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Innovation Capacity and Entrepreneurship Development in Africa: Bi-Causality Analysis

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Abstract

This paper investigates the interconnectedness of the capacity of innovation and entrepreneurship development in Africa. This paper provides novel empirical evidence about the bi-causality dynamics of entrepreneurship development and the capacity of innovation nexus which is virtually absent in the entrepreneurship literature. The evidence in this study has demonstrated that the data in Africa support the entrepreneurship development-led innovation hypothesis. It specifically examines the bi-causality between the variables of interest. The paper employs Toda and Yamamoto Granger's Granger Causality approach to conducting the causality test. Annualised data from 54 African countries from 2000 to 2021 are used for the investigation. A 22-year data span with 1184 observations is used for the analyses. The data are sourced from World Bank Development Indicator (WBDI) and Global Entrepreneurship Monitor (GEM). The findings reveal that there is no bi-causality between the capacity of innovation and entrepreneurship development in Africa. It is concluded that a unidirectional causality exists between the capacity of innovation and entrepreneurship development in Africa. The causality runs from entrepreneurship development to the capacity for innovation. This means that the data in Africa support the entrepreneurship development-led innovation hypothesis.

Keywords: *Africa, Entrepreneurship, Entrepreneurship development, Capacity of innovation, Toda and Yamamoto Granger's Granger Causality Approach*

Introduction

The world has continued to struggle to contain unemployment, poverty, and unstainable economic stability. It has been recognised that the potent policy for addressing the worsening economic conditions, economic uncertainties, rising unemployment, and poverty is an enterprise-induced growth policy that emphasises venture creation and the development of entrepreneurship (Balkienė & Jagminas, 2010; Frimpong, 2013; Mason & Brown, 2014; Ozgen & Minsky, 2007; Warwick, 2013). Several emerging evidence has demonstrated that entrepreneurship development provides a reasonable avenue to win against these economic menaces (Huang & Chen, 2021; Kansheba

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2020; Nwagu & Enofe, 2021; Quaidoo, 2018; Carreea, & Thurika, 2002).

Gobally governments have therefore been advocating for venture creation and entrepreneurship. According to Global Entrepreneurship Monitor (GEM) report, over 582 million people have started their own enterprises within the period in reporting (GEM, 2017). The growing interest in entrepreneurship and venture creation has been evident in all regions globally and enterprises are yielding the desired results.

For instance, in the United Kingdom (UK), about 70,000 enterprises in 2016 contributed to 1.3% of the gross domestic product (GDP) amounting to £24 billion and employed one million people (Huang & Donner, 2018).

Similarly, the economic growth in Africa is enterprise-induced as evident in the high contribution of micro, small and medium enterprises (MSMEs) to economic growth, job creation, and improved economic welfare (Abor & Quartey, 2010; Agyapong, 2010; Ali, Rashid, & Khan, 2014; Atiase et al, 2017; Frimpong, 2013). Specifically, MSMEs is believed to account for 85% of job creation and 70% of GDP (Atiase et al, 2017).

Additionally, MSMEs account for 61% of employment and is between 52% and 57% of GDP in South Africa (Abor & Quartey, 2010; Atiase et al, 2017), about 85% of job creation and 67% of GDP in Kenya and Tanzania (Atiase et al, 2017; Frimpong, 2013). In summary, on average MSMEs contribute to about 70% of all employment in Africa and about 60% of GDP in most countries in Africa (Agyapong, 2010; Ali, Rashid, & Khan, 2014).

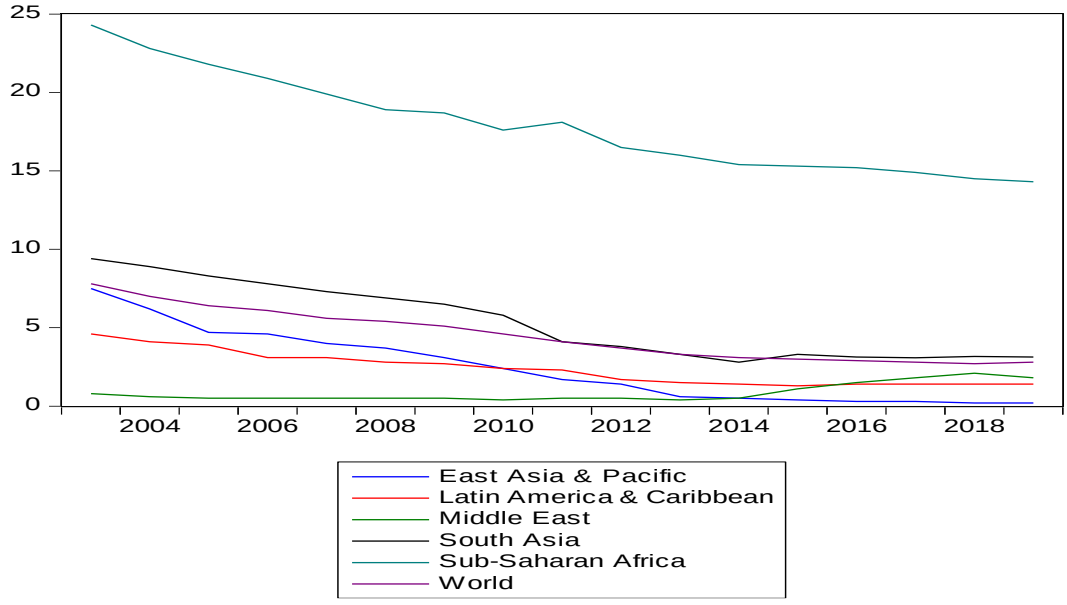
These statistics and evidence demonstrate how critical entrepreneurship development is for African economic development. Surprisingly, African economies have not explored the full potential for entrepreneurship development (Ahmed & Nwankwo, 2013; Naude, 2010). The rather few enterprises which are the mainstays for the countries are not resilient with poor development and survival rate (World Bank report, 2022). Alarmingly, about 8.4% of enterprises in Africa could not withstand the shocks of the Covid-19 pandemic and therefore collapsed (World Bank report, 2022). The weak entrepreneurship development culture and poor resilience might have contributed to the growing unemployment rates, worsening economic welfare, and poverty.

For instance, while the global unemployment rate as reported by United Nations Statistics Division (UNSD, 2021) stood at 6.5% for 2020 (2019: 5.4%), African countries such as South Africa recorded an unemployment rate of 28.74%; Lesotho, 24.75%; Gabon 24.47% and Tunisia 16.69% (Saleh, 2022). Figure 1 also shows the poverty trend in Africa in relation to other continents in the world.

Although Figure 1 suggests a downward trend in Africa's poverty line, the poverty line is above all

the other continents as depicted by the light green curve.

Figure 1: Comparative Trend in Poverty Rate
Source: Author's Construct Developed from WDI



The growing ill-health of African economies (high poverty, unemployment and worsening economic welfare (Saleh, 2022; UNSD, 2021) coupled with the evidence of strong inverse relation between these economic challenges and African enterprise development (Abor & Quartey, 2010; Agyapong, 2010; Ali, et al., 2014; Atiase et al, 2017; Frimpong, 2013), stakeholders and experts have advocated for entrepreneurship development (Naudé, 2014; Toma et al., 2014; Wennekers et al., 2010). Although almost all governments in Africa are pursuing entrepreneurship policy, the results have been slow. This has drawn the interest of academics and researchers to explore an avenue to deepen entrepreneurship development (Acs, et al., 2018; Brownson, 2013; Economidou, et al, 2018). These studies have evolved as some studies have examined challenges of entrepreneurs and entrepreneurship development (Atiase, et al., 2017; de Bruin et al, 2017), others drivers of entrepreneurship (Brownson, 2013; Economidou, et al, 2018) and entrepreneurship and growth dynamics (Acs, et al., 2018).

It has been argued that for African countries to achieve entrepreneurship development, the enterprises emanating from the enterprise-led policy should be sustainable (Atiase et al, 2017; Economidou, et al, 2018; Frimpong, 2013). This would require drivers of value creation and sustainability in the business process. Following the knowledge spillover theory, the level of

concentration of innovation could drive the enterprise value chain process and deepen sustainability. This implies that theoretically, the concentration of innovation may be considered an antecedent of entrepreneurship development (Del Giudice et al., 2014; Carayannis & Grigoroudis, 2012). Even though this has been extensively explored in other related disciplines and subjects, much has not been done in respect of its connection with entrepreneurship development in Africa. Moreover, it is believed that developed and vibrant enterprises could have the capacity to develop a strong network, build and manage the knowledge economy to drive innovation through new product development and invention (Carayannis & Grigoroudis, 2012; Scuotto et al., 2019). Thus, there is a possible bi-causal relationship between the capacity of innovation and entrepreneurship development.

Studies such as Ionescu et al., (2020) and Zsuzsanna and Hermana (2012) argued that the innovation and entrepreneurship relationship can be a complex one. It is opined that while innovation could drive entrepreneurship, there is also a possible feedback mechanism (i.e. reverse effect from entrepreneurship) (Hamel, 2006; Ionescu et al., 2020; Kivimaa, & Kern, 2016; Miller, Fern, & Cardinal, 2007; Zsuzsanna & Hermana, 2012).

Despite these assertions, the authors' analyses did not consider any such bi-causality analyses. This paper, therefore, seeks to explore the interconnectedness between the innovation-entrepreneurship development nexus in Africa. Evidence from this study would make significant contributions to the literature. First, evidence of bi-causality would not only deepen the understanding of the theoretical relationship between the two constructs but also provide the foundations for investing in innovation and/or entrepreneurship initiatives. Secondly, the findings would provide motivation or otherwise for pursuing innovation and entrepreneurship development concurrently which have been emphasised in the theory (Del Giudice et al., 2014; Carayannis & Grigoroudis, 2012; Ionescu et al., 2020; Kivimaa, & Kern, 2016; Scuotto et al., 2019).

Literature Review and Hypothesis Development

The innovation capacity-entrepreneurship development nexus is grounded in theory. This paper follows the Knowledge Spillover Theory of Entrepreneurship (KSTE). The KSTE posits that knowledge is an instrumental and shareable resource for firms and enterprise development (Jones & Ratten, 2021; Van Stel & Nieuwenhuijsen, 2004). The shareable nature of knowledge speed-up the spillover effects and multiplier benefits for other businesses. Infant businesses, micro, small and medium enterprises (MSMEs) depend more on knowledge spillover for growth and development as compared to large businesses.

According to the proponents of KSTE, the spillover is enhanced by the fact that not all knowledge

created by actors is used or fully exploited by the originators (Audretsch & Keilbach 2008). The unused knowledge or underexploited knowledge can spillover as resources or opportunities for new enterprises or venture creation (González-Pernía, Jung, and Peña-Legazkue 2015; Tsvetkova, Thill, & Strumsky 2015; Tsvetkova & Partridge 2019). Thus, knowledge spillover is a critical driver for an entrepreneurial process and enterprising (Audretsch, 2007). The continuous flow of knowledge does not only create profitability opportunities for entrepreneurship through new venture creation but innovative means to improve existing enterprises making them sustainable for continuity and development (González-Pernía, et al., 2015; Tsvetkova & Partridge 2019). Thus, the existence and availability of innovation through spillover could deepen entrepreneurship development. Innovativeness or innovation capacity also breeds knowledge creation which may also contribute to the spillover for entrepreneurship development. Therefore, investing in innovation may propel a sound and effective venture creation and ultimately the development of an entrepreneurship culture. This implies that innovation capacity could have a significant effect on entrepreneurship development.

In the competitive world today, innovation is essential for the prosperity and survival of inventive businesses and creative individuals. Businesses are predestined to destruction and degradation if innovation is lost, because of the fast pace of the growth of the global economy, limited supply and high demand (Amabile & Pratt, 2016). The entrepreneurial process depends highly on innovation. Entrepreneurial innovation is a process by which entrepreneurs generate new CSP or increase the pool of resources to enhance the potential to generate wealth (Carayannis, Samara & Bakouros, 2015). Entrepreneurs might turn the ideas in their possession into profitable products through the innovation process. This requires the contribution to hastening the the transformation. Innovation is therefore, one of the essential growth strategy instruments to go into new markets, improve the share of the existing market, and offer the company a competitive edge. Therefore, innovations institute an essential constituent of corporate strategies for numerous reasons which include applying more industrious manufacturing processes, seeking positive status in the perception of customers, performing better in the market and as a result, gaining sustainable competitive advantage (Alpkan 2009).

It has been asserted that innovation helps enterprises to continuously identify and explore new ideas and markets that eventually improve their customers' satisfaction and engage in more productive entrepreneurial activities, enhance survival rate and improve growth (Del Giudice et al., 2014; Carayannis & Grigoroudis, 2012). Following these assertions, it is expected that high innovative culture among entrepreneurs could improve entrepreneurship development. Given the ascendency of globalisation and competitive business-related environments, entrepreneurs need to innovate in order to remain competitive (Scuotto, Del Giudice, Bresciani, & Meissner, 2017). This

projects a link between innovation and entrepreneurship development.

On the other hand, the knowledge creation and innovativeness discourse also suggest high-growth firms and large enterprises are capable to develop new knowledge and innovation. Thus, it is also possible that entrepreneurship development could also drive innovation through a feedback mechanism. Developed and vibrant enterprises would have the capacity to develop a strong network and build and manage the knowledge economy to drive innovation through new product development and invention (Carayannis & Grigoroudis, 2012; Scuotto et al., 2019). Following these assertions and theoretical foundations, it can be argued that there is a possible bi-causality between innovation and entrepreneurship development. Innovation could drive entrepreneurship development and reverse feedback from entrepreneurship development (Hamel, 2006; Ionescu et al., 2020; Kivimaa, & Kern, 2016; Miller, Fern, & Cardinal, 2007; Zsuzsanna & Hermana, 2012).

Furthermore, a developed enterprise has the capacity to accommodate the capital outlay for research and development to deepen its innovation. This implies that entrepreneurship development could also drive innovation through a feedback mechanism. Following these assertions and theoretical foundations, this paper would subject these propositions to empirical investigation. The evidence would provide a comprehensive framework for developing and sustaining entrepreneurship. This paper, therefore, follows these theoretical arguments and assertions to formulate its hypothesis as follows:

H_1: There is a bi-causality relationship between innovation concentration and entrepreneurship development in Africa

Analytical Strategy

This paper follows the post-positivism philosophy. This research paradigm or philosophy advocates the use of scientific techniques and approaches to conduct an investigation into the social reality that moves away from the purely objective stance adopted by logical positivists (Bryman & Bell, 2007; Ryan, 2006). The paper adapts the assumptions of the post-positivism paradigm, with the belief that complete objectivity is nearly impossible to achieve (contrary to positivism), but still pursues it as an ideal to regulate social truth and reality, the objectivity of social reality, and the estimation of social real factors. To implement the framework of post-positivism, the analytical framework in this study is tied to a quantitative approach where numerical data are collected to measure the relevant proxies used to represent the variables of interest. This is consistent with objective analysis and scientific procedures for test hypothesis as emanating from this paper. Explanatory design is also used to complement both the post-positivism and quantitative approaches. The implementation of this design and the associated strategies are done through panel model specifications and an appropriate econometric estimation approach (i.e. Toda and

Yamamoto approach).

Data and Variable Description

The paper primarily uses numerical data collected from secondary sources. These data are collected to measure the variables of interest and the control variables in the specifications. The data are collected from the World Bank's data (WDBI) and Global Entrepreneurship Monitor (GEM) database. These sources are commonly used in the literature and they have high data quality (Atiase, et al, 2018; Ionescu et al., 2020; Yan & Guan, 2019).

The variables of interest are entrepreneurship development and innovation capacity. This paper measures entrepreneurship development (ED) by average new venture creation or formation (Ahmad, & Hoffman, 2007; Iversen, Jørgensen, & Malchow-Møller, 2008). The innovation capacity (IC) is also measured by the innovation capacity index (ICI). The paper uses annualized data spanning from 2000 to 2021 for all African countries. Table 1 summarises the data sources and their measurement.

Table 1: Summary of Variables and Measurements

Variables	Proxy	Source
Entrepreneurship Development(ED)	New Venture Creation	WBDI
Innovation Capacity (IC)	Innovation Index	GEM
Note: WBDI, and GII denote World Bank Development Indicator and Global Entrepreneurship Monitor, respectively		

Source: Authors' Construct (2022)

Hypothesis Testing Specifications

This paper draws from the assumptions of KSTE and some existing empirical evidence to formulate the bi-causality between innovation capacity and entrepreneurship development (González-Pernía, et al., 2015; Hamel, 2006; Ionescu et al., 2020; Kivimaa, & Kern, 2016; Miller, et al., 2007; Tsvetkova et al., 2015; Tsvetkova & Partridge 2019; Zsuzsanna & Hermana, 2012). The paper recalls the hypothesis as:

H_0: There is no bi-causality relationship between innovation capacity and entrepreneurship development in Africa

This hypothesis is tested using the causal models specified in Eqn (1) and Eqn(2) and expressed as:

$$\Delta \mathrm{EDI}_{it} = f(\mathrm{K}, \Delta \mathrm{ICI}_{it}) \quad (1)$$
$$\Delta \mathrm{ICI}_{it} = f(\mathrm{K}, \Delta \mathrm{EDI}_{it}) \quad (2)$$

Where:

'i' and 't' represent the cross-sectional (African countries) and the time-series dimensions respectively

'EDI' is the entrepreneurship development index.

'ICI' is the innovation capacity

Estimation Strategy

This study follows Toda and Yamamoto Granger's Causality approach to conducting the causality test. The choice of Toda and Yamamoto rather than the traditional approach (Granger Causality) is that studies have demonstrated that the Granger causality approach suffers from a stationarity problem (Toda & Yamamoto, 1995). Granger causality could exemplify the problem of spurious regression when the data are non-stationary (Adom, 2011). This makes the choice of Toda and Yamamoto (1995) an appropriate alternative approach to test for causality.

Toda and Yamamoto's (1995) causality follows the time-domain procedure of causality and also uses the Wald test statistics for the estimation. This means that the test cannot suffer from unit root problems or be falsified by the nature of the order of integration or the cointegration behaviour of the variables. Furthermore, no information is even lost when data or the series are used in their raw form. Toda and Yamamoto's (1995) approach follows an augmented VAR. This estimation approach guarantees the asymptotic distribution of the Wald statistic. The model is specified as follows:

$$EDI_{it} = \omega + \sum_{i=1}^{p} \theta_1 ED_{it-i} + \sum_{i=p+1}^{p+dmax} \theta_2 ED_{it-i} + \sum_{i=1}^{p} \delta_1 ICI_{it-i} + \sum_{i=p+1}^{p+dmax} \delta_2 ICI_{it-i} + \upsilon_{1t} \quad (3)$$

$$ICI_{it} = \Psi + \sum_{i=1}^{p} \varphi_1 ICI_{it-i} + \sum_{i=p+1}^{p+dmax} \varphi_2 ICI_{it-i} + + \sum_{i=1}^{p} \gamma_1 ED_{it-i} + \sum_{i=p+1}^{p+dmax} \gamma_2 ED_{it-i} + \upsilon_{2t} \quad (4)$$

Where

dmax denotes the maximum order of integration suspected to occur in the system; ν1t and ν2t

represent residuals of the two models

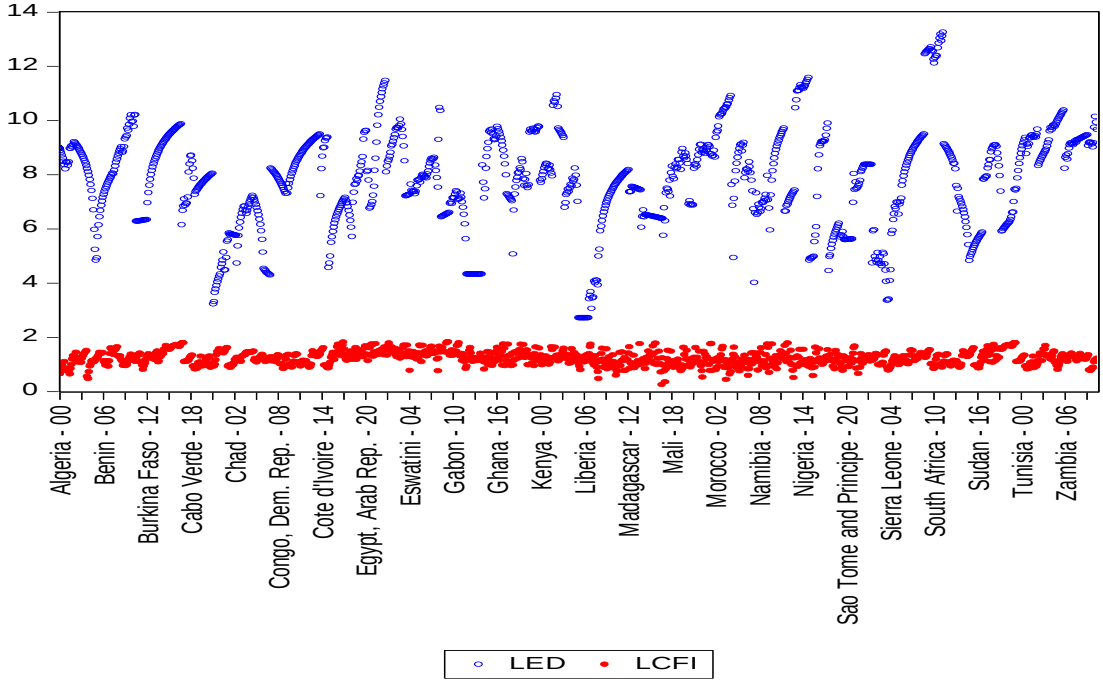
The rest of the variables remained as described earlier

Trend Analyses of Capacity of Innovation and Entrepreneurship Development in Africa

Figure 1 presents the trend in Africa's capacity of innovation (CFI) and entrepreneurship development (ED). The dot plot shows year-on-year smoothness in the trend of both entrepreneurship development and capacity of innovation.

At the country level, it can be observed that while there are no significant variations among all the African countries, in the plot of entrepreneurship development, visible differences or variations can be observed among the countries. Specifically, African countries such as South Africa, Nigeria, Egypt, Morocco, and Kenya are exhibiting relatively high entrepreneurship development within the period of the investigation while others are still lagging.

Figure 1: Trend in Capacity of Innovation and Entrepreneurship Development in Africa (2000-2021)



Source: Authors' Graph Developed from Eviews 9.0 Package

Descriptive Analyses

Table 2 reports the descriptive statistics of entrepreneurship development and capacity of innovation. The mean value for entrepreneurship development as captured in table 2 is 12504. This indicates that each African country on average establishes 12504 new enterprises yearly. This is quite encouraging and therefore expected to draw down the level of unemployment and poverty and improve economic welfare.

However, this seems not to reflect the expectation. Further analysis of the statistics in Table 2 explains why despite the high all-sample mean, the economic situations in Africa are still troubling. Although the all-sample mean is high, the individual country's observations are highly dispersed from the mean as shown by the high coefficient of variation of about 370% (3.6987).

Moreover, while some countries are developing enterprises with an annual score of 564264, others are scoring 15. This is quite troubling especially since the economy is driven by these enterprises (Atiase et al, 2017; Oppong et al., 2014; Quaidoo, 2018). This corroborates the slow entrepreneurship development observed by some researchers in Africa (Ahmed & Nwankwo, 2013; Naude, 2010).

It can further be seen from Table 2 that the mean score for capacity of innovation is 3.4754. This is relatively low suggesting that Africa has a weak capacity for innovation. The standard deviation and coefficient of variation are relatively low. This means that the individual scores of CFI are closely packed around the mean. The implication is that the consequence of the weakness in CFI is widespread in Africa. The low volatility in CFI and high volatility in ED are consistent with the observations in Figure 1.

Table 2: Descriptive Statistics (2000-2021)

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	CoV*	Observations
ED	12503.98	2839.217	564264.0	15.0000	46248.55	3.6987	1188
CFI	3.4754	3.3590	6.1201	1.2665	0.8837	0.2542	1188

Note: *CoV denotes the coefficient of variation

Source: Authors' Estimation from Eviews 9.0 Package

Panel Unit Root

The unit root problem is common in data that have time series characteristics. Therefore, to determine the appropriate econometric estimation approach it is useful to determine the

stationarity properties of the data so as to make an informed choice of the estimator.

The paper follows the Fisher-Augmented Dickey-Fuller model, the Philip and Perron test model, and the Levin, Lin, and Chu unit root (Choi 2001; Levin et al., 2002; Maddala & Wu, 1999) to determine the stationarity of the variables.

The Fisher ADF and PP are the main unit root tests used in this study. However, when there are inconclusive results of primary unit root tests, the study follows Lin and Chu (LLC) to make the choice. Table 3 reports the unit root statistics and p-values. The results show that the test statistics of entrepreneurship development (ED) are insignificant even at 10%.

This means that the study fails to reject the null hypothesis that there is a unit root problem. However, the t-statistics is significant at first difference. This implies that ED is an I(1) variable. Regarding the capacity of innovation (CFI), it can be seen from the table that the statistics has a p-value less than 1%.

This suggests that the t-statistics is significant and therefore the null hypothesis of unit root problem is rejected at level. Thus, CFI is 1(0) variables. These unit root results would not have implications on the estimation as this paper employs Toda and Yamamoto approach which is capable to handle the stationarity problem.

Table 3: Summary of Group Unit Root Results

Variable	Fisher ADF Test	Fisher PP Test	LLC	Order
At Levels				
ED	21.8713(0.8512)	18.8097 (0.8993)	-1.6542(0.1320)	I(1)
CFI	272.303 (0.0000)	360.801 (0.0000)	-5.5860(0.0000)	I(0)
1st Diff				
ED	246.743 (0.0000)	369.381(0.0000)	-14.6721(0.0000)	I(1)

Source: Computed from Eviews 9.0 Package

Empirical Results of Toda and Yamamoto Granger Estimation

The study follows Toda and Yamamoto's approach to estimating the bi-causality between the capacity of innovation and entrepreneurship development. In conducting the bi-causality, the paper first tests for the appropriate order of the VAR.

The Akaike Information Criterion (AIC) is used to determine the order. The results are captured

in Table 4. Table 4 reveals that the appropriate order is two (2). This order is supported not only by AIC but by almost all the other selection criteria other than Schwarz Information Criterion (SC).

Table 4: Tests for Selecting the Order of the VAR Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1990.012	NA	0.206601	4.098790	4.108830	4.102611
1	-410.2244	3149.824	0.008072	0.856429	0.886548*	0.867892
2	-401.0603	18.23383*	0.007987*	0.845803*	0.896002	0.864909*
3	-398.4489	5.185220	0.008010	0.848660	0.918939	0.875408
4	-394.9062	7.019895	0.008017	0.849601	0.939960	0.883991

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

Source: Computed from Eviews 9.0 Package

With the order of VAR of 2 or the established optimal lag length, the models (3) and (4) are re-specified to include in the order of the VAR in Eqn(5) and Eqn(6) as follows:

$$EDI_{it} = \omega + \sum_{i=1}^{3} \theta_1 ED_{it-i} + \sum_{i=p+1}^{3} \theta_2 ED_{it-i} + \sum_{i=1}^{3} \delta_1 ICI_{it-i} + \sum_{i=p+1}^{3} \delta_2 ICI_{it-i} + \upsilon_{1t} \quad (5)$$

$$ICI_{it} = \Psi + \sum_{i=1}^{3} \varphi_1 ICI_{it-i} + \sum_{i=p+1}^{3} \varphi_2 ICI_{it-i} + + \sum_{i=1}^{3} \gamma_1 ED_{it-i} + \sum_{i=p+1}^{3} \gamma_2 ED_{it-i} + \upsilon_{2t} \quad (6)$$

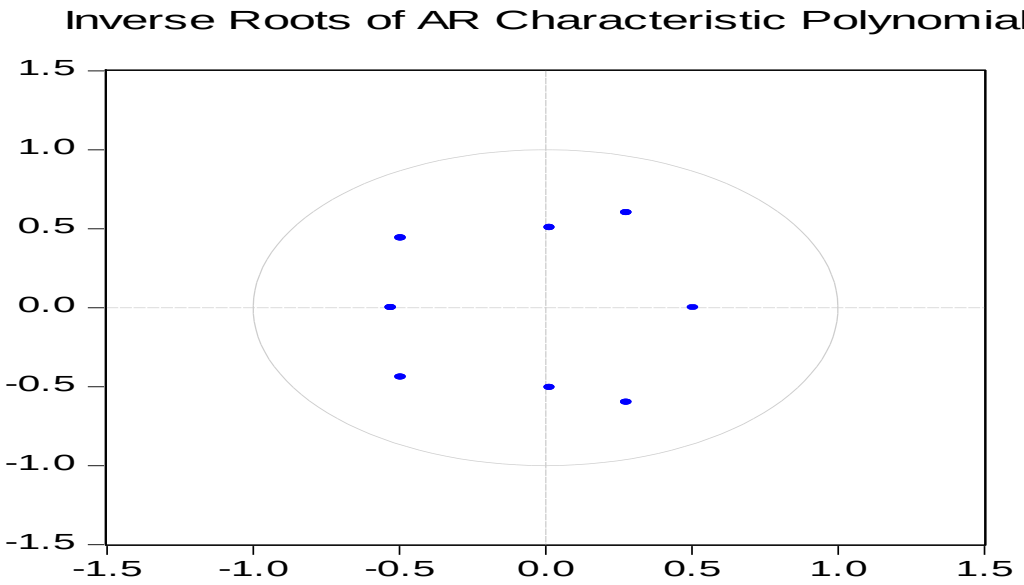
Where 'p' = 2 and 'dmax' = 1.

Results from the estimation of the models (5) and (6) are reported in Table 5.

However, prior to the analyses of the results in Table 5, the study also assesses the stability of the estimation to determine the robustness and reliability of the estimates from the specified models. The paper follows the roots of the characteristic polynomial to assess the stability. Figure 2 shows the results of the stability evaluation. It can be observed that there are some dots in a unit circle.

These dots represent the roots of the characteristic polynomials. Since all the roots lie inside the unit circle, it is concluded that the estimated models satisfy the stability condition. Therefore, the results from the estimations are sound for the analyses.

Figure 2: Model Stability Evaluation



Source: Authors' Dot Plots Developed from Eviews 9.0 Package

Having determined the soundness of the specifications and model estimations, the paper proceeds to present the statistics in Table 5. Table 5 shows causality from a capacity of innovation (CFI) as the cause to entrepreneurship development (ED) as the effect is 5.3949 with a p-value of 0.2491. This p-value is greater than 1%, 5%, and even 10%. This implies that the chi-square is not significant. Therefore, the paper fails to reject the null hypothesis that the capacity of innovation does not granger cause entrepreneurship development in Africa.

In respect of causality from entrepreneurship development (ED) as the cause to the capacity of innovation (CFI) as the effect, it can be observed that the chi-square is 12.9120. The associated p-value for this chi-square is 0.0117. This p-value is less than 5%. This means that the chi-square is significant at 5%. The implication is that the study fails to reject the null hypothesis that entrepreneurship development does not granger cause capacity of innovation in Africa. This suggests that entrepreneurship development granger causes the capacity of innovation in Africa.

From the results in Table 5, it can be concluded that a unidirectional causality exists between the

capacity of innovation and entrepreneurship development in Africa. The causality runs from entrepreneurship development to the capacity for innovation. This means that the data in Africa support the entrepreneurship development-led innovation hypothesis.

Table 5: Granger Causality/Block Exogeneity Wald Tests

Cause	Effect	Chi-square	P-Value	Decision
CFI	ED	5.3949	0.2491	Fail to Reject the Null
ED	CFI	12.9120	0.0117	Reject the Null

Source: Computed from Eviews 9.0 package

Discussions and Implications

The uni-directional causality observed in this study flowing from entrepreneurship development to innovation is inconsistent with the study's expectations. However, it supports some empirical evidence (Amabile & Pratt, 2016; Carayannis & Grigoroudis, 2012; Carayannis, et al., 2015; Del Giudice et al., 2014). Amabile and Pratt (2016) revealed that in this competitive world, businesses are predestined to destruction and degradation if innovation is lost, therefore, businesses continuously invest to be innovative to meet the growing needs. Competitive firms invest in innovation for their own needs, competitiveness, and sustainability. Thus, it is not surprising that enterprise development drives innovation. Moreover, borrowing from Alpkan (2009), large and competitive firms invest in innovation to achieve and improve industrious business processes, seek positive status in the perception of customers, perform better in the market, and as a result, gain sustainable competitive advantage rather than creating opportunities for other business to thrive. This implies that innovation per se would not attract new venture creation but the development of the individual creators consistent with the evidence found in this paper.

The findings are partly consistent and partly inconsistent with the Knowledge Spillover Theory of Entrepreneurship (KSTE). The significant positive influence of enterprise development on innovation found in this study corroborates the assumption that enterprises consider innovation as an instrument for their growth and sustainability and therefore strive to invest in either product or process innovation (González-Pernía, et al., 2015; Tsvetkova & Partridge 2019). However, one possible reason for the causality from innovation to enterprise development is that African enterprises do not share their created knowledge or innovation to enhance the spillover effect for new venture creation. This is inconsistent with the assumption that the unused knowledge by the originator spillover as resources or opportunities for new enterprises or venture creation (Tsvetkova, Thill, & Strumsky 2015; Tsvetkova & Partridge 2019).

Another possible reason for the evidence found in this study is that high-growth firms and large enterprises are capable to develop new knowledge and new innovation. Developed and vibrant enterprises would have the capacity to develop a strong network and build and manage the knowledge economy to drive innovation through new product development and invention (Carayannis & Grigoroudis, 2012; Scuotto et al., 2019). This could make enterprise development cause innovation. Additionally, a developed enterprise has the capacity to accommodate the capital outlay for research and development to deepen its innovation.

One practical implication of the uni-directional causality flowing from ED to CFI found in this study is that African enterprises keep innovation (product or process innovation) at the firm-level and possibly hold it as an instrument for competitive advantage. These innovations do not become open knowledge or resource to be tapped by the infant businesses, micro, small and medium enterprises (MSMEs) for growth and development as compared to large businesses or the originators/creators of the innovation.

There is therefore a weak flow of innovation among African enterprises limiting the extent of profitability opportunities arising from such innovation for entrepreneurship through new venture creation. The innovation is concentrated on the originators to improve their existing businesses and operations to propel their sustainability, continuity, and development. Thus, firms in Africa invest in innovation to propel a sound and effective business operation and ultimately continuity and development. This implies that innovation capacity could have a significant effect on internal business processes with limited spillover or diffusion for general entrepreneurship development.

The fundamental policy implication of the findings is that Africa's capacity for innovation is enterprise-led which emphasises concentration of innovation rather than diffusion of innovation to propel new venture creation. Thus, it is the individual enterprises and firms that drive innovation for their products and business processes. This enterprise-led innovation may not be sufficient to create avenues or opportunities for new ventures and infant enterprises that may not have the capacity to invest in innovative processes. Government and other entrepreneurship institutions should balance the scale to create some level of open source innovation to support the infant businesses, micro, small and medium enterprises (MSMEs) for growth and development.

Conclusions and Recommendations

This paper investigates the interconnectedness of the capacity of innovation and entrepreneurship development in Africa. The study was conceived on the grounds that it has been recognised that the potent policy for addressing the worsening economic conditions, rising unemployment and poverty is an enterprise-induced growth policy that emphasises venture creations and the

development of entrepreneurship. Innovation and entrepreneurship development have been identified as the catalysts to achieve the desired success from this policy requiring concurrent efforts and policy framework to propel these catalysts. However, empirical evidence about the interconnectedness of these drivers through a bi-causality framework is limited not only in African literature but also globally. In view of this, this paper sought to examine the bi-causality between the capacity of innovation and entrepreneurship development using Africa as the study setting.

The paper uses annualised data from 54 African countries from 2000 to 2021 for the investigation. A 22-year data span with 1184 observations is used for the analyses. The study uses Toda and Yamamoto Granger's Causality approach to conducting the causality test. The findings reveal that there is no bi-causality between the capacity of innovation and entrepreneurship development in Africa. It is concluded that a unidirectional causality exists between the capacity of innovation and entrepreneurship development in Africa. The causality runs from entrepreneurship development to the capacity for innovation. This means that the data in Africa support the entrepreneurship development-led innovation hypothesis.

The practical implication of the uni-directional causality flowing from entrepreneurship development to the capacity of innovation found in this study is that African enterprises keep innovation (product or process innovation) at the firm-level and possibly hold it as an instrument for competitive advantage. These innovations do not become open knowledge or resource to be tapped by the infant businesses, micro, small and medium enterprises (MSMEs) for growth and development as compared to large businesses or the originators/creators of the innovation.

Individual firms and potential entrepreneurs in Africa should not count on spillover or diffusion of innovation among other firms as the bases for the growth and sustainability of their firms as this may not be guaranteed following the data analysed within the African sub-region. It is suggested that entrepreneurs should incorporate the cost of innovation (research and development) in their start-up decision.

The fundamental policy implication of the findings is that Africa's capacity for innovation is enterprise-led which emphasises concentration of innovation rather than diffusion of innovation to propel new venture creation. Thus, it is the individual enterprises and firms that drive innovation for their products and business processes. This enterprise-led innovation may not be sufficient to create avenues or opportunities for new ventures and infant enterprises that may not have the capacity to invest in innovative processes.

Government and other entrepreneurship institutions should balance the scale to create some level of open source innovation to support the infant businesses, micro, small and medium enterprises (MSMEs) for growth and development. Governments in Africa should partner with other

stakeholders to develop the capacity for innovation and support new ventures to make entrepreneurship attractive.

Limitations and Suggestions for Future Studies

This paper focused on the bi-causality between the capacity of innovation and entrepreneurship development. Although this has provided insight into the dynamics of the relationship, the paper operationalises innovation in a composite score. It is possible that the nature of causality may change when innovation is decomposed into product innovation and process innovation. It is therefore suggested that future studies would build on this foundational evidence to re-estimate the relationship using the decomposition approach. Moreover, this paper measures entrepreneurship development from the perspective of entrepreneurship deepening through a number of new ventures. When these new ventures are segregated into high-growth firms and low-growth firms, the results and implications are likely to differ. Therefore, future studies may explore these dynamics.

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