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The Impact of the Institutional Environment on the Use of Licensed Technology

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Abstract

The robustness of the institutional environment is a requisite factor for the growth and development of a firm. This study is focused on the impact of factors of institutional environment on SMEs' acquisition and use of licensed technology from abroad. The independent variables considered as the factors of institutional environment are: financial institutions, regulatory institutions, infrastructure, and security, while the dependent variable is the use of licensed technology from abroad. Data from the manufacturing and the service sectors of the economies of Africa and the Middle East are collected from the database of the World Bank Enterprise Survey. The survey employs random sampling to select firms in each country. The firms are stratified based on the number of employees and the geographical region. Questionnaires are administered to firms from 2006 to 2018 through cross-sectional data collection method. By focusing on the scope of research on the two regions and SMEs, the sampled observations are scaled down from 136,887 to 33,977 firms in 53 countries. Although not all the Pearson correlation coefficients of the independent variables with the dependent variable are high, there are satisfactory levels of significance with p-values below 5%. The independent variables in the regression model have a statistically significant impact on the use of licensed technology from abroad. The forecasting power of the regression model, the possible implications from the test results are shown. The limitations of the research and the possible areas for future research are discussed in the last section.

1 INTRODUCTION

The building of strong institutions has become an essential agenda of reforms by various governments in least developing countries (LDC) to obtain their needed economic growth, development and global

competitiveness. The BRICS (Brazil, Russia, India, China, and South Africa) economies have been very successful with regards to their total economic growth and supremacy in the international economy. It is identified that the governments of each of the BRICS economies have undertaken a unique path to their economic growth and development, through the availability of their exclusive

human and financial capitals (Aidis et al., 2008; Kahn, 2011; Wilson & Purushothaman, 2006; Michailova & Jormanainen, 2011; Atsmon, Kertesz, & Vittal, 2011). The governments play a role by undertaking robust institutional reforms and infrastructure which in turn provide an enabling environment for all businesses in their respective countries to innovate, grow and develop rapidly (Ahlstrom & Bruton, 2010; Fogel et al., 2006; Zhang & Thomas, 2009).

Investigations in entrepreneurship indicate that structure and quality of the factors of institutional environment in countries affect the decision of firms to undertake and/or continue any innovative and entrepreneurial activity to the competitive market (Bao et al., 2016; Urban, 2014; Welter & Smallbone, 2010). According to researchers Stiglitz (2006) and Baumol (1990) entrepreneurship and innovation activity by firms are borne out of the implementation and improvement of institutions in an economy that inspires entrepreneurial endeavours. Firms and individuals do respond to the incentives that underpin an economy thus, factors of institutional environment can serve as grounds for both good and vice (against corruption, crime, thievery, vandalism and others.) activities of firms.

The literature on how the diverse institutional environment factors affect firm's capability to obtain contemporary licensed technology from a foreign firm is few. By taking into consideration the merits and difficulties of the institutional environment facing firms and entrepreneurs in developing countries, the objectives of this research study is to: (1) find out the impact of the factors of independent variables in institutional environment on the use of licensed technology from abroad, and (2) forecast how SMEs can attain licensed technology from abroad in their business operations. The forecast estimation is done by using the results from the analyses of the regression model.

This research helps to narrow the gaps detected in the above-mentioned literature review. The research question posed in this research is: do the institutional environment factors in a developing economy have influence on SME's acquisition and use of licensed technology from abroad? The answer to this question helps to contribute to the relationship between institutional environment factors and the use of licensed technology.

2 THEORETICAL FRAMEWORK AND HYPOTHESES

This section focuses on the development of hypotheses for the research, and the discussions on the impact of significant factors of institutional environment on the use of licensed technology from abroad. The independent and dependent variables are explained in the following subsections.

2.1 Financial Institutions

Williamson (1975) argues that internalizing the functions of a firm helps to arrange the structural features that govern the allocation of liquidity. The internal arrangement enables a firm to undertake growth, development and innovation activities (Liebeskind, 2000). The allocation of liquidity from a firm's "internal capital market" is more reliable, efficient and comes with a minimal transaction cost due to information symmetry (Myers & Majluf, 1984; Stein, 1997), minimum investment fad and cyclicity (Henderson, 1970, 1979).

Overdraft facility is also a popular financial instrument in the environment of commercial banking. It is used as an emergency capital accessibility given by the commercial banks to their reliable and trusted customers who are in need of liquidity to service and/or finance their maturing obligations. State enterprises and agencies make use of these available services in the banking sector just as their competitors in the private sector. For instance, in India, the gap in the financial space created as a result of firms' overdraft is helped and filled by the Reserve Bank of India (Thavaraj, 1982).

Firms provide their customers the opportunity to delay their payment of goods and services already delivered. This is done by offering customers some flexible terms of trade credit to assist the firms to deal with problems that result from liquidity. Results from prior studies have identified the importance of trade credits to SMEs businesses. External credits are offered to firms in the form of short-term finances (Bonte & Nielen, 2011; Ng, Smith, Smith, 1999). Credits are relatively expensive when they are issued as a financial instrument to firms in the short-term. Firms are attracted to accept this form of relatively expensive external credits because of the rationing of credits by commercial banks, the innovativeness, and rate of growth of business activities. Accordingly, firms are therefore constrained to resort to the short-term external credits though it comes with a comparatively more cost to them (Petersen & Rajan, 1994).

Again, firms seek the services of their suppliers, in the short-run, to access flexible working capital or credit. The credit acquired from the suppliers has a less price attached to them with more elastic demand. Suppliers have a long-run motivation to assist their customers who have been indulged in financial difficulties so as to keep their business activities in progress (Pike, Cheng, Carvens, & Lamminmaki, 2005; Petersen & Rajan, 1997). There is no formal procedure and documentation when firms are transacting with their suppliers. This reduces stress and increases the easiness in their transaction process. SMEs do tap into the credit resources available from their suppliers in situations of financial challenges or when access from commercial banks becomes impossible (Bonte & Nielen, 2011).

With a robust financial environment, commercial banks become a hub for firms to access credits and capital

accumulation with less difficulty, which supports them to improve their investment, growth and innovativeness (Levine, 2005; Levine, Loayza & Beck, 2000; Beck, Demircuc-Kunt & Maksimovic, 2008).

2.2 Regulatory Institutions

The regulation of labor is perceived to be the bedrock for the growth and development of firms and an economy as a whole. This is evidenced in the work of Engerman (2003, p. 60) that shows the importance of employees in the overall national economy (Huberman & Meissner, 2010). The regulation of labor is often considered as one of the essential variables that create conducive business environment. A favorable labor regulation boosts the morale of employees to put in extra effort in their respective assignments. The productivity, growth and development level of a firm are therefore projected to increase significantly (Besley & Burgess, 2004). However, in situations of a high cost of labor market and flexible labor regulation, employers are willing to lay off workers in order to safeguard their revenue and growth (Dollar, Iarossi, & Mengistae, 2001).

Business licensing is a process that involves the application and approval of a firm by a recognized state institution. Institutions are able to locate and transact businesses with licensed firms without going through any form of stress. State institutions provide the necessary protection in times of threat of security from within or outside the working environment. Also, the reputation of registered firms is enhanced in the eyes of their customers and the population at large. Such firms are seen as very responsible with regards to the rules and regulations of the state (De Mel, McKenzie, & Woodruff, 2013; Garnaut, Song, Yao, & Wang, 2012, p. 118). Firms do acquire a license for new product they introduce into the market. The main aim for obtaining a license for new product is to seek protection from other firms and to own it. Favorable protection from a sanctioned institution of state helps to raise the motivation of firms to increase their innovation activities (Kulatilaka & Lin, 2006; Katz & Shapiro, 1985). Though the acquisition of a license may not necessarily provide a winning opportunity, it may, in the long run, provide some comparative benefits to firms.

The regulation of access to and use of land is pervasive in most cities. The rules and regulations may border on: minimum size of a parcel of land, the architectural design, the height, the concentration of commercial and industrial property, the density of residential areas, and the availability of infrastructure. The regulatory intervention presented by the authorities is to provide dynamism and flexibility for both individuals and firms to the competitive market. The regulation brings out the competitive force in firms which has the potential to influence the quality and sustainability of a business life-cycle (Hanushek & Quigley, 1990). The regulation of land provides support to firms by preventing them from the cumbersome and stressfulness associated with land acquisition and usage.

Trading has a higher tendency to positively affect the investment, savings, production, output and wealth of firms. It also plays a significant role in the growth of employment in an economy which is the utmost aim of all state authorities (Ghose, 2011; Ruppel, 2018, p. 771). Developed economies have taken advantage of free trade among nations to specialize in the production and exportation of modern manufactured products. Developing countries on the other hand, do specialize in the production and exportation of primary products while importing manufactured products from developed countries. The regulatory measures are meant to assist and formalize the export of products while inhibiting the importation of products that are already produced in the local market (Trujillo, 2010; Domar, 1957). The regulatory measures and reforms at the ports of entry are meant to assist firms in their international transactions. The intent of trade regulation is to standardize the processes of undertaking transactions between firms from different countries. Although, the regulations are considered to provide relief to firms, sub-standard implementation can adversely affect the same firms these measures are meant to assist.

2.3 Infrastructure

There is a growing evidence to buttress the argument that accessibility of electrical infrastructure has a significant influence on the growth and development of firms and the economy as a whole (Dinkelmann, 2009; Lipscomb, Mobarak & Barham, 2013). Unfavorable infrastructure development and poor service delivery have the potential to increase the general cost of business operations. This drives firms away from initiating energy-intensive technological projects that can improve existing products and innovate new ones (Eifert, Gelb, & Ramachandran, 2008; Allcott, Collard-Wexler, & O'Connell, 2016).

A constant supply of electric power strengthens the energy base of firms. This makes them stay in an un-intermittent production process. The associated benefit from constant production is an increase in revenue. Firms therefore, rely so much on the unceasing supply of electric power to their work environment to the extent that generators are often on a stand-by to augment the energy supply in periods of unreliable supply of electricity from the national grid (Alby, Dethier, & Straub, 2013).

Variations in the accessibility stage of land use have the potential to sway the development and relocation of firms from the affected localities. The dynamism in the transportation and usage of land in the form of 'transportation land-use cycle' (Farber & Marino, 2017; Giuliano, 2004; Wegener & Fuerst, 2004) is stated as:

- the zoning of land usage is determined by the location of individuals' actions;
- the temporal arrangements of human actions lead to the need for transportation; and

- the modern technology and infrastructure inculcated in the transportation system enable easy accessibility by individuals and firms.

Below is Figure 1 that shows the cycle of land usage and transportation.

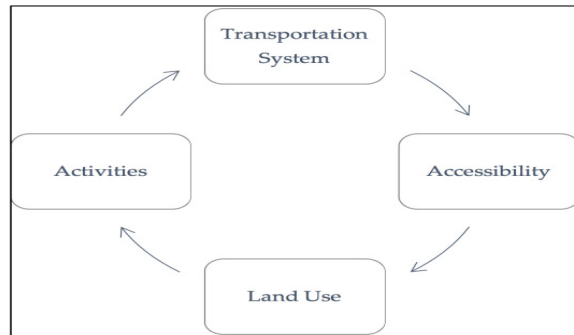


Figure 1: Transportation Land-use Cycle (Farber & Marino, 2017)

Transport opens up rural areas to engage in social and economic activities with urban communities. However, inadequate social amenities and poor weather conditions prevent the movement of goods and services between communities. Products, especially agricultural products, get stuck in the production sites due to the non-availability of transport to the market. This difficulty does not only affect individual homes, but firms that use these products as an intermediate input for further production (Gwilliam, 1997).

2.4 Security

The cost of insecurity is a major concern to firms. All the costs associated with such threats of peace come down to frustration of employees and loss of revenue. A decrease in the rate of revenue accumulation is linked to declining production which eventually, obstructs the growth and development of firms. Consequently, firms are faced with a sharp decline in their number of customers. Although their core customers may remain loyal, a tremendous cut-off of customers collapses the reputation of firms which renders their financial capacity in a poor state. Firms have to spend extra resources for advertisement, campaigns to repair reputations and help restore security at the work environment (Fowler, 2018).

Due to the consequences associated with security breaches firms turn to establish measures to prevent and protect property at the work environment. The payments for these protections are substantial but the benefits associated with it outweigh the cost of non-production and loss of property. The employees of protected firms have a free and peaceful mind-set to do their required duties and responsibilities without any form of fear from the internal or external environment (Howe & Sims, 2011). This initiative enables firms to increase their revenue pattern which subsequently leads to their growth and

development. As Benjamin Franklin suggested, “an ounce of prevention is worth a pound of cure”.

2.5 Firm Age and Size

Age of a firm is considered as the number of years a particular firm has been in existence. Formally, a firm comes into existence on the day it completes its business licensing in a regulatory institution. The size of a firm is defined as the number of full-time employees and it is important for several aspects. Small firms tend to have less resource to undertake research and development to create new and/or improve existing activities. The age and size of firm are used as control variables in this research study.

2.6 Licensed Technology from Abroad

Previous studies have shown a positive and close relationship between technology and innovation. This linkage indicates that there is a linear and gradual progression from technology to the creation of innovation. The motive behind the innovativeness of SMEs is largely dependent on the ability to meet some perceived needs and satisfaction of buyers. The perceived needs may include a new trend in fashion, artifact, or cultural ways of life. Some of the biggest, profitable and reputable firms in industries such as: health and pharmaceuticals, automobiles, electrical and electronic, fashion and clothing accessories, energy, and petrochemical products rely on the perception of buyers’ need which is practically difficult to envisage. SMEs, just as big firms, depend on the ability of their workers to use this rapidly changing and sophisticated technology to create innovative products in the market. The frequent use of licensed technology improves the knowledge, experience, and expertise of workers which enables them to develop and improve the quality of products. For SMEs to adopt and use licensed technology from abroad, it can be inferred that their workers are endowed with enough technical know-how to handle that technology (Marburger III, 2011).

Kao (2007), a guru in the field of innovation, elaborates on the innovativeness of firms as the ability of workers, firms, and the nations as a whole to regularly establish their preferred future. Innovation uses knowledge from diverse disciplines such as: science, technology, design, social science, and arts. Innovation is more than just creation of new products; it includes new services, processes and commercialization of new and/ or improved products. The activities of entrepreneurs, scientists and software engineers alike also contribute to innovation. It is also about the individuals who know how to harness value from ideas. Innovation flows from a change in way of thinking that can generate new business models, identify new opportunities and create innovations throughout every aspect of society. It is about a new paradigm of understanding and doing things as much as it is about the breakthrough idea (Kao, 2007, p. 19).

The research work of Bettis and Prahalad (1995) suggests that firms must not only manage the available technology, but they must make conscious efforts to integrate new technology into their already existing technologies. Technologies that come from diverse organizations are usually entrenched in a particular set of codes and convention. In most cases, these codes and conventions are not in harmony with the existing organizational structure of a firm. Firms have to accept and enrol a fundamental change in their organization in order to successfully integrate new technology into their already existing ones (Fiol & Lyles, 1985).

At a lesser degree, the number of new technologies are restricted when the exposure of firms to foreign markets are inadequate. The management and integration of new technologies to existing ones in firms come with minimal cost, which in turn increases their operational success and performance. The benefits that are accrued from a licensed and new technology to firms are: minimal operational cost, competitive advantage, and further growth and development of products (Wu, 2013).

In view of the above discussions the research study postulates the hypotheses below:

Hypothesis: Institutional environment has a significant influence on the use of licensed technology from abroad.

H1: The impact of financial institutions is significant on the use of licensed technology from abroad.

H2: The impact of regulatory institutions is significant on the use of licensed technology from abroad.

H3: The impact of infrastructure is significant on the use of licensed technology from abroad.

H4: The impact of security is significant on the use of licensed technology from abroad.

A summary of the theoretical framework and hypotheses of all the independent variables on the dependent variable is shown in a pictorial form in Figure 2.

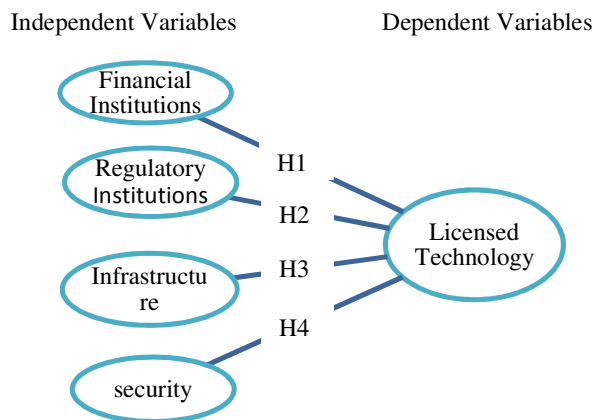


Figure 2: Theoretical Framework and Hypotheses (Author’s compilation, 2020)

3 METHODOLOGY

The variables used for this research are explained in this section. The research employs the industry-level data from the database of the World Bank Enterprise Survey (WBES) (The World Bank, 2018). The survey questionnaires taken for this research are conducted from the years 2006 to 2018. The specific data which borders on institutional environment and the use of licensed technology are taken from the database. Renowned researcher like Yang (2016) employed the WBES for his scientific research and publications. Stratified random sampling method is used to select firms in the manufacturing and the service industries in each of the countries that the survey is focused on (The World Bank, 2005). The countries in this research are in the geographical regions of Africa and the Middle East.

In line with the scope of the research, Africa and the Middle East, firms from the manufacturing and the service industries in 53 out of 138 countries are surveyed. The total number of firms in these countries is found to be 41,336 out of a total number of 136,887 observed firms. Since the main goal of the research is focused on SMEs (i.e., firms with a total number of less than 100 permanent employees), all large firms (i.e., firms with a total number of permanent employees of 100 and beyond) are removed from the data. The research maintains the age of the firm in the data for analyses. The age of a firm is estimated as the number of years a firm has been in existence. This is calculated by using the date a particular firm answers the survey questionnaire minus the date it started operating in the market. From this estimation, the youngest and oldest firms are one and 212 years old respectively. The size and age of the firm are considered as control variables. In view of these estimations the sample is found as 33,977.

For many variables used in WBES as attributes of factors of institutional environment, the principal component factor (PCF) analysis is used to reduce the number of variables. The independent variables that are strongly related to each other converge with factor loadings greater than 0.3 (R-bloggers, 2018). The results from the PCF analysis reveal four unique factors. These four factors have converging items that are measuring similar constructs. From the constructed factors, first and second factors have four items, while the remaining two factors have two items each. The four principal components are: financial institutions, regulatory institutions, infrastructure, and security. The results from the PCF statistical analysis with varimax rotation are shown in Table 1.

Table 1: Factor Analysis

Variables	Financial Inst.	Regulatory Inst.	Infrastructure	Security
Capital from bank	0.844	0.004	0.031	-0.008
Capital from internal fund	-0.737	0.073	-0.176	-0.053
Lines of credit	0.735	0.056	-0.133	0.091
Overdraft facility	-0.584	-0.120	0.314	-0.148
Labour regulation	0.020	0.751	0.000	0.003
Trade/custom regulation	0.062	0.716	0.071	0.113
Business licensing	-0.067	0.688	0.125	-0.003
Access to land	0.018	0.451	0.439	-0.069
Access to electricity	-0.028	0.024	0.826	0.059
Transportation	0.062	0.445	0.560	0.055
Loss from insecurity	-0.031	-0.019	-0.049	-0.761
Payment for security	0.103	0.051	0.026	0.747

Principal component factor (PCF) with varimax rotation and Kaiser Normalization. KMO=73.11%

Source: Author's compilation (2020)

Attributes

The attributes and references in the literature are explained in this section. Below are the attributes of the independent and dependent variables considered under this research.

Financial Institutions. Four variables are used to construct the attribute of financial institutions based on the research studies of Liebeskind (2000); Beck, Demircuc-Kunt, and Maksimovic (2008); Levine (2005); Peterson and Rajan (1994); Pike, Cheng, Carvens and Lamminmaki (2005); and Thavaraj (1982). Two of the survey questions require respondents to indicate in percentage (%), their accessibility of credit from banks and internal funds relative credits they receive from all sources. Another two of the survey questions require respondents to indicate on a dummy scale (Yes=1, No=0) whether they are able to access credit through their lines of credit and overdraft facility.

Regulatory Institutions. Four variables are used to construct the attribute of regulatory institutions based on the research works of Huberman and Meissner (2010); De Mel, McKenzie and Woodruff (2013); Hanushek and Quigley (1990); Ghose (2011); and Trujillo (2010). The survey respondents are asked to indicate on a five-point Likert's scale (0-no obstacle to 4-very severe obstacle) whether government regulations on labor, trade and custom, business licensing and access to land obstruct their business transactions.

Infrastructure. Two variables are used to construct the attribute of infrastructure based on the studies of Dinkelmann (2009); Lipscomb, Mobarak and Barham (2013); Allcott, Collard-Wexler and O'Connell (2016); Farber and Marino (2017); Giuliano (2004); and Gwilliam (1997). The survey asks respondents to identify on a five-point Likert's scale (0-no obstacle to 4-very severe obstacle) whether transportation of products and access to electricity obstruct their business operations.

Security. Two variables are used to construct the attribute of environmental security based on the investigations by Fowler (2018); and Howe and Sims (2011). The survey asks respondents to indicate on a dummy scale (Yes=1, No=0) whether their businesses ever experienced losses due to theft and payment for security operations and accoutrements.

Licensed Technology. The variable is selected based on previous research (Wu, 2013; Fiol & Lyles, 1985; Marburger III, 2011). The survey question from the OECD asks respondents to indicate on a dummy scale (Yes=1, No=0) whether a firm has in the last three years obtain and uses a licensed technology from abroad. The "last three years" is used in the questionnaire to enable investigators detect how a firm is abreast with the changing demands from the competitive market and consumer preference.

3.1.1 Data Analyses

The data analyses of this research are explained in this subsection. The descriptive statistics: mean, standard deviation, minimum, maximum, and number of observations of both the independent and dependent variables are given in this subsection. The analyses of the Pairwise correlation of all independent and dependent variables are also estimated. These are followed by designation of the regression model, analyses, outcomes, and discussions. All the independent and dependent variables are coded to allow for easy reporting of statistical estimations and analyses:

- Tech: the use of licensed technology from abroad;
- Ins_Fin: financial institutions;
- Ins_Reg: regulatory institutions;
- Ins_Inf: infrastructure;
- Ins_Sec: security;
- Age: firm age; and
- Size: firm size (SMEs).

The Table 2 below shows the descriptive statistics of the independent and the dependent variables.

Table 2: Descriptive Statistics of Dependent and Independent Variables

Variable	Obs.	Mean	Standard Dev.	Min.	Max.
Licensed Technology	17,896	0.101	0.302	0	1
Financial Institutions	26,438	0.000	1.000	-1.182	4.432
Regulatory Institutions	26,438	0.000	1.000	-2.067	3.841
Infrastructure	26,438	0.000	1.000	-3.148	3.405
Security	26,438	0.000	1.000	-1.940	2.351
Age	24,077	16.386	13.837	1	212
Size (SMEs)	33,977	18.630	18.808	1	99

Source: Author's compilation (2020).

3.1.2 Pairwise Correlations between Independent Variables in Institutional Environment and Licensed Technology

From Table 3 the Pairwise correlation results reveal a positive correlation coefficient in: financial institutions (corr=0.072), regulatory institutions (corr=0.095), security (corr=0.097), age (corr=0.011), and size (corr=0.140). This is not same with infrastructure, it recorded a negative correlation coefficient (corr=-0.015). The correlation coefficients are all significant since their corresponding p-values are less than 0.05 (p<0.05) for all the independent variables except infrastructure (p-value=0.068) and age (p-value=0.224). Although p-value for age is 0.224>0.05 it is still kept in the list of independent variables since the probability of having a Type I error of 22.4% is small.

Table 3: Pairwise Correlations between Independent Variables in Human Capital and Product Innovation

Variable	Tech	Ins_Fin	Ins_Reg	Ins_Inf	Ins_Sec	Age	Size
Tech	1						
Ins_Fin	0.072	1					
Ins_Reg	0.0951	0.4E-3	1				
Ins_Inf	-0.015	0.3E-4	0.7E-5	1			
Ins_Sec	0.097	0.1E-3	0.5E-4	0.5E-4			
Age	0.011	0.069	-0.059	-0.092	0.068	1	
Size	0.140	0.183	0.061	-0.110	0.167	0.199	1

Source: Author’s compilation (2020).

3.1.3 Regression Model

This subsection presents the regression model for the independent and dependent variables used in this research study. R-squared value in a regression explains the degree to which the independent variables explain the variation of the dependent variable. The adjusted R-squared is a goodness-of-fit statistical test that gives an adjustment to the R-squared statistical test.

The Root mean squared error (Root MSE) is a statistical test that measures how well a model performed. It measures the relationship between the expected and the actual values.

$$\text{Root MSE} = \sqrt{\frac{1}{n} \sum (\hat{y} - y)^2} \tag{1}$$

where \hat{y} : computed value, and y : expected value,

The Mean Percentage Error (MPE) shows the size of detected errors when undertaking a regression model.

$$\text{MPE} = \frac{1}{n} \sum \frac{|\hat{y} - y|}{y} \tag{2}$$

The F-statistical test is explained as the ratio of two variances. It shows whether a linear regression model gives a better goodness-of-fit to the data.

$$F = \frac{\text{Var}(\hat{y})}{\text{Var}(y)} \tag{3}$$

The confidence interval of a statistical test result shows the extent of uncertainty connected with a regression model. The confidence interval provides two numbers where the sample parameter is said to fall in between, combined with a statement of probability.

3.1.4 The Impact of Independent Variables in Institutional Environment on Licensed Technology from Abroad

The Table 4 shows the results of the regression analysis between the factors of institutional environment (financial institutions, regulatory institutions, infrastructure and security), control variables (age and size) and dependent variable (licensed technology). This is performed by using the regression model in Equation 4 below:

$$\text{Licensed_technology} = \beta_0 + \beta_1 \text{Financial_institutions} + \beta_2 \text{Regulatory_institutions} + \beta_3 \text{Infrastructure} + \beta_4 \text{Security} + \beta_5 \text{Age} + \beta_6 \text{Size} \tag{4}$$

The impact of financial institutions, regulatory institutions, infrastructure and security on licensed technology are statistically significant, with p<0.05. On the other hand, the impact of infrastructure on licensed technology is not statistically significant (p=0.162>0.05).

For this regression model, the total number of firms under consideration is 9,351. The R-squared of the regression is found as 0.093, the root mean squared error (Root MSE) is 0.422, and the mean percentage error (MPE) is 0.291.

Table 4: The Impact of Independent Variables in Human Capital on Product Innovation

Source	SS	df	MS	No. of obs.	9351
				F(21, 2502)	17.45
Model	81.110	59	1.375	Prob>F	0.000
Residual	788.270	9,291	0.085	R-sq.	0.093
Total	869.380	9,350	0.093	RMSE	0.291
				MPE	0.111
Variables	Coef.	Std. Err.	T-test	P-value	Conf. Int.
Ins_Fin	0.021	0.003	6.620	0.2E-35	0.015, 0.027
Ins_Reg	0.028	0.003	8.350	0.3E-11	0.021, 0.034
Ins_Inf	-0.005	0.004	-1.400	0.162	-0.012, 0.002
Ins_Sec	0.019	0.004	5.420	0.1E-15	0.012, 0.026
Age	0.5E-4	0.2E-3	0.270	0.783	-0.3E-4, 0.4E-3
Size	0.002	0.1E-3	11.560	0.8E-24	0.001, 0.002
Constant	0.309	0.033	9.340	0.1E-27	0.244, 0.374

Note: Country fixed effect – Yes; Industry fixed effect – Yes

Source: Author’s compilation (2020).

The regression coefficients and the p-value for the independent variables in institutional environment are: financial institutions ($\beta_1=0.021$, $p=0.2E-35$), regulatory institutions ($\beta_2=0.028$, $p=0.3E-11$), infrastructure ($\beta_3=-0.005$, $p=0.162$), security ($\beta_4=0.019$, $p=0.1E-15$), age ($\beta_5=0.05E-4$, $p=0.783$), and size ($\beta_6=0.002$, $p=0.8E-24$).

3.1.5 Forecasting Through Regression Model

After using the OLS regression model to determine the statistically significant impact of the independent variables on the dependent variable, the results are used to predict the values of the dependent variable. Through the function of *sumproduct* in excel, the regression coefficients are used to compute the *calculated value*, Y_c . A threshold, ϵ , is decided to distinguish 0 and 1 from the *calculated value* in decimals.

By assuming that a firm supplies the values of the independent variables ($x_1, x_2, x_3, x_4, x_5, x_6$) and the values of the dependent variable Y_{exp} , the corresponding regression coefficients are: $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 . The OLS regression model is constructed as:

$$Y_c = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + \beta_6x_6 \quad (5)$$

The calculated values Y_c are transformed into dummy variable, Y_p :

$$Y_p = \begin{cases} 1, & Y_c \geq \epsilon \\ 0, & Y_c < \epsilon \end{cases} \quad (6)$$

The error of the forecasting is calculated by:

$$Error = \begin{cases} 0, & Y_p = Y_{exp} \\ 1, & Y_p \neq Y_{exp} \end{cases} \quad (7)$$

Accuracy of the forecasting is calculated by:

$$Acc. = 1 - \frac{\sum Error}{N} \quad (8)$$

where N is the number of observations and $Acc.$ is the accuracy of forecasting.

Recall that the prediction value is given by:

$$Y_p = \begin{cases} 1, & Y_c \geq \epsilon \\ 0, & Y_c < \epsilon \end{cases} \quad (9)$$

Therefore if $Y_p = 1$, a firm whose data is supplied is potentially a firm with the ability to acquire and use licensed technology from abroad. If $Y_p = 0$, potentially the firm has no capacity to use licensed technology from abroad.

3.1.5.1 Policy Proposal

The firm with independent variable values x_1, x_2, x_3, x_4, x_5 and x_6 are moved around the reported values and the effects on Y_c are observed. When Y_c is reached to a value $Y_p \geq \epsilon$ then the region of these values of x_1, \dots, x_6 are reported to the firm. If the firm improves the existing values to those values that give $Y_c \geq \epsilon$, the firm will therefore, have the potential to acquire and use licensed technology from abroad.

3.1.6 Forecasting the Impact of Institutional Environment Factors on Licensed Technology

How the regression model in Equation 4 is used to forecast whether a firm has the ability to get a licensed technology or not is shown in Table 5 below. It indicates that the accuracy of forecast by this regression model is found as 62.94% when a threshold of $\epsilon=0.422$ is used.

Table 5: Forecasting the Impact of Institutional Environment Factors on Licensed Technology

Tech. Exp.	0.374	0.021	0.028	-0.005	0.019	0.000	0.002	Cal. Val.	Tech. Forc.	Error	Accuracy
1	1	-0.418	1.640	0.992	0.222	9	20	0.447	1	0	62.94%
0	1	-0.743	1.032	0.710	0.171	8	15	0.415	0	0	
0	1	-0.644	0.926	0.888	-1.025	5	12	0.385	0	0	Threshold
0	1	0.225	0.368	-0.697	0.149	10	7	0.409	0	0	0.422
1	1	-0.530	0.809	-0.316	0.130	8	18	0.423	1	0	
0	1	-0.694	0.915	-0.434	-1.121	11	6	0.378	0	0	
0	1	-0.691	0.384	-0.767	-0.952	9	8	0.371	0	0	
0	1	-0.460	0.280	0.966	0.132	11	13	0.394	0	0	
1	1	-0.864	0.835	-1.072	0.343	13	30	0.447	1	0	

Source: Author's Compilation (2019)

4 CONCLUSION

The hypothesis claims that institutional environment factors play a major role on the use of a licensed technology from abroad by firms. In examining the impact of the factors of institutional environment on the use of a licensed technology from abroad, as in H1; financial institutions have a positive regression coefficient ($\beta_1=0.021$), a standard error of 0.003, and a high statistical significance level with a p-value of 0.2E-35. At a 95% level of confidence, confidence interval of the regression coefficient of financial institutions is (0.015, 0.027). For H2, regulatory institutions have a positive coefficient ($\beta_2=0.028$), a standard error of 0.003, and a high statistical significance level with a p-value of 0.3E-11. At a 95% level of confidence, confidence interval of the regression coefficient of regulatory institutions is (0.021, 0.034). For H3, infrastructure has a negative regression coefficient ($\beta_3=-0.005$), a standard error of 0.004, and a significance level with a p-value of 0.162. At a 95% level of confidence, confidence interval of the regression coefficient for infrastructure is (-0.012, 0.002). For H4, security has a positive regression coefficient ($\beta_4=0.019$), a standard error of 0.004, and a high significance level with a p-value of 0.1E-15. At a 95% level of confidence, confidence interval of the regression coefficient of security is (0.012, 0.026).

The results from the regression analysis reveal that factors of the independent variables in institutional environment are statistically significant on licensed technology. The research of Ayyagari, et. al., (2011) has a similar outcome which supports the discussion that a firm will be able to use a licensed technology from abroad provided one of the essential factors for the firm has adequate capital from a financial institution.

4.1 Forecasting Through Regression Model for Licensed Technology

The results of the forecasting through regression models are shown below. The levels of accuracy of all the calculated values that are predicted through the regression models are shown in the following discussions. The regression coefficients of the four independent variables in factors of institutional environment, the two control variables, and the constants are used for the estimations and analyses of the forecasting power. When a threshold of $\varepsilon=0.422$ is used through the regression model in Equation 4, the forecast for a licensed technology is accurate at 62.94%.

4.1.1 Implications and Limitations

This research has implications on managerial decisions and government policy. Firstly, the findings from this research will open the pathway for growth and development of firms. Management is able to effectively plan and execute policies that help to attain the set goals and objectives of the firm. Also, management is able to predict the outcome of their policy decisions with regards to the acquisition and use of licensed technology from abroad given the factors of institutional environment.

Secondly, the results of this research study show that interventions and regulations from authorities are essential determinants of successful activities in SMEs in Africa and the Middle East. As this research shows, one factor of institutional environment is not capable to single-handedly promote the activities of SMEs to a significant level. In view of this, government should resort to providing diverse range of policies, regulations and policies that can boost the morale of firms in their quest to achieve set goals and objectives.

The research study however has some limitations. The study considers a single activity in SMEs, thus the use of licensed technology from abroad. Future research can therefore focus on other activities such as market and organizational innovations. SMEs in other geographical and economic regions like East Asia and Organization of Eastern Caribbean States respectively, should be considered in future research.

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