

# **Financing structure and Innovation in African Enterprises**

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By

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## **Abstract**

Lack of access to finance is a critical obstacle to firm innovation especially in SMEs. This is even crucial for firms in emerging economies especially in Africa where access to external finance is a huge obstacle. Though most of the existing literature on finance and firm innovation is skewed toward large firms in advanced economies such as in US and Western Europe. This study sets out to examine the various financing options available to firms in Africa for innovation. Innovation is defined broadly to include web site ownership, email utilisation, international certification, foreign technology utilisation and independent auditors.

Ordinary least square was used to establish the relationship between finance and firm innovation in selected African countries. Our findings show that access to finance is associated with more firm innovation. In addition, firms that have highly educated and experienced managers, both foreign and domestic private ownerships, and exposure through internationalisation and foreign competition is associated with greater firm innovation.

**Keywords:** Financing structure, firm innovation, OLS

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## **1. Introduction**

Innovation is an important channel through which firms/enterprises enhance their productivity (Radas and Bozic, 2009:438). According to Bell and Pavitt (1993:89) innovation is the introduction of technology embodied in new (products and processes) through significant investment projects; and incremental adaption and improvement of existing production capacity. Innovation does not occur naturally and the ability to innovate depends on some factors such as firm size, market structure, finance, growth, trade and profitability (Bhattacharya and Bloch, 2004; Rogers, 2004). A critical and yet less discussed factor is the role of finance in innovation. Literature has shown that financially constrained firms find it difficult to innovate (Acs and Audretsch, 1990). Firms without access to finance are severely constrained in their ability to expand and are hardly able to engage in the innovative pathway (Oyelaran-Oyeyinka et al, 1996; Beck and Demirguc-Kunt, 2012). Despite the importance of finance in innovation very few empirical studies exist in this area, generating a knowledge gap that we will examine in this paper.

More importantly the ability of African firms to innovate is severely constrained by the lack of access to finance (Demirguc-kunt and Klapper, 2012; Oyelaran-Oyeyinka et al 1996). A number of studies (Adeboye, 1997; Adams, 1999; Mahemba and De Bruijn, 2003; Chipika and Wilson, 2006; Robson et al, 2009) on firm innovation in Africa concentrate on growth, manufacturing, network, performance, models of innovation and entrepreneurship.

Most empirical literature on innovation hardly discusses the role of finance. This is especially so for developing countries in Africa where firm innovation lags behind the global trend and access to finance remains a major challenge to firm productivity and growth (Himmelberg and Petersen, 1994; Adams, 1994; Hadjimanolis, 2000). However, it has been shown that access to finance brings about firm innovation (Giudici and Paleari, 2000). But empirical literature that establishes the link between finance and innovation are limited and available literature is skewed towards the developed economies. Equally important and less explored are the structure and type of finance be it debt, equity or retained earnings and their relationship with innovation. Furthermore, the paper finds out whether access to finance enhances more product innovation or process innovation?

This paper is divided into six sections. Section 2 provides a brief over view of innovation in Africa. Section 3 discusses literature review beginning with theoretical outline of innovation

and the link to firm development and access to finance. This is followed by empirical literature. Section 4 outlines the data source and methodology while section 5 discusses the results. Section 6 concludes and provides policy recommendations.

## **2.0 Overview of innovation in Africa**

The New Partnership for Africa's Development's (NEPAD) Ministerial Forum on Science and Technology noted that innovation is critical for enterprises and economic development of the Africa continent (AfDB, 2008:49). Agribusiness contributes significantly to most African economies yet over the last 40years it has declined due to a number of reasons including lack of access to finance and innovation (IFPRI, 2010). The Forum for Agricultural research in Africa (2012:7) has indicated that for African agriculture and agribusinesses to increase productivity they need to innovate. Africa needs technology (innovation), a critical mass of skilled personnel to serve as a catalyst for economic revival and development of the continent (AfDB (2008:29).

The African competitive report 2013 states that innovation remains important in the development of African enterprises. However innovation is severely limited in African enterprises. Accordingly no African country is ranked among the top 50 globally, African countries are ranked far behind most countries in innovation. The top 5 African countries in the Global Innovation Index (2013) are ranked fifty-third (Mauritius), fifty-eight (South Africa), seventy (Tunisia), eighty-nine (Uganda) and ninety-one (Botswana).

## **3.0 Literature Review**

### **3.1 Theory**

The theoretical link between finance and innovation can be traced to the works of Schumpeter (1912) who hypothesised that the innovative outcome of an economy is connected with the functioning of its credit and capital markets. Later on Schumpeter (1942 and 1950) stated that because of the high cost of entry, innovative activities are often carried by large firms. Enterprises normally spend their accumulated capital or finances in a hierarchical order. As such, enterprises with internal funds are likely to start with their internal finances to conduct innovation before turning to external sources of funds – debt and equity (Donaldson, 1961). This is known as the pecking order theory. Access to external finance ease capital accumulation and therefore encourage enterprise innovation. However,

information asymmetry can lead to financing problem between investors and entrepreneurs (Jensen and Meckling, 1976).

The level of financial development in an economy eases access to finance (Geroski and Mazzucato, 2002) and this has a direct influence on firm innovation. Enterprises are able to raise funds from the sale of shares (and used part of this funds raised for overall investment) on innovation, thanks to equity market improvements (Brown and Petersen, 2009). However, it may also be the case that innovative firms may be the ones that attract more finance. Hence the link between finance and innovation could be endogenous. For instance Giudici and Paleari (2000) indicated that innovative firms attract equity capital for further innovation. Innovative firms use equity capital to finance the take-up phase that is associated with employing technology.

Stiglitz (1985) indicated that the structure of debt contracts is not well suited for highly innovative enterprises due to riskiness and volatile returns. Moral hazards and adverse selection problems are very likely in constantly innovating enterprises due to the risk (Stiglitz and Weiss, 1981). Highly innovative enterprises are risky yet such risky enterprises can pledge collateral in order to obtain debt finance Berger and Udell (1990).

It has been said that equity finance is the better financing option for firms engaged in innovation. Equity has several advantages over debt finance for young highly innovating enterprises (Carpenter and Petersen, 2002).

### **3.2 Empirical literature**

There are a few empirical studies that directly examine the link between finance and innovation. Nonetheless we review a number of studies which attempt directly or indirectly to examine the finance innovation link. Audretsch (1995) examined the impact of availability of funds on company performance and found that availability of funds through company profitability influences subsequent innovative activities. It is believed that firm innovation and growth is enhanced through access to finance. However the financing options do impact growth differently and as such could impact the innovation process differently. For instance, Carpenter and Petersen (2002) examining an unbalance panel of over 2,400 publicly traded US high-tech companies during the period 1981-98 found that new equity financing appear to be very important to the rapid growth of young high-technology firms. Atanassov, Nanda and Seru (2005) using a panel of US companies from 1974-2000 found that firms with innovative projects and technologies used arm's length financing such as public debt and

equity; while less innovative firms relied on relationship based borrowing such as bank borrowing. Blass and Yosha (2003:446) concluded that during the 1990s publicly traded innovation intensive manufacturing firms in Israel depended on equity.

Brown et al (2009) examined a panel level data for 1,347 publicly traded, high-tech firms from 1990-2004 using GMM procedure found that access to both internal and equity finance have significant positive effects on firm innovation and productivity. They also examined the link between equity finance and innovation found that equity market liberalisation has a disproportionate impact on intangible investment and innovation.

Gustav Martisson (2009) provide evidence that new high-tech firms in the UK experienced a supply shift in both internal and external equity during the late 1990s that enabled the firms to invest more in R&D resulting in increasing innovation intensities. While high-tech firms in new continental Europe experienced a supply shift in cash flow it was not the same story in external equity. This resulted in lower innovation intensities than their counterparts in the UK. Demirgüç-Kunt and Maksimovic (1998) provide evidence at both firm and industry levels that reduced access to external finance is associated with slower innovation and growth. Similarly a number of studies show that firms that are constraint by access to finance are less innovative (Himmelberg and Petersen, 1994; Hall, 2002 and Berger and Udell, 2006).

Acs and Isberg (1991:324) provide empirical evidence that capital structure is an important determinant of (technological change) innovation. This is complimented by Hall (2002) who noted that the capital structure of highly innovative enterprises often exhibit less leverage relative to those of other enterprises. This may be one of the reasons why young innovative enterprises hardly obtain debt finance.

There is also the possibility however that those innovative firms may be the ones with access to finance hence an endogeneity issue can be of concern here. For instance innovative firms employ equity capital to finance take-off phase (Guidici and Paleari, 2000). Florida and Kenney (1994) show that venture capitalists do act as a liaison between different resource networks (investors, research institutions and universities) and this promotes enterprise innovation. Mazzucato (2002: 852) outlined the funders of innovation to include venture capitalists, business angels, others public funding bodies including state investment banks. This means that the level of financial development in an economy does not only ease access to finance but also facilitates innovation.

## 4.0 Methodology

### 4.1 Data source

We use data from the World Bank Enterprise Survey (WBES) with information on innovations and financing structure from selected firms across African countries. The surveys sample from the universe of registered businesses in each country and follow a stratified random sampling methodology. The core survey uses standardized survey instruments to benchmark the investment climate of individual economies across the world and to analyse firm performance.

For the purpose of this paper we consider 3209 firms from 5 countries representing the five regions of the continent. The following countries (Morocco; 407 firms, Cameroon; 363 firms, Kenya; 781 firms, Senegal; 601 firms, and South Africa 937 firms) covering the period 2007 to 2014 were selected due to data availability.

As stated earlier, innovation can be in product and/or process with improvement in either or in some cases brand new product, packaging and transformation of the entire production process (OSLO Manual; 2005). This mostly happens in the advanced economies of the West. In Africa where you have more of SMEs and most of the economies are emerging, we have re-defined innovation broadly to include imitations, improvement in product, processes, technologies and knowledge transfer. Within the WBES data set, innovation has been measured at the basic level through issues as web site ownership, email utilisation, international certification, foreign technology utilisation and the use of independent auditors to audit firm's financial statement. Hence in this paper product innovations measured by (i) the use of foreign technology and (ii) whether a firm has an internationally qualified standard.

Table 1: shows Percentage of innovation per variable

Country	Percentage of innovation per variable				
	Website ownership	Email utilisation	International certification utilisation	Foreign license utilisation	Financial statement
<b>Cameroon</b>	33.9	62.5	22.8	19.5	69.1
<b>Kenya</b>	52.1	81.1	29.2	23.3	85
<b>Morocco</b>	70.3	96.3	25.9	17.7	52.3
<b>Senegal</b>	28.2	54.2	5.8	13.5	27.6

South Africa	40.4	69.5	31.6	14.7	70.9
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### 3.2 Analysis

We have adopted the model of Ayyagari et al. (2012). Ayyagari et al (2012) created innovation index using the “summation” method. Ours differ from theirs in that we have used the multiple correspondence analysis (MCA) to create the innovation indexes. Unlike the “summation” method that rely on adding ‘1’ to the innovation index. If the firm has that innovation variable, the MCA also uses categorical variables in the construction of the index with improvement on some of its limitations. The MCA is good at analyzing categorical variables such as “0-1” or “yes - no” questions and the innovation variable questions, makes it appropriate for this study. Furthermore, the MCA assigns weight according to the significance of the variables in the innovation index. Following Benzi cri (1973), Van Kerm; (1998) and Booy sen et al.; 2008, the MCA for the creation of the innovation index is given generally as:

$$\alpha_i = \sum_{k=1}^k F_{1k} d_{ki}$$

The *i*th firm innovation index is  $\alpha_i$ ,  $d_{ki}$  is the *k*th value of the categorical variables (with  $k=1 \dots K$ ) indicating the firms’ innovation variables included in the index construction.  $F_{1k}$  is the MCA weights generated for the analysis.

The product innovation index (PDII) comprising the product oriented variables such as internationally recognized quality certification and technology license from a foreign company have been used to construct the PDII. While the variables: use of email, use of external auditors and own a website have been used to construct the process innovation index (PRII). The combination of all of these variables is used in the construction of the aggregate innovation index.

Ordinary least square techniques were utilised in the analysis of this data. We regress each of the finance variables on aggregate innovation, product innovation and process innovation.

These finance variables are: working capital from private and public banks, trade credit, funds from public and private banks meant for fixed assets, overdraft and retained earnings. Our control variables includes age of firm (calculated as year of survey – year firm started operation), size of firm (small: 5-19, medium 20-99 and large 100+), experience of top manager of the firm (number of years of work), exports (is the firm involved in the export market), industry, regions, local market share, number of competitors, domestic private ownership, foreign private ownership, female ownership, legal status of the firm, electricity cost, labour cost, total annual sales of firm, and growth.

The regression equation for every finance variable on any of the innovation index is specified below:

$$I_{Product_t} = \beta_1 + \beta_2 Fin + \beta_3 X + \mu_t \quad \text{--- (3.1)}$$

$$I_{Process_t} = \beta_1 + \beta_2 Fin + \beta_3 X + \mu_t \quad \text{--- (3.2)}$$

$$I_t = \beta_1 + \beta_2 Fin + \beta_3 X + \mu_t \quad \text{--- (3.3)}$$

Where  $I_{Product_t}$  = *Product Innovation index*

$I_{Process_t}$  = *Process Innovation index*

$I_t$  = *Combined Index*

the  $\beta$ 's are independent parameters in the equation,  $X_i$  represents a vector of control variables: size, age, top manager's experience, private domestic ownership and private foreign ownership.

*Fin = external finance and retained earnings*

In order to cross check the consistency and robustness of this results, (and to also establish a link or casual effect between finance and innovation), it would be necessary for us to show the contrary to factor that had the firm not had access to finance it could not have been able to carry out innovation.

Our data source (WBES) is a secondary survey that is randomised across firms and countries. However it does not allow us to control the random assignment of firms to external finance. In order to establish casual effect in the absence of random assignment, it is possible to rely



on quasi randomisation either through instrumental variable (IV) techniques or by considering a natural experiment such as a policy change that produces an exogenous variation. Any of these methods have their own limitations and cannot be carried out due to the limitations of our data. Instrumental variable techniques that would enable us to address firm-specific counterfactual requires the use of firm level instruments that are not available in our survey data set. Though randomised control trials or natural experiments can render ways of identifying causal effects in the presence of heterogeneity, this survey data which is cross country study, makes it almost impossible to identify an exogenous policy change that occurred across each of these nations at same time.

On the whole, we acknowledge the limitations of the data that has prevented us from exploring causal relations in this study. However, we believe this result to be an essential first step in assessing the relationship between finance and innovation across Africa.

## **5.0 Results**

This section presents the results in five tables. Each table presents the regression output of finance on innovation (aggregate innovation, product innovation and process innovation) for South Africa, Senegal, Morocco, Cameroon and Kenya respectively. The number of regressions ranges from 6 for Morocco to 12 for South Africa and 15 for the rest of the countries.

Table 2: Regression result for South Africa for finance on innovation.

Dependent variable	(1) Aggregate innovation index	(2) Aggregate innovation index	(3) Aggregate innovation index	(4) Aggregate innovation index	(5) Product innovation index	(6) Product innovation index
Working capital from banks	0.138 (1.70)					0.194** (2.62)
Trade credit		315* (.44)				0.353** (3.91)
Bank funds for Fixed assets Overdraft			-09.49* (-2.92)		0.422* (1.49)	
Age			0.083** (3.37)		0.030** (2.31)	
Size					0.561** (3.63)	
Sector			-0.128* (-2.95)		-0.10 (-1.98)	
Top manager experience	0.011** (3.20)	0.011*** (3.39)	-0.072 (-1.78)		-0.038** (-2.74)	0.0112*** (3.68)
Number of competitors	-0.046 (-1.18)	-0.045 (-1.16)	-0.481 (-1.71)			0.012*** (3.89)
Foreign Private ownership	0.332* (2.24)	0.352* (2.39)				
Full time production workers	0.001 (1.11)	0.001 (1.18)				
Export	0.681*** (7.50)	0.672*** (7.41)	0.906 (1.90)		0.923** (3.01)	0.538*** (6.51)
Domestic Private Ownership	0.157 (0.95)	0.193 (1.18)	0.955 (2.01)			0.107 (1.03)
Electricity Cost	-2.85e-08 (-1.71)	-2.91e-08 (-1.75)				-1.08e-08 (-1.13)
Labour Cost	6.42e-09***	6.35e-09***				3.77e-09*** 4.98e-09***

	(3.38)	(3.35)			(4.00)	(3.51)
FemaleOwners	0.0779	0.073			0.107	0.108
	(0.96)	(0.90)			(1.41)	(1.42)
Industry	0.007*	0.007*	0.0691		0.005	0.005
	(2.17)	(2.09)	(1.60)		(1.72)	(1.67)
Legal Status	-0.089**	-0.093**			-0.051	-0.058*
	(-2.92)	(-3.07)			(-1.83)	(-2.05)
Main market	0.122	0.128*			0.119*	0.145**
	(1.87)	(1.97)			(2.23)	(2.73)
Local market share	0.007*	0.007*			0.008**	0.008**
	(2.42)	(2.28)			(2.84)	(2.67)
CiQS	-0.046	-0.048				
	(-0.76)	(-0.78)				
_cons	1.920***	1.639***	3.939*	0.826***	0.419*	0.0240
	(6.37)	(5.14)	(3.25)	(3.50)	(2.29)	(0.10)
N	648	648	17	67	678	678
F	18.42	18.72	6.458	12.92	22.70	18.97
r2	0.304	0.308	0.866	0.564	0.234	0.239
r2_a	0.288	0.291	0.732	0.520	0.224	0.226

*t* statistics in parentheses

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table 2: Regression result for South Africa for finance on innovation continues.

	(7)	(8)	(9)	(10)	(11)	(12)
	Product innovation index	Product innovation index	Process innovation index	Process innovation index	Process innovation index	Process innovation index
Working capital			0.189*		0.154	
From banks			(2.41)		(1.91)	
Trade finance				0.295**		
				(2.67)		
Bank funds for	0.154					0.154
Fixed assets	(1.91)					(1.91)
Overdraft		0.280***				0.280***
		(4.45)				(4.45)
Size	0.476***	0.525***		0.525***	0.476***	0.525***

	(8.42)	(11.30)		(11.63)	(8.42)	(11.30)
Number of competitors	-0.0690	-0.0203	-0.0357		-0.0690	-0.0203
	(-1.50)	(-0.60)	(-0.94)		(-1.50)	(-0.60)
Top manager experience	0.0109**	0.00704*	0.0114***	0.00705*	0.0109**	0.00704*
	(3.03)	(2.44)	(3.55)	(2.52)	(3.03)	(2.44)
Sector	-0.0742**				-0.0742**	
	(-2.62)				(-2.62)	
Export	0.385***	0.354***	0.544***	0.357***	0.385***	0.354***
	(4.10)	(4.44)	(6.16)	(4.65)	(4.10)	(4.44)
Industry	0.076**	0.002	0.00512	0.004	0.0759**	0.002
	(2.70)	(0.70)	(1.56)	(1.27)	(2.70)	(0.70)
Full time production workers		-0.001	0.001			-0.001
		(-0.51)	(0.78)			(-0.51)
Domestic Private ownership		0.121		0.150		0.121
		(1.23)		(1.58)		(1.23)
Legal Status		0.0167	-0.053	0.007		0.0167
		(0.62)	(-1.80)	(0.25)		(0.62)
Local market share		0.007*	0.008**	0.006*		0.007*
		(2.50)	(2.62)	(2.34)		(2.50)
Electricity Cost			-1.56e-08			
			(-0.97)			
Labour Cost			4.46e-09*	2.51e-10		
			(2.49)	(0.27)		
Female Owners			0.106	0.0923		
			(1.33)	(1.33)		
Main market			0.121	0.0565		
			(1.91)	(1.15)		
CiQS			-0.0671			
			(-1.12)			
_cons	0.235	-0.357	1.317***	-0.103	0.925***	0.333
	(1.14)	(-1.81)	(5.39)	(-0.45)	(4.48)	(1.69)
N	313	648	648	678	313	648
F	28.77	37.30	14.28	34.94	28.77	37.30
r2	0.398	0.369	0.226	0.366	0.398	0.369
r2_a	0.384	0.359	0.211	0.355	0.384	0.359

*t* statistics in parentheses

\**p*< 0.05, \*\**p*< 0.01, \*\*\**p*< 0.001

Table 3: Regression result for Senegal for finance on innovation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
	Aggregate innovation index	Aggregate innovation index	Aggregate innovation index	Aggregate innovation index	Aggregate innovation index	aggregate innovation index	Product innovation index	Product innovation index	Product innovation index
Senegal 1									
Working capital		0.480**							
From banks		(3.18)							
Working capital		0.289							
From banks		(1.59)							
Bank funds					1.019*				
For fixed assets					(2.57)				
Bank funds for					0.182				
Fixed assets					(0.51)				
Trade credit			-0.034						-0.014
			(-0.24)						(-0.10)
Trade credit			-0.283						-0.277
			(-1.93)						(-1.88)
Overdraft				0.421***					0.484***
				(4.36)					(5.20)
Retained earnings					0.585*				
					(2.30)				
Retained earnings					0.499*				
					(1.98)				
Age of firm	0.007*	0.004	0.00627	0.009	0.004	0.005	0.006	0.007*	
	(2.06)	(1.19)	(1.80)	(0.95)	(1.27)	(1.62)	(1.77)	(2.10)	
Size of firm	0.116*	0.145**	0.121*	0.164	0.127**	0.099**	0.132**	0.0900	
	(2.54)	(3.14)	(2.51)	(1.68)	(2.80)	(2.59)	(2.85)	(1.92)	
Top manager' experience	0.007	0.007	0.009*	0.005	0.007	0.010*	0.007	0.008	
	(1.45)	(1.58)	(2.20)	(0.56)	(1.52)	(2.58)	(1.57)	(1.83)	
Regions	-0.141**	-0.134**	-0.133**	-0.261	-0.151***	-0.161***	-0.150***	-0.172***	
	(-3.24)	(-3.11)	(-3.01)	(-1.89)	(-3.57)	(-4.52)	(-3.48)	(-3.98)	
Total annualsales	1.71e-12	2.03e-12	2.25e-12	1.77e-12	2.25e-12		2.25e-13	-1.36e-13	

	(1.43)	(1.72)	(1.92)	(0.61)	(1.91)		(0.19)	(-0.12)
Growth	0.001	0.001	0.001	0.003		0.001	0.001	
	(0.84)	(0.28)	(0.47)	(1.04)		(1.17)	(0.39)	
Firm export	0.646***	0.499**	0.530**	-0.156	0.514**	0.331*	0.408*	0.345*
	(3.84)	(2.94)	(3.10)	(-0.43)	(3.09)	(2.30)	(2.40)	(2.10)
Industry	0.009***	0.008**	0.008**		0.009**	0.009***	0.009**	0.009**
	(3.32)	(3.15)	(3.00)		(3.19)	(4.12)	(3.31)	(3.23)
Competition from	-0.121		-0.197					-0.140
Informal sector	(-0.96)		(-1.58)					(-1.15)
Foreign private	0.661***	0.666***		0.761*	0.693***	0.535***	0.684***	0.577***
ownership	(4.42)	(4.55)		(2.34)	(4.74)	(4.27)	(4.68)	(4.00)
Electricity Cost		7.48e-10	7.65e-10	3.37e-10	7.98e-10	8.23e-10*		
		(1.80)	(1.85)	(0.52)	(1.93)	(2.13)		
Labour Cost		2.85e-10**	2.82e-10**	5.61e-10*	2.97e-10**		1.67e-10	1.23e-10
		(3.05)	(3.08)	(2.03)	(3.23)		(1.81)	(1.42)
Domestic Private				0.679				
ownership				(1.86)				
_cons	0.739***	0.700***	0.662**	0.562	0.215	-0.171	-0.0985	-0.115
	(3.61)	(3.82)	(3.16)	(1.13)	(0.73)	(-1.11)	(-0.54)	(-0.57)
N	376	385	358	91	386	502	385	358
F	18.26	17.40	19.89	4.760	19.28	20.03	14.12	19.42
r2	0.376	0.379	0.409	0.446	0.383	0.310	0.313	0.382
r2_a	0.356	0.357	0.388	0.352	0.363	0.295	0.291	0.362

*t* statistics in parentheses

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table3: Regression result for Senegal for finance on innovation continue

dependent variable	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Product innovation index	Product innovation index	Process innovation index	Process innovation index	Process innovation index	Process innovation index	Process innovation index

Working capital  
From banks

0.500\*\*\*  
(3.62)

Working capital			0.178				
From banks			(1.06)				
Working capital	0.770					0.802*	
For fixed assets	(1.90)					(2.08)	
Working capital	0.305					0.308	
For fixed assets	(0.86)					(0.89)	
Trade credit					-0.014		
					(-0.10)		
Trade credit					-0.277		
					(-1.88)		
Overdraft						0.484***	
						(5.20)	
Retained earnings		0.430					0.421
		(1.68)					(1.75)
Retained earnings		0.386					0.329
		(1.52)					(1.39)
Age	0.007	0.006	0.005	0.006	0.007*	0.00704	
	(0.71)	(1.67)	(1.44)	(1.77)	(2.10)	(0.80)	(1.74)
Size	0.067	0.114*	0.0930*	0.132**	0.090	0.0750	0.111**
	(0.66)	(2.51)	(2.43)	(2.85)	(1.92)	(0.79)	(2.87)
Top manager experience	0.009	0.007	0.0102*	0.00700	0.008	0.009	0.0116**
	(0.97)	(1.51)	(2.57)	(1.57)	(1.83)	(0.96)	(2.90)
Regions	-0.302*	-0.166***	-0.162***	-0.150***	-0.172***	-0.294*	-0.161***
	(-2.17)	(-3.90)	(-4.55)	(-3.48)	(-3.98)	(-2.17)	(-4.46)
Total annual sales	-8.41e-13	3.38e-13		2.25e-13	-1.36e-13	-8.84e-13	
	(-0.30)	(0.28)		(0.19)	(-0.12)	(-0.33)	
Growth	0.004		0.001	0.001		0.004	
	(1.45)		(0.82)	(0.39)		(1.47)	
Export	-0.286	0.410*	0.276	0.408*	0.345*	-0.313	0.421**
	(-0.77)	(2.44)	(1.89)	(2.40)	(2.10)	(-0.89)	(2.87)
Industry	0.002	0.009***	0.009***	0.009**	0.009**		0.009***
	(0.33)	(3.44)	(4.06)	(3.31)	(3.23)		(3.94)
Foreign Private ownership	0.677*	0.684***	0.516***	0.684***	0.577***	0.682*	0.611***
	(2.18)	(4.65)	(4.11)	(4.68)	(4.00)	(2.25)	(4.85)
Labour Cost	4.84e-10	1.61e-10	1.68e-10	1.67e-10	1.23e-10	4.90e-10	2.29e-10**
	(1.76)	(1.74)	(1.85)	(1.81)	(1.42)	(1.83)	(2.61)
Electricity Cost	3.34e-11	4.94e-10	6.90e-10				
	(0.05)	(1.18)	(1.76)				
Competitors from						-0.140	

Informal sector LegalStatus					(-1.15)			0.0454 (1.34)
_cons	0.539 (1.41)	-0.462 (-1.56)	0.585*** (3.78)	0.632*** (3.43)	0.615** (3.03)	1.311*** (3.71)		0.0599 (0.20)
N	91	386	502	385	358	91		504
F	3.082	14.30	18.74	14.12	19.42	3.721		18.87
r2	0.342	0.315	0.315	0.313	0.382	0.341		0.297
r2_a	0.231	0.293	0.298	0.291	0.362	0.250		0.281

*t* statistics in parentheses

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table4: Regression result for Morocco for finance on innovation

Dependent variable	(1) Aggregate innovation index	(2) Aggregate innovation index	(3) Product innovation index	(4) Product innovation index	(5) Process innovation index	(6) Process innovation index	
Trade credit	-0.277 (-1.91)		-0.320* (-2.04)			-0.326* (-2.08)	
Trade credit	-0.503** (-3.22)		-0.521** (-3.09)			-0.516** (-3.04)	
Retained earnings		0.150 (0.62)			0.132 (0.51)		0.132 (0.51)
Retained earnings		0.191 (0.79)			0.142 (0.55)		0.142 (0.55)
Size	0.303*** (4.38)	0.344*** (4.79)	0.243** (3.27)		0.316*** (4.09)	0.267*** (3.59)	0.316*** (4.09)
Top manager experience	0.001 (0.22)	0.001 (0.28)	0.001 (0.11)		-0.0000132 (-0.00)	0.001 (0.21)	-0.000 (-0.00)
Competitors from Informal sector Regions	-0.194 (-1.87)	-0.071* (-2.09)	-0.012 (-0.11)		-0.052 (-1.44)	-0.032 (-0.84)	-0.052 (-1.44)
Foreign Private ownership	0.482** (2.96)	0.355* (2.22)	0.352* (2.01)		0.300 (1.76)	0.377* (2.14)	0.300 (1.76)
Export	0.180	0.215	0.153		0.122	0.150	0.122



Labour Cost	(1.37) 7.44e-10	(1.60)	(1.08) 1.01e-09	(0.85) 7.41e-10	(1.06) 9.91e-10	(0.85) 7.41e-10	
Industry	(1.17) 0.004*	(2.17) 0.004*	(1.48) 0.005**	(1.04) 0.005*	(1.44) 0.006**	(1.04) 0.005*	
Age	(2.36)	(2.17)	(2.71)	(2.50)	(3.00)	(2.50)	
Total annualsales		-0.003 (-0.43)		-0.002 (-0.45)		-0.002 (-0.45)	
Growth		1.87e-10 (1.43)		7.36e-11 (0.51)		7.36e-11 (0.51)	
_cons	2.201*** (9.42)	1.800*** (5.61)	0.136 (0.54)	-0.000740 (-1.78)	-0.125 (-0.36)	4.202*** (17.27)	4.075*** (11.92)
N	334	333	334	333	342	333	
F	7.752	5.483	4.817	3.280	5.641	3.280	
r2	0.194	0.145	0.130	0.110	0.133	0.110	
r2_a	0.169	0.119	0.103	0.0761	0.109	0.0761	

*t* statistics in parentheses

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table5: Regression result for Cameroon for finance on innovation

Dependent variable	(1) Aggregate innovation index	(2) Aggregate innovation index	(3) Aggregate innovation index	(4) Aggregate innovation index	(5) Aggregate innovation index	(6) Product innovation index	(7) Product innovation index	(8) Product innovation index
1.debtwc	0.373*** (3.77)					0.305** (2.62)		
Working capital	0.373*** (3.77)					0.305** (2.62)		
From banks						0.180 (1.28)		
Working capital	0.372** (3.20)							
From banks								
Bank funds				0.025 (0.15)				
For fixes assets								
Bank funds				0.398*				

For fixed assets				(2.40)				
Trade credit	0.259*						0.199	
	(2.38)						(1.57)	
Trade credit	-0.190						-0.297*	
	(-175)						(-2.36)	
Overdraft			0.377***					0.230*
			(4.15)					(1.99)
Retained earnings					0.145			
					(0.89)			
Retained earnings					0.062			
					(0.38)			
Age	0.002	0.002	0.005	0.003	0.001	-0.004	-0.005	-0.005
	(0.51)	(0.55)	(1.44)	(0.56)	(0.49)	(-0.92)	(-1.13)	(-0.93)
Size	0.319***	0.359***	0.354***	0.258**	0.342***	0.230**	0.255***	0.241**
	(5.26)	(5.83)	(5.69)	(2.93)	(5.47)	(3.17)	(3.59)	(3.04)
Top managers' experience	0.003	0.004	0.004	0.002	0.005	0.003	0.003	-0.005
	(0.64)	(0.78)	(0.82)	(0.30)	(0.97)	(0.52)	(0.61)	(-0.85)
Regions	-0.135*	-0.170*	-0.121		-0.122	0.198**	0.135	0.258**
	(-2.23)	(-2.59)	(-1.91)		(-1.90)	(2.73)	(1.77)	(3.13)
Total annualsales	6.14e-12**	5.96e-12*	6.32e-12**	2.15e-12	4.07e-12	9.28e-12**	8.34e-12**	1.54e-11*
	(2.61)	(2.49)	(2.64)	(0.78)	(1.50)	(2.99)	(2.69)	(2.19)
Growth	0.001	0.001	0.001					0.001
	(1.40)	(1.36)	(1.10)					(0.81)
Export	0.150	0.296	0.468**	0.146	0.341*		0.403*	0.228
	(0.98)	(1.92)	(3.13)	(0.87)	(2.17)		(2.24)	(1.21)
Industry	0.004	0.004*	0.005*	0.006*	0.005*	0.002	0.003	
	(1.78)	(2.00)	(2.43)	(2.00)	(2.20)	(0.60)	(1.28)	
Foreign private ownerships	0.732***	0.503***		0.777***	0.514***	0.752***	0.713***	0.430*
	(4.96)	(3.88)		(4.19)	(3.92)	(5.09)	(4.73)	(2.52)

Domestic private ownership	0.546** (3.18)			0.628** (2.85)				
LegalStatus	0.003 (0.07)		-0.023 (-0.58)	-0.125* (-2.33)				-0.079 (-1.51)
LabourCost				3.69e-11* (2.05)	3.72e-11* (2.04)	3.98e-11 (1.89)	4.09e-11* (1.97)	
Electricity								-1.17e-10 (-0.29)
_cons	-0.063 (-0.23)	0.561** (2.68)	0.331 (1.40)	0.353 (0.94)	0.387 (1.56)	-0.425 (-1.83)	-0.327 (-1.34)	-0.134 (-0.49)
N	347	347	346	165	347	343	343	238
F	16.62	17.15	17.60	8.742	15.85	14.28	14.14	9.992
r2	0.394	0.360	0.344	0.408	0.342	0.301	0.320	0.327
r2_a	0.370	0.339	0.325	0.362	0.321	0.280	0.297	0.294

*t* statistics in parentheses

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table 5: Regression result for Cameroon finance on innovation continue

dependent	(9) Product innovation index	(10) Product innovation index	(11) Process innovation index	(12) Process innovation index	(13) Process innovation index	(14) Process innovation	(15) Process innovation index
Working capital From banks			(3.53)				
Working capital From banks			0.401** (3.07)				
Bank funds For fixed assets	0.142 (0.53)					0.0782 (0.41)	
Bank funds For fixed assets	0.188 (0.77)					0.349 (1.83)	
Trade credit				0.256* (2.08)			
Trade credit				-0.104			

Overdraft				(-0.85)		0.371***		
						(3.68)		
Retained earnings		0.195						0.134
		(1.04)						(0.74)
Retained earnings		0.373						-0.062
		(1.96)						(-0.34)
Age	-0.00869	-0.00391	0.004	0.004	0.005	0.006	0.005	
	(-1.19)	(-0.87)	(0.90)	(0.97)	(1.10)	(1.16)	(1.03)	
Size	0.313*	0.246***	0.328***	0.368***	0.317***	0.272**	0.340***	
	(2.21)	(3.39)	(4.82)	(5.28)	(4.54)	(2.70)	(4.83)	
Regions	0.394*	0.162*	-0.278**	-0.292**	-0.242**	-0.143	-0.244***	
	(2.27)	(2.19)	(-4.08)	(-3.93)	(-3.47)	(-1.08)	(-3.41)	
Total annual sales	1.75e-11*	6.41e-12*	2.86e-12	2.45e-12	9.57e-13	-3.51e-13	2.49e-12	
	(2.40)	(1.97)	(1.08)	(0.91)	(0.31)	(-0.11)	(0.91)	
LabourCost	2.34e-11	4.40e-11*			1.55e-11	2.09e-11		
	(0.96)	(2.08)			(0.77)	(1.01)		
Export	-0.003	0.377*	0.108	0.269		0.086	0.255	
	(-0.01)	(2.05)	(0.62)	(1.53)		(0.45)	(1.44)	
Industry	0.001	0.001	0.004	0.004	0.004	0.003	0.005	
	(0.13)	(1.09)	(1.53)	(1.74)	(1.62)	(0.88)	(1.81)	
Foreign Private ownership	0.551*	0.768***	0.615***	0.325*	0.329*	0.339	0.333*	
	(2.24)	(5.00)	(3.71)	(2.21)	(2.32)	(1.85)	(2.25)	
ElectricityCost	-3.47e-10							
Top managers' experience		0.003	0.004	0.004	0.005	0.006	0.005	
		(0.46)	(0.66)	(0.79)	(0.88)	(0.79)	(0.96)	
Growth in employment		0.001	0.001	0.001	0.001	0.001	0.001	
		(1.08)	(1.00)	(0.96)	(1.12)		(1.07)	
Domestic Private ownership			0.677***					
			(3.51)					
LegalStatus			0.028			-0.082		
			(0.66)			(-1.35)		
_cons	-0.554	-0.638*	0.046	0.832***	0.692**	1.212**	0.767**	
	(-1.29)	(-2.21)	(0.15)	(3.50)	(3.02)	(3.16)	(2.75)	
N	108	343	347	347	346	165	347	
F	5.761	12.30	11.93	11.11	13.04	3.997	10.73	
r2	0.398	0.309	0.318	0.267	0.280	0.240	0.261	
r2_a	0.329	0.284	0.291	0.243	0.259	0.180	0.236	

*t* statistics in parentheses

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table 6: Regression result for Kenya for finance on innovation.

Dependent variable	(1) Aggregate innovation index	(2) Aggregate innovation index	(3) Aggregate innovation index	(4) Aggregate innovation index	(5) Aggregate innovation index	(6) Product innovation index	(7) Product innovation index	(8) Product innovation index
From banks	(2.06)					(2.13)		
Working capital	0.167					0.272**		
From banks	(1.83)					(2.82)		
Bank funds				0.071				
For fixed assets				(0.58)				
Bank funds				0.028				
For fixed assets				(0.23)				
Trade credit		0.151					0.062	
		(1.54)					(0.45)	
Trade credit		-0.029					-0.169	
		(-0.30)					(-1.33)	
Overdraft			0.214**					0.232**
			(2.61)					(2.66)
Retained earnings					0.140			
					(0.97)			
Retained earnings					0.078			
					(0.53)			
Age	0.005*	0.005	0.007**	0.006	0.005	0.008**	0.006*	0.008**
	(2.13)	(1.88)	(2.93)	(1.85)	(1.66)	(2.84)	(2.00)	(3.16)
Size	0.306***	0.304***	0.383***	0.265***	0.295***	0.196***	0.180*	0.231***
	(6.12)	(6.07)	(7.72)	(4.03)	(4.21)	(3.71)	(2.37)	(4.39)
Top managers' experience	0.004	0.004	0.005	0.003	0.001	-0.003	-0.006	-0.002
	(1.00)	(1.15)	(1.29)	(0.64)	(0.17)	(-0.73)	(-1.16)	(-0.59)
Regions	0.108**	0.108**	0.0754*	0.0849	0.0742	-0.0472	0.0152	-0.0543
	(3.27)	(3.24)	(2.26)	(1.90)	(1.93)	(-1.34)	(0.35)	(-1.53)
Total annual sales	1.13e-11*	1.15e-11*	1.51e-11**	1.08e-11*	6.65e-12	2.12e-11**	2.01e-11***	2.44e-11**
Growth	(2.09)	(2.13)	(2.76)	(2.13)	(1.09)	(2.90)	(3.61)	(3.27)
	-0.000	-0.000	0.000	-0.000		-0.000	-0.000	-0.000
	(-0.06)	(-0.36)	(0.14)	(-0.56)		(-1.10)	(-1.20)	(-1.17)
Export	0.384***	0.424***		0.294*	0.309**	0.357***	0.201	

	(4.13)	(4.58)		(2.58)	(2.77)	(3.63)	(1.61)	
Sector	0.004	0.003	0.005	0.005	0.013*	0.001	-0.006	0.001
	(1.83)	(0.65)	(1.83)	(1.66)	(2.08)	(0.48)	(-0.85)	(0.31)
Foreign private ownership	0.429**	0.350**		0.337*	0.344*	0.416**	0.367*	0.485***
	(3.21)	(2.88)		(2.46)	(2.54)	(3.22)	(2.46)	(3.77)
Domestic private ownership	0.190							
	(1.05)							
Full time production workers					0.000			
					(0.82)			
ElectricityCost						-1.22e-10		-1.38e-10
						(-0.34)		(-0.38)
Main market							0.116	
							(1.38)	
_cons	0.736**	1.016***	0.992***	1.387***	1.034***	0.151	-0.0301	0.230
	(2.81)	(5.39)	(5.28)	(5.02)	(4.08)	(0.75)	(-0.09)	(1.16)
N	604	602	611	295	317	593	332	595
F	13.69	13.46	16.25	7.060	9.512	10.66	5.404	10.81
r2	0.218	0.215	0.178	0.215	0.255	0.181	0.181	0.156
r2_a	0.202	0.199	0.167	0.185	0.229	0.164	0.147	0.142

*t* statistics in parentheses

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table 6 Regression result for Kenya for finance on innovation continue.

dependent	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Product innovation index	Product innovation index	Process innovation index	Process innovation index	Process innovation index	Process innovation index	Process innovation index
Working capital From banks			0.212*				
			(2.33)				
Working capital from banks			0.114				
			(1.37)				
Bank funds For fixed assets	0.228						-0.051
	(1.42)						(-0.48)
Bank funds For fixed assets	0.0625						0.0350
	(0.41)						(0.34)
Trade credit				0.157			
				(1.71)			
Trade credit				0.047			
				(0.52)			

Overdraft					0.144		
					(1.89)		
Retained earnings		-0.104					
		(-0.76)					
Retained earnings		-0.161					
		(-1.18)					
Age	0.007	0.008**	0.002	0.001	0.003	0.003	0.001
	(1.67)	(3.08)	(0.71)	(0.46)	(1.25)	(1.06)	(0.33)
Size	0.288***	0.207***	0.269***	0.265***	0.305***	0.179**	0.248***
	(3.39)	(3.87)	(5.87)	(5.64)	(6.61)	(3.12)	(3.80)
Top managers'	0.002	-0.002	0.010**	0.008*	0.009**	0.005	0.006
Experience	(0.29)	(-0.62)	(2.83)	(2.42)	(2.66)	(1.26)	(1.38)
Regions	-0.087	-0.059	0.116***	0.146***	0.123***	0.119**	0.092*
	(-1.52)	(-1.67)	(3.91)	(4.73)	(3.98)	(3.06)	(2.57)
Totalannualsales	1.81e-11**	2.01e-11***		1.46e-12	1.04e-12	2.00e-12	-1.44e-12
	(2.76)	(3.52)		(0.29)	(0.16)	(0.45)	(-0.25)
Growth	-0.000	-0.000	0.000	0.000	0.000	0.000	
	(-1.27)	(-1.22)	(0.68)	(0.29)	(0.55)	(0.28)	
Export	0.281	0.385***	0.289***	0.296***		0.198*	0.243*
	(1.91)	(3.91)	(3.37)	(3.42)		(2.01)	(2.35)
Industry	0.005					0.005	
	(1.13)					(1.68)	
Foreign private ownership	0.496**	0.392**	0.215	0.164	0.230*	0.061	0.105
	(2.81)	(3.02)	(1.92)	(1.44)	(2.05)	(0.51)	(0.84)
		(0.85)					
Sector			0.005*	0.003	0.004		0.017**
			(2.09)	(1.35)	(1.87)		(3.04)
ElectricityCost			1.36e-10		1.73e-10		
			(0.53)		(0.54)		
Full time production Workers							0.000
_cons	0.166	0.339	1.122***	1.170***	1.129***	1.676***	1.034***
	(0.47)	(1.54)	(6.49)	(6.67)	(6.48)	(6.99)	(4.40)
N	290	588	673	602	604	295	317
F	6.511	11.06	11.69	10.76	10.80	3.688	7.568
r2	0.205	0.174	0.163	0.167	0.154	0.125	0.214
r2_a	0.173	0.159	0.149	0.152	0.140	0.0914	0.186

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

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## **6. Discussion of Results**

From the regression out put on tables 2 to 6, working capital from private and public banks drives product innovation within firms in South Africa, Cameroon, Kenya and Senegal where it is significant at 1%. This debt from private and public banks also drives process innovation in South Africa, Senegal and Cameroon. Debt from private and public banks further contributes to aggregate innovation in Cameroon, Kenya and Senegal. This is in line with prior studies (Ayyagari et al, 2012:1576). This means an increase in access to working capital from private and public banks is likely to increase product, process and aggregate innovation within firms in the various countries accordingly.

Trade credit drives aggregate innovation in both South Africa and Cameroon. Trade credit further contributes to product innovation in South Africa, and process innovation in South Africa and Cameroon respectively. However, it has little or no impact on firms in Morocco.

Debt from private and public banks meant for fixed assets, contributes to aggregate innovation in Senegal and Cameroon, and process innovation in Senegal.

Access to overdraft or short term financing drives aggregate innovation across firms in Cameroon, Kenya, Senegal and South Africa with Cameroon and Senegal being significant at the 1% level. Short term financing also advances product innovation in Cameroon, Kenya, Senegal and South Africa. Furthermore, short term financing contributes significantly (1% level) to process innovation within firms in South Africa, Kenya and Cameroon. This indicates that an increase in access to short term financing is likely to boost aggregate, product and process innovation within firms in the African region, *ceteris paribus*.

Another source of finance for firms sampled for this study, was working capital from retained earnings. This retained earnings has proven to drive aggregate innovation in Senegal and process innovation in Kenya. This imply an increase in working capital from retained earnings could lead to an increase in process and aggregate innovation in Kenya and Senegal respectively.

In spite of the impact of the afore-mentioned finance variable on various types of innovation, there were some key control variables such as age of firm, size of firm, sector, industry in which the enterprise belong and more. We now examine their outcomes. Age of firms contributes significantly to product and aggregate innovation in Senegal, South Africa and Kenya. In addition, age of a firm drives process innovation in Senegal at the 1% level of

significance. Meaning, the older a firm is in Kenya, Senegal and South Africa the higher the chances of that firm engaging in some sort of process and aggregate innovation respectively.

Firm size is seen to contribute significantly to all types of innovation – product, process and aggregate, in all the sampled countries used, namely Morocco, Cameroon, Kenya, Senegal and South Africa. This is a clear indication that no matter the size of the firm, innovation is inevitable. However, the larger the firm size the higher the chances of the firm carrying out innovation of any type. This is in line with theory that says, larger firms well-structured and better placed to enable them to raise capital faster and as such are able to conduct innovative activities (Schumpeter; 1942, 1950).

The experience of the top most manager of the enterprise contributes significantly to drive process innovation within firms in South Africa, Senegal and Kenya. The experience of the top manager drives product and aggregate innovations in South Africa and Senegal. It is only logical that highly experienced top managers should lead and drive appropriate innovation within their firms accordingly.

The industry in which a firm finds itself contributes to the advancement of all 3 types of innovation (product, process and aggregate) at the 1% level in Morocco and Senegal. The particular industry in which a firm belongs also drives aggregate innovation in Cameroon. The sector where a firm operates contributes to push product and process innovation in Kenya.

Firm exports contributes significantly (1%) to drive product and aggregate innovation in South Africa, Cameroon, Senegal and Kenya. Firm exports contributes very significantly to process innovation in South Africa, Senegal and Kenya. This also could be the case that firms which are involved in the export or international market, are able to raise funds necessary to carry out innovation.

Foreign private ownership contributes positively to firm innovation. The regression output shows that, enterprises that have a large number of foreign private owners among their shareholders contribute significantly to drive product, process and aggregate innovations in Morocco, Cameroon, Senegal and Kenya. This seems reasonable because foreign ownership (shareholders) participants are likely to bring in foreign funds and probably have some experience edge that enables them to push for all types of firm innovation. In Cameroon domestic private ownership is associated with product and aggregate innovation. This means

a firm with more indigenes as shareholder is likely to see itself conducting product and aggregate innovation.

Total annual sales of a firm drives product and aggregate innovation in both Cameroon and Kenya. This means that, the higher the sales of a firm the more funds they can raise that will enable them invest in innovation. In South Africa, a firm's share in the local market contributes to drive product, process and aggregate innovations. Furthermore, the main market where in the enterprise sell, contributes to drive product and aggregate innovation.

Labour cost is seen to impact innovation positively. This means that lower labour cost contributes to drive aggregate innovation in Cameroon and Senegal. The electricity cost also contributes to drive innovation in South Africa and Senegal. This means that when firms spend less on labour and electricity, it can gain some funds through cost saving that can enable the firm to engage in innovation. The legal status of a firm has little or no impact on firm innovation. The region where a firm is located contributes to product innovation in Cameroon, and also drives process and aggregate innovation in Kenya. It should be noted that certain regions are more developed than others and in such regions innovation is what keeps rival firms in the market.

## **7. Conclusion and recommendation**

This paper set out to examine the impact of finance on firm innovation within African enterprises. We used the World Bank enterprise survey data base, and selected a country from each of the regions that make up Africa, based on data quality. Five countries were selected namely South Africa, Morocco, Senegal, Cameroon and Kenya. Innovation is broadly defined to capture imitation, improved product and processes to reflect the kind of innovation found in most of these emerging economies of Africa.

The empirical evidence of importance of external financing for firm growth and innovation has been confirmed in this study. Access to finance and an understanding of how a developed and effective financial system ease access to finance, and its contribution towards innovation and growth was looked in the literature.

This study finds out that access to finance is associated with increase firm innovation. Majority of the firms are SMEs and the predominant external source of finance available to them is from the banks (Beck et al. 2008). This is especially so since most of the financial market and other related market-based sources are still developing. We found that short term

financing (overdraft), and working capital from private and public banks, is associated with greater levels of innovations relative to financing from other sources such as trade credit and retained earnings.

We also found that firm size was highly associated with innovation and surprisingly across all firm sizes (small, medium and large). The age of the firm is related with innovation just as the industry in which a firm belongs, is also associated with innovation. Another interesting finding (with the exception of South Africa) was that foreign private ownership or firms with a high proportion of foreign private participants is associated with all types of innovation. The education and experience of top management is associated with innovation. Furthermore, enterprises that are involved in the export market are highly associated with innovation.

Our results have some policy implications. This study has shown the association between finance and innovation, thus providing new or potential channel through which access to finance can contribute to the general economic growth. The results also show the importance of industry to innovation and therefore the need for evolution in the industrial structure to keep firms innovative. Since foreign ownership and participation increase firm innovation, international investors and foreign partners should be encouraged to come and invest in the emerging economies of Africa. Our results also point to the fact that exposure to the international and global market through exports triggers innovation in firms across board from SMEs to large probably by some competition to stay in the market and this push them to innovate.

All in all, our results show that access to finance is positively associated with firm innovation in the emerging economies of Africa.

## Reference

- Acs, Z. J. and Audretsch, D. B., (1990). *Innovation and Small Firms*, Cambridge: MIT Press.
- Adeboye, T. (1997). Models of innovation and sub-Saharan Africa's development tragedy. *Technology Analysis and Strategic Management*, 9(2), 213–235.
- African Development Bank, (2008) Eminent speakers series: sharing the visions of Africa's Development, volume (1), p25-61.
- Atanassov, J., Nanda, V.K.. and Seru, A (2009). Finance and innovation: The Case of Publicly Traded Firms. Working Paper No. 42: 3-31. University of Michigan.
- Audretsch, D. B. (1995). Firm profitability, growth, and innovation. *Review of Industrial Organization*, 10(5), 579–588.
- Ayyagari, M., Demirguc-kunt, A. and Maksimovic, V., (2011), Firm innovation in emerging markets: The role of finance, governance, and competition. *Journal of Financial and Quantitative Analysis*, 46, 1545-1580.
- Bell, M. and Pavitt, K. (1993). Accumulating technological capability in developing countries. *Industrial and Corporate Change*, 2(2), 157–210.
- Berger, A.N., Udell, G. F., (2006). A more complete conceptual framework for SME finance. *Journal of Banking and Finance*.
- Booyesen, F., Servaas, V.D.B., Ronelle, B., Micheal, V.M. and Gideon, D.R. (2008) “Using an index to assess trends in poverty in seven sub-Saharan African countries”, *World Development* 36(6): 1113-1130.
- Carpenter, R.E., and Petersen, B.C., (2002). Capital market imperfections, high-tech investment, and new equity financing. *Economic Journal*, 112, 54– 72.
- Chipika, S. and Wilson, G., (2006). Enabling technological learning among light engineering SMEs in Zimbabwe through networking. *Technovation*, 26(8), 969–979.
- Demirguc,-Kunt, A., and Maksimovic, V., (1998). Law, finance, and firm growth. *Journal of Finance*, 53, 2107–2137.
- Demirguc,-Kunt, A., Love, I. and Maksimovic, V., (2006). Business environment and the incorporation decision. *Journal of Banking and Finance*, 30, 2967–2993.
- Donaldson, G., (1961). *Corporate Debt Capacity: A Study of Corporate Debt Policy and the Determination of Corporate Debt Capacity*, Harvard Business School, Division of Research.

- Echevin, D. (2011) Vulnerability to asset-poverty in sub-Saharan Africa, Munich Personal RePEc Archives (MPRA) paper No. 35660, from [www.mpra.ub.uni-muenchen.de/35660](http://www.mpra.ub.uni-muenchen.de/35660).
- Florida, L. and Kenney, M., (1988). Venture capital-financed innovation and technological change in the U.S.A., *Research Policy*, 17, 119–137.
- Forum for Agricultural research in Africa (2012) Agricultural innovation in Sub-Saharan Africa: Experiences from multiple-stakeholders approaches.
- Geroski, P., Machin, S. and Van Reenen, J. (1993). The profitability of innovating firms. *RAND Journal of Economics*, 24(2): 198-211.
- Geroski, P.A. and M. Mazzucato (2002), ‘Myopic selection,’ *Metroeconomica*, 53(2), 81–199.
- Giudici, G. and Paleari, S., (2000). The provision of finance to innovation: A survey conducted among Italian technology-based firms. *Small Business Economics* 14, 37-53.
- Hadjimanolis, A., (2000). An investigation of innovation antecedents in small firms in the context of developing countries. *R&D Management*, 30(3), 235–245.
- Himmelberg, C.P. and Petersen, B.C., (1994), R&D and internal finance: A panel study of small firms in high-tech industries, *Review of Economics and Statistics*, 76, 38–51.
- International Food Policy Research Institute (IFPRI) and the World Bank (2010) Bundling development services with agricultural finance: The experience of DrumNet: 2020 vision, Focus 18, brief 14 (July 2010).
- Jansen, S.A. and Carter, M.R. (2013) *The impact of microinsurance on asset accumulation and human capital investments: Evidence from a drought in Kenya*, ILO Microinsurance Innovation Facility Research paper No. 31, Geneva: International Labour Organisation.
- Jensen, M. and Meckling, W., (1976). Theory of the firm: Managerial behaviour, agency cost and capital structure. *Journal of Financial Economics*, 3, 305– 360.
- Mahemba, C.M. and De Bruijn, E. J., (2003). Innovation activities by small and medium-sized manufacturing enterprises in Tanzania. *Creativity and Innovation Management*, 12(3), 162–173.
- Mambula, C., (2002). Perceptions of SME growth constraints in Nigeria. *Journal of Small Business Management*, 40, 58–65.

- Myers, S.C. and Majluf, N.S., (1984). Corporate financing and investment decisions when firms have information that investors do not, *Journal of Financial Economics*, 13, 187–221.
- OECD (2013) Agricultural innovation systems: A framework for analysing the role of the government.
- Oyelaran-Oyeyinka, B., Laditan, G. O. A. and Esubiyi, A. O., (1996). Industrial innovation in sub-Saharan Africa: The manufacturing sector in Nigeria. *Research Policy*, 25, 1081–1096.
- Radas, S., and Bozic, L., (2009). The antecedents of innovativeness in an emerging transition economy. *Technovation*, 29, 438-450.
- Robson, P. J. A. and Obeng, B. A., (2008). The barriers to growth in Ghana. *Small Business Economics*, 30(4): 385–403.
- Schumpeter, J. A. (1942). *Capitalism, socialism and democracy*. New York: Harper .
- Schumpeter, J. A., (1950). *Capitalism, Socialism, and Democracy: The competitiveness of nations in a global knowledge-based economy*. (3ed New York: Harper Torchbooks.
- Schumpeter, J.A. (1912), *The Theory of Economic Development*, trans. by R. Opie from the 1926 (revised) edition of *Theorie der Wirtschaftlichen Entwicklung*, London: Oxford University Press, 1961.
- Stiglitz, J.E. and Weiss, A., (1981). Credit rationing in markets with imperfect information. *American Economic Review*, 71, 393–410.
- Stiglitz, J.E., (1985), Credit markets and capital control, *Journal of Money, Credit and Banking* 17, 133–152.