burundi Cote D'Ivoire, Madagascar, Mali, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Senegal, Seychelles, South Africa, Tanzania, Uganda, Zambia, The Gambia, Ghana, Guinea, Kenya, Lesotho, Zimbabwe, Gabon, Liberia and Malawi. For the purposes of this study, the variable of interest is the determinants for innovation by entrepreneurs in respective countries in SSA and this was obtained from the World Economic Forum Report of 2016 in its global information-technology report. Other data variables included extent of staff training, quality of management schools, venture capital availability, availability of latest technologies, intensity of local competition, intellectual property protection, government procurement of advanced technology, number of days to start a business and tertiary education gross enrolment rate. This was sourced from the global information-technology report of the world economic forum of 2016. Other variables included brain drain rates sourced from the Quality of Government Institute Standard Dataset (QGISD) version of 2019, absence of excessive bureaucracy and red tape sourced from the Mo Ibrahim Foundation, and cost to register a business sourced from the World Bank. Others included time required in days to start a business both in general and by gender, number of start-up procedures to register a business both general and by gender and cost of start-up procedures which was as a percentage of GNI per capita in general and by gender sourced from the WB development indicators dataset.

Theoretical model

This study used the traditional neo-classical aggregate production function theoretical model to investigate the effect of determinants of innovation in entrepreneurship and innovation capacity in Sub-Saharan Africa. This model is however, based on economic growth model which is then appropriately modified to determine the relationship between determinants of innovation in entrepreneurship and innovation capacity. This theoretical model has been adopted as similarly used by Chanie (2017) and it takes the form of:

$Y_{jt} = AK_{jt}^{\alpha} L_{jt}^{1-\alpha}$ …… (1)

Where:

Y_{jt} = gross domestic product (GDP) in country *j* in year *t*

K_{jt} = capital stock in country *j* in year *t*

L_{jt} = labour in country *j* in year *t*

A = a parameter that measures total factor productivity (TFP)

α and 1-α are the elasticities of capital and labour from the total production.

Taking logarithms on both sides of equation (1), the equation becomes:

$lnY_{jt} = C + \alpha lnK_{jt} + (1-\alpha) lnL_{jt} + U_{jt}$ …… (2)

Equation (2) can further be simplified to become:

$lnGDPPPC_{jt} = \beta_0 + \beta_1 lnK_{jt} + \beta_2 lnL_{jt} + U_{jt}$ …… (3)

where β_0 is a constant term, $lnGDPPPC_{jt}$, lnK_{jt} and lnL_{jt} are the natural logarithms of $GDPPPC_{jt}$, K_{jt}, and L_{jt} respectively while U_{jt} is the error term. $\beta_1$and β_2 are elasticity coefficients of capital and labour respectively.

Where:

GDPPPC = Gross domestic product per capita, constant prices (Purchasing power parity; 2011 international dollar) in country *j* in year *t*

K = Gross capital formation (% of GDP) in country *j* in year *t*

L = Labour force participation rate, total (% of total population ages 15+) in country *j* in year *t*

FDI = Foreign direct investment, net inflows (% of GDP) in country *j* in year *t*

j and t are countries and time in years respectively where j =1, 2, ……. 30 and t = 1, 2, …….7

for the purposes of this study, Equation (3) was used to derive the model to be used in the model section to develop models for estimation of the relationship between determinants of innovation and entrepreneurial innovation capacity in Sub-Saharan African countries.

Empirical Model

To investigate the relationships between the determinants of entrepreneurial innovation capacity and innovation capacity (CA), equation (3) is modified into equation (4) in an appropriate form by using innovation capacity (CA) as the dependent variable in place of GDPPC. In this estimation, the socioeconomic variables were not included in the estimations so as to get a clear picture of the effect of the determinants of entrepreneurial innovation on innovation capacity in SSA. For clarity, the variables will be included in the model regardless of the classification with variables in each of the classes estimated simultaneously as follows:

$lnCA_{jt} = \beta_0 + \beta_1 lnBD_{jt} + \beta_2 lnHFP_{jt} + \beta_3 lnABRT_{jt} + \beta_4 lnEST_{jt} + \beta_5 lnILC_{jt} + \beta_6 lnTEGE_{jt} + \beta_7 lnIPP_{jt} + \beta_8 lnVCA_{jt} + \beta_9 lnALT_{jt} + \beta_{10} lnGPAT_{jt} + \beta_{11} lnQMS_{jt} + \beta_{12} lnCRB_{jt} + \beta_{13} lnNDSB_{jt} + \beta_{14} lnTRSB_{jt} + \sum_{j=2}^{30} c_j D_j + U_{jt}$ …… (4)

Where:

CA = Innovation capacity

K = Gross capital formation (% of GDP) in country *j* in year *t*

L = Labour force participation rate, total (% of total population ages 15+) in country *j* in year *t*

FDI = Foreign direct investment, net inflows (% of GDP) in country *j* in year *t*

BD = Brain drain
HFP = Hiring and firing practice
ABRT = Absence of Excessive Bureaucracy & Red Tape
EST = Extent of staff training
ILC = Intensity of local competition
TEGE = Tertiary education gross enrollment rate, %
IPP = Intellectual property protection
VCA = Venture capital availability
ALT = Availability of latest technologies
CRB = Cost to register a business, % of GNI per capita
GPAT = Gov't procurement of advanced tech
QMS = Quality of management schools
NDSB = No. days to start a business
TRSB = Time required to start a business (days)

Where Dj is a dummy variable for country j and cj stand for the difference between the intercept for country j and that of the first country.

NB: The variables were developed using 7-point Likert scales for respondent perceptions except for TEGE and others which are in percentage form as explained in the summary statistics.

Results

This sub-section presents regression findings and discussion of results for the third research question on the effect of determinants of entrepreneurial innovation on innovation capacity in Sub-Saharan African countries. The independent variables of interest were the various determinants of innovation and how they relate with innovation capacity in Sub-Saharan Africa. The results were estimated based on equation (4) using fixed effects regression with country dummies and the elasticities of the independent variables are as presented in Table 1. To address any possible challenges of heteroscedasticity, robust option was included in the Stata command when running the results using fixed effects regression with country dummies. The results in column 1 were estimated using random effects estimation while the results in column 2 were estimated using fixed effects estimation. However, to take care of country difference, the results in column 3 were estimated using fixed effects regression with country dummies and were thus used for interpretation purposes. The R^2 value for the estimation in column 3 in Table 1 is very high at .908 implying that 90.8 percent of innovation capacity is explained by the included independent variables in the regression. From the results in column 3 in Table 1, a number of findings can be drawn. Firstly, the elasticity of extent of staff training (EST) is 0.491 which is positive and statistically significant at 0.1 significance level as shown in column 3 in Table 1. The result implies that an increase in extent of staff training by 1 percent leads to an increase in innovation capacity by 0.289 percent. This result is as was expected since staff training is a preliquisite for acquisition of new knowledge and skills that for development of new technologies hence the positive relationship with innovation. Business enterprises that train their staff ensure that the staff have the required knowledge to develop and or use new technologies in the running of their busienesses and this boosts innovation capacities of such businesses. The results are in harmony with those of of Szeto (2000) who found that accummulation of knowledge positively contributes towards innovation capacities of a firm and also with the findings of Timeus and Gasco (2018) who find that innovation labs positively contributed to increased innovation by firms.

Secondly, the elasticity of brain drain is 0.598 which is positive and statistically significant at 0.05 significance level as shown in column 3 in Table 1. The result implies that an increase in brain drain by 1 percent leads to an increase in economic growth by 0.598 percent. This result is plausible and as similarly found by other scholars who have argued that brain drain positively contributes to innovation in economies of origin since most of the highly qualified staff who move to other countries for greener pastures make investments back in their home countries hence making huge contributions innovation capacity by availing the necessary capital for procurement of necessary innovations. This is in harmony with the findings of Beine et al. (2001) who observed that most prospective job migrants heavily invest in their education before migrating this often positively contributes to innovation as observed by Szeto (2000). Dodani and Laporte (2005) further argue that brain drain leads to increased innovation through the knowledge and skills shared back home by the migrant professionals.

Thirdly, the elasticity of hiring and firing practice is 0.0787 which is negative but statistically not significant as shown in column 3 in Table 1. The results imply that if hiring and firing flexibility increases by 1 percent, then there is a likelihood of a decrease in innovation capacity by 0.0787 percent. In as much as high hiring and firing flexibility gives managers room to make changes in the staff composition, this may on the contrary lead to loss of skilled manpower who are essential in development of new technologies. It may also discourage potential employees with necessary skills for enhanced innovation. The results are in harmony to those of Kleinknech et al. (2006) who found that high hiring and firing flexibility may lead to low labour productivity and this may slow down their innovativeness. The results are also in harmony with those who finds a negative relatioship between contractual and financial flexibility of labour and both employee driven innovation and organizational innovativeness but on the other hand finds a positive relationship between functional labour flexibility and both employee driven innovation and organizational innovativeness. This implies that the effect of labour flexibility on innovation will depend on what hiring and firing forms are adopted by the business firms.

Fourthly, the elasticity of absence of excessive bureaucracy and red tape is 0.0810which is positive and statistically significant at 0.05 significance level as shown in column 3 in Table 1. The results imply that an increase in absence of excessive bureaucracy and red tape by 1 percent could lead to an increase in entrepreneurial innovation by 0.0810 percent. The result is plausible and as expected since less bureaucracy and red tape means that business decisions and action move faster and with much flexibility. Absence of excessive bureaucracy and red tapeis especially important in productive decisions which facilitates production efficiency. The results are in harmony with those of Goedhuys et al.(2016) who found that bureaucracy and corruption have a negative effect on the likelihood that a firm is an innovator and that bureaucracy has an effect on the overall growth of the firm. Hence absence of bureaucracy and red tape facilitates easy decision making especially on production and also where it entails bureaucratic obstacles that relate to obtaining necessary permits and licenses for product innovaton. Absence of excessive bureaucracy and red tape could imply that it takes less time to get such permits and licenses hence making innovation easier and vice versa.

Fifthly, the elasticity of intellectual property protection is 0.474 which is positive and statistically significant at 0.05 significance level, as shown in column 3 in Table 1. The results imply that an increase in in the rate of intellectual property protection by 1 percent could lead to an increase in firm innovation by 0.474 percent which is a very high response in firm innovation. Intellectual property protection is a major factor in firm growth and innovation as

it ensures that firm intellectual property rights and those of its employees are protected and the benefits that accrue from such rights benefit the firm. When the employees are assured of the protection of their intellectual rights, this encourages creativity and innovation leading to the development of new technologies and products which are necessary for increased production efficiency hence positively contributing to firm growth and innovation. The results are in harmony with those of Kim et al. (2012)found that patent protection was an important determinant of innovation and that patentable innovations contributed to firm growth and overall economic growth mostly in developed countries.

Sixthly, the elasticity of venture capital availability is 0.378 which is positive and statistically significant at 0.01 significance level as shown in column 3 in Table 1. The results imply that an increase in venture capital availability by 1 percent could lead to an increase in firm innovation by 0.378 percent which is a very high response in firm innovation. The result is plausible and as expected since an increase in venture capital availability implies that most firms can easily access the required capital to invest in research and development which could increase the firms' innovation capacity. This result is in harmony with the findings of Samila and Sorenson (2011) who found that increases in the availability of venture capital has a positive effect on firm starts, employment and overall income and this means that such firms can invest in research and development which is key in innovation. This is also in harmony with the findings of Kortum and Lerner (2000) who found a positive relationship between venture capital and industrial innovation.

Seventhly, the elasticity of availability of latest technologies is 0.0245 which is negative and statistically insignificant as shown in column 3 in Table 1. The results imply that an increase in availability of latest technologies by 1 percent could lead to a decrease in firm innovation by 0.0245 percent. The result is as was expected as a negative coefficient is an indicator that availability of latest technologies demotivates the firms from investing in research and development. In this case firms will tend to rely on the available technologies with little motivation to invest in research and development hence the possible reason for the insignificance and negative results.

Eight, the elasticity of cost to register a business as a percentage of GNI per capita (CRB) is 0.101 which is negative and statistically insignificant as shown in column 3 in Table 1. The results imply that an increase in cost to register a business by 1 percent could lead to a decrease in firm innovation by 0.101 percent. The result is as was expected as a positive coefficient is an indicator that if the cost of registering a business increased then this could otherwise reduce available resources that could be invested in research and development hence the negative effect. High cost of registering a business is also a deterrent to prospective entrepreneurs as it making it generally expensive to start and run a business and hence limiting their innovative capacity. This is in harmony with the findings of Eifert et al.(2008)who found that indirect costs accounted for a relatively high share of business firms in African countries hence posing a problem of lack of competitiveness and performance and hence limited funds to invest in inventing new technologies.

Ninth, the elasticity of government procurement of advanced technology (GPAT) is 0.434 which is negative and statistically significant at 0.05 significance level as shown in column 3 in Table 1. The results imply that governments in the region were procuring less and less of advanced techonologies over time and this was having a negative impact on entrepreneurial innovation in the region. Some advanced technologies are highly expensive to be procured by individual firms due to finncial constraints hence the need for government intervention.

However, from the data on this variable, there was an indication that governments were procuring less and less of advanced technologies over time. This could be due to the fact that most governments in the region are financially constrained due to the high poverty levels in SSA implying that most governments may not have sufficient capital for procurement of the advanced technologies that are necessary to boost induce increased ouptu in business enterprises. Besides lack of funds, there is also limitted knowledge and skills that will be required to operationalize the advanced technologies if procured. The results are in harmony with the findings of of Eifert et al. (2008) who attribute low innovation to high costs of businesses in SSA.

On intensity of local competition (ILC), the elasticity of intensity of local competition is 0.546 which is positive and statistically significant at 0.01 significance level as shown in column 3 in Table 1. The results imply that an increase in in the rate of intensity of local competition by 1 percent could lead to an increase in firm innovation by 0.546 percentwhich is a very high response in firm innovation. The result is as expected since higher intensity of competition among firms trigers creativity and innovative ways to produce unique and superior products for a bigger market share and in the process this leads to new ways of doing business with a possible result of better products and increased productivity. Thus competetion trigers more innovation as firms invest more resources in research and development so as to beat their competitors in the market. The results are in harmony to those of Crowley and Jordan (2016) who found a positive relationship between competition and the likelihood of innovation with an observation that as competition among firms increased, the innovation likelihood also got higher. However, they observe that competition has a higher effect on innovation in developed economies unlike emerging economies and that firms that relied on local markets were less likely to introduce innovation as compared to firms that were trading domestically and outside their local markets. However, Peroni and Ferreira (2011) observe that the relation between competition is non-linear and is highly dependent on the inputs used in production. They further indicate that innovation likelihood increases as firms converge closer to the frontier while it decreases as technology spreads.

On number of days to start a business, the elasticity of number of days to start a business is 0.0593 which is negative and statistically insignificant as shown in column 3 in Table 1. The results imply that despite the insignificance of the results, anincrease in in the number of days to start a business by 1 percent could lead to a decrease in innovation by 0.0593 percent. The result is plausible and as expected since more time to start implies an indirect increase in the cost of starting and doing business which not only affects the number of businesses started but also slows down innovation. The fewer the number of days required to start a new business to more the businesses that are likely to be started which then has a positive effect on economic development. This is in harmony with the findings of Dejardin and Fritsch (2011) who found a positive relationship between new businesses and regional economic development. This is through increased productivity which is normally a result of increased innovation and therefore, fewer days to start a business could indirectly contribute to a higher likelihood of innovation by most of the new firms. This could be through increased investments in research and development after startup so as to boost productivity.

On quality of management schools, the elasticity of number of quality of management schoolsis 0.218 which is positive but statistically insignificant as shown in column 3 in Table 1. The results imply that despite the insignificance of the results, anincrease in the quality of management schoolsby 1 percent could lead to an increase in innovation by 0.218 percent. High quality of management schools ensures that business enterprises have access to quality

manpower that is essential in the management of firms which is key in increasing the likelihood of being innovative. The results are in harmony to those of Bourke and Roper (2017) who found a positive relationship between quality training and innovation. They further argue that adoption of quality management training has an effect on both short term and long term product innovation performance.

On tertiary education gross enrollment rate (TEGE), the elasticity of tertiary education gross enrollment rate is 0.00582 which is positive but statistically insignificant as shown in column 3 in Table 1. The results imply that an increase in in the rate tertiary education gross enrollment rate by 1 percent could lead to an increase in firm innovation by 0.00582 percent. The result is as expected even though insignificant since an increase in the number of people that transit to tertiary institutions is an indication that majority of the people will acquire the necessary knowledge and skills that are essential in coming up with new technologies and running of business enterprises hence increasing the likelihood of the forms becoming more innovative. Transition to higher institutions of learning also ensures majority of the populace are able to get into job positions which ensures availability of market for goods and services and this indirectly induces the firms to invest in research and development so as to better meet the needs of the consumers and this further increases the likelihood of the firms to innovate. This result is in harmony with the findings of Raghupathi and Raghupathi (2017)who found a positive relationship between higher education and research and development expenditure which in turn translates to a higher likelihood of innovation. A country with a higher transition to higher institutions of learning invests more in research and development and this normally has a positive effect on innovation.

On start-up procedures to register a business (SUPRB), the elasticity of start-up procedures to register a business is 0.122 which is negative but statistically insignificant as shown in column 3 in Table 1. The results imply that an increase in the start-up procedures to register a business by 1 percent could lead to a decrease in the likelihood of firm innovation by 0.122 percent. This result is plausible and as expected even though insignificant since an increase in the start-up procedures to register a business is an indicator that entrepreneurs will take long to start their businesses and this has the effect of not only affecting the number of businesses started but it has an effect of slowing down the likelihood of such businesses to innovate. To increase the number of new businesses started and to positively contribute towards innovation, the startup procedures need to be considerably reduced and simplified so that entrepreneurs have the motivation to invest in new ventures that can contribute towards increased innovation in the process. This result is in harmony with the findings of Dejardin and Fritsch (2011) who found a positive relationship between new businesses, productivity and regional economic development, implying that if start-up procedures were many, then they could result in fewer new businesses which could eventually negatively affect the likelihood of innovation.

On time required to start a business which is closely related to the start-up procedures to register a business, the elasticity of time required to start a business is 0.0743 which is positive but statistically insignificant as shown in column 3 in Table 1. The results imply that an increase in in the time required to start a business by 1 percent could lead to an increase in the likelihood of innovation by 0.0743 percent. This result is not as expected since like in the number of procedures to register a business, it is expected that if more time was required to start a business then, this becomes a deterrent to possible entrants and this as a high possibility of discouraging innovation. However, from another view more time to start the business could be an indicator that new firms have sufficient time to plan about their

business ventures and what technologies are more likely to be more efficient and therefore in this case, more time could lead to a higher likelihood of the firms being more innovative once started.

Table 1: Effect of determinants of innovation on entrepreneurial innovation capacity

	(1)	(2)	(3)
	Re	fe	fc
VARIABLES	lnCA	lnCA	lnCA
lnEST	0.114	0.491*	0.491*
	(0.174)	(0.278)	(0.255)
lnBD	0.624***	0.598**	0.598**
	(0.127)	(0.234)	(0.252)
lnHFP	-0.0811	-0.0787	-0.0787
	(0.0796)	(0.126)	(0.133)
lnABRT	0.0514	0.0810	0.0810**
	(0.0329)	(0.0491)	(0.0395)
lnIPP	0.299***	0.474***	0.474**
	(0.109)	(0.167)	(0.180)
lnVCA	0.491***	0.378***	0.378***
	(0.103)	(0.128)	(0.119)
lnALT	-0.419***	-0.0245	-0.0245
	(0.161)	(0.262)	(0.237)
lnCRB	-0.0849	-0.101	-0.101
	(0.122)	(0.347)	(0.138)
lnGPAT	-0.335**	-0.434**	-0.434**
	(0.148)	(0.207)	(0.208)
lnILC	0.568***	0.546***	0.546***
	(0.130)	(0.152)	(0.196)
lnNDSB	-0.0316	-0.0593	-0.0593
	(0.0337)	(0.0437)	(0.0389)
lnQMS	0.212	0.218	0.218
	(0.130)	(0.211)	(0.240)
lnTEGE	-0.0203	0.00582	0.00582
	(0.0224)	(0.0343)	(0.0363)
lnSUPRB	-0.0400	-0.122	-0.122
	(0.0700)	(0.159)	(0.156)
lnTRSB	0.0184	0.0743	0.0743
	(0.0485)	(0.0893)	(0.0899)
lnCBSUP	0.0687	0.0709	0.0709
	(0.121)	(0.347)	(0.134)
Observations	210	210	210
R-squared		0.787	0.908
Number of id	30	30	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Stata software output

Conclusion and Recommendation

On the effect of the determinants of innovation on entrepreneurial innovation capacity, it was concluded that extent of staff training, brain drain, absence of excessive bureaucracy and red tape, intellectual property protection, venture capital availability and intensity of local competition among firms were positively and significantly correlated with entrepreneurial innovation capacity in SSA. On the other hand, government procurement of advanced technologies was negatively and significantly correlated with entrepreneurial innovation capacity in SSA. Based on the above conclusion, it is recommended that respective countries and business enterprises should adopt strategies that will help to capitalize from the positive benefits of extent of staff training, brain drain, absence of excessive bureaucracy and red tape,

intellectual property protection, venture capital availability and intensity of local competition among firms on entrepreneurial innovation capacity. This could be through increased funding for research and development, increased staff training, adoption of deterrents to bureaucracy and corruption and increased adoption of stringent measures in intellectual property protection so as to induce increased innovation. On the other hand, the governments should adopt mechanisms that will ensure that firms benefit from their procurement of advanced technologies so as to boost innovation in the region.

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