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TECHNOLOGY INCUBATION PROGRAMME AND SMEs' SURVIVAL IN NIGERIA

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Abstract

The study examines the effects of infrastructure supports(working space, quality control laboratory & mechanical workshop, electricity & water supply, and security) provided by Technology Incubation Centre, Kanoas well as sales growth of incubates on the incubates' business survival (measured by profitability growth). The study used cross sectional data from the incubatees of the Technology Incubation Centre, Kano, using a structured questionnaire where a sample of 76 incubatees was drawn. Logit and Probit regression models were used. Diagnostic checks (specification test and goodness of fit test) were conducted. The empirical findings show that independent variables have positive effects on incubatees' business profitability. However, out of the five variables tested (working space, quality control laboratory & mechanical workshop, electricity & water supply, security, and sales growth), only sales growth reveals significant effect on incubatees' business profitability. The study recommends that quality control laboratory and mechanical workshop of the technology incubation centre should be well equipped and upgraded to the best standard and full utilization of same by incubatees should be ensured. This will assist incubatees to produce qualitative products that can compete favourably in the market thereby improving the level of their business profitability. Electricity and water supply in the Technology Incubation Centre needs to be improved for the benefits of incubates. This will assist incubatees to minimize their cost of production and make more profits.

Keywords: *Technology Incubation Programme, Incubatees, Infrastructure Supports*

INTRODUCTION

Technology incubation programme is designed to accelerate the successful development of 'start-up' and 'fledging' technology based entrepreneurial firms, through an array of business support services and infrastructure developed by incubator management, and offered both within the incubator or through its networks of contacts. The fundamental goal of technology incubation programme is to produce successful firms that will leave the programme financially viable and freestanding. It is expected to produce significant impact on the businesses of its incubatees (SMEs) and ensure their survival by providing them with necessary business support services and infrastructure, such as working spaces, offices, water and power supply, hands-on management, access to financing, networking and exposure to critical business and technical support services that enhance the success of such enterprises during incubation period. This will ultimately give birth to companies that can stand on their own to provide employment, create wealth, and contribute significantly to the Gross Domestic Product (GDP), as well as overall economic growth of a country. The firms established in the incubators are referred to as tenants or incubatees. Studies have shown that enterprises that go through the incubation process have more than 75 per cent chance of survival in sustaining the business during and after the incubation process, when compared to businesses outside the incubation

process (Jamoh, 2012). The study focuses on the how infrastructure supports of technology incubation programme on promotes the survival of small and medium enterprises (SMEs) (measured in term of profitability growth) as provided by Technology Incubation Centre, Kano. Despite the growing popularity of incubators as a means to stimulate economic development by supporting new ventures, research on the impact of business incubation is under-developed and represents an opportunity for conducting more researches (Hackett and Dilts, 2004).

Relevant literature on business incubation revealed that the fundamental goal of any business incubator is to produce successful new ventures. To determine whether new ventures are successful, or to assess their level of success, the issue of their business performance needs to be evaluated (Benjamins, 2009). Most evaluation studies on business incubators are conducted in developed countries. There are few studies that quantitatively evaluate the incubator experience in developing countries (Akcomack, 2009), hence the need for conducting this research.

CONCEPTUAL LITERATURE

Incubatees

Incubatees are small and medium enterprises (SMEs) undergoing incubation programme in technology incubation centre.

Infrastructure Supports

Infrastructure supports are supports provided to incubatees (SMEs) directly by technology incubation centre within its premises (FMST, 2005). These supports include:

i. Incubation unit (a spacious production room for free) for daily operation of incubatees' businesses within the technology incubation centre.
ii. Office space for daily administrative activities of incubatees within the technology incubation centre.
iii. Quality control laboratory for testing the incubatees' products to ensure that they meet the required standard before entering the market.
iv. Mechanical workshop for assisting the incubatees to have access to machineries and equipment which are beyond their capability as start-up or small scale businesses.
v. Electricity and water supply for assisting the incubatees to produce their products regularly and at lower cost.
vi. Security (24 hours) for ensuring the safety of incubatees' businesses within the technology incubation centre.

Incubatee Business Performance

Voisey et al. (2006) classified performance indicators as measures for evaluating incubatees' or incubators' performance in an incubation study into; soft indicators and hard indicators as presented in the table below:

Table 1: Indicators of Incubatee Performance

	Incubatee-specific	Incubator-specific
Soft Indicators	Professionalism Business skills Confidence in self and business Networking with peers Knowledge Cost savings Positive publicity	Expertise or experience of staff Recognition by enterprise community Stakeholder support Internal evaluation

Hard Indicators	Sales turnover	Number of incubatees
	Profitability	Number of businesses graduated
	Growth of enterprise	Meeting targets
	Graduation	Continued operation or success

Source: Voice et al. (2006)

THE EVOLUTION AND GROWTH OF INCUBATORS IN THE WORLD

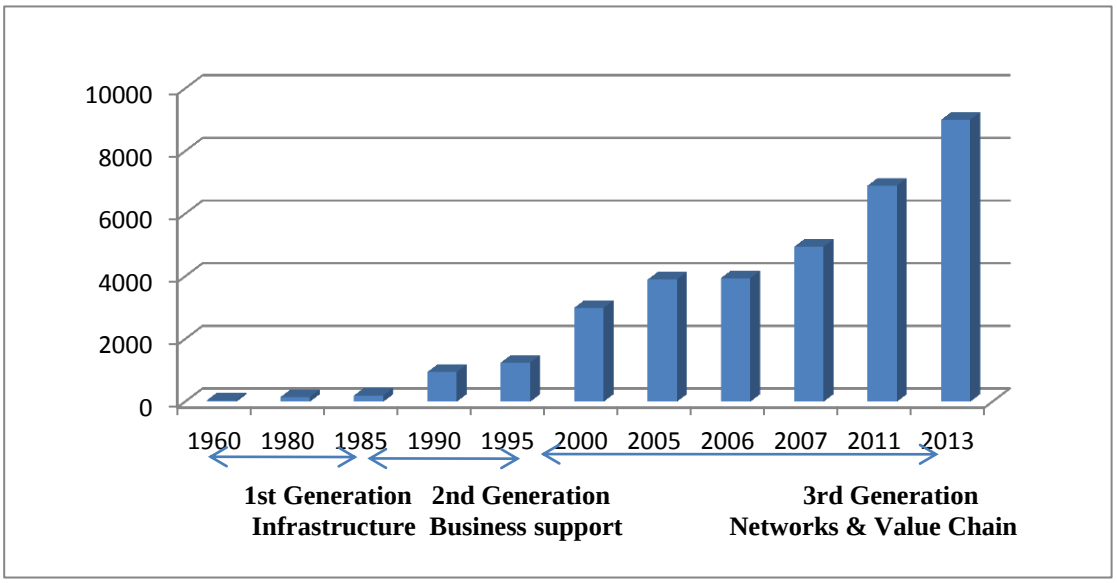

Figure 1: Evolution and Growth of Incubators

Source: National Business Incubation Association Reports (NBIA, 2013)

The evolution of the incubation programme can be traced back to 1959 when Joseph Mancuso opened the first incubator (Batavia Industrial Centre) in Batavia, New York, United States of America. Mancuso in trying to fill the empty building he had bought partitioned the building and rented some spaces to help small and medium enterprises (SMEs) to get established and grow. Several ventures were launched and this event is considered to be the first in the evolution of business incubation. The concept has expanded to United Kingdom (UK) and Europe in 1980s, Asia and Africa in 1990s. Since then, incubator has become a potential economic development tool for local, regional and country level policy makers and government (NBIA, 2013).

The America's National Business Incubation Association (NBIA, 2013) classified incubators into three generations based on their evolution. The first generation incubators evolved between late 1950s and mid-1980s, and this is the period of initiation and development of incubation concept. These incubators provide mainly "infrastructure" (office spaces and shared resources) to their incubatees. The second generation incubators sprang up between mid-1980s and mid-1990s, and this is the period of active growth and development of incubation programme. These incubators provide "business support services" to their incubatees in addition to infrastructure support provided by the first generation. The third generation incubators evolved in late 1990s up to the present, and this is the period of industry maturity and new leaps of development for the incubation programme. These incubators provide "networking and value chain" to their incubatees in addition to infrastructure and business support services provided by the first and second generation. The number of incubators in the world grew from less than 100 in 1960s to about 9,000 incubators in 2013 based on the NBIA 2013 survey as depicted on the figure below:

EMPIRICAL LITERATURE

Mian (1996) conducted a study assessing the value added contribution of University Technology Business Incubators (UTBIs) to their new technology-based tenant firms using structured interview and descriptive statistics on sample of 47 incubatees and 6 incubators in United States. The findings revealed that client firms in UTBIs benefit from university image, student employees, and university labs and infrastructure. That's, the incubator services have value-added contributions to the growth and survival of their tenant firms, thereby making UTBI a viable tool for nurturing new technology-based firms.

Lesakova (2012) examined the role of Business Incubators in Supporting the SMEs start-up in Slovakia. The study used secondary data and descriptive statistics. The study revealed that, business incubators form an important part of the support infrastructure for SMEs start-ups in Slovakia. Their mission is to provide the starting companies (usually for 3 years from the commencement of business) with complex support on one spot and create favorable starting conditions. The main services provided are: office space, production and storage premises, administration support, educational services and counseling. Another study by Al-Mubaraki (2013) assessed the effect of Business Incubation in Developing Countries using a multi-case study of 5 incubator organizations in the world: Bahrain, Jordan, Marocco, Syria and China. The findings revealed that, business incubators provide support for start-up companies, and graduated companies tend to have greater probability of success and significant impact on economic development.

In addition, Pena (2004) examined the extent to which the support received by entrepreneurs from Incubator Centres is critical to ensure firm's success, using survey research method and OLS regression on sample of 114 incubatees in Spain. The findings revealed that, most incubator support services have no impact on firm's performance indicators, and only human capital attribute of entrepreneurs indicated significant impact on sales and employment growth, which seem to be critical in explaining business success of incubatees.

METHODOLOGY

Methods

The study used a survey research method using a well-structured questionnaire on sample of 76 incubatees (SMEs) drawn from a population of 95 entrepreneurs of Technology Incubation Centre, Kano. Stratified sampling is adopted where the incubatees are stratified into: Fabrication, Chemical and allied, Electrical and Electronics, Foods and Drugs, ICT and others. A simple random sample is drawn from each stratum that made up the required sample size. Logit and Probit regressions were used to analyze the data using STATA 11 software. The choice of logit and probit models is due to the categorical nature of the dependent as well as the independent variables. To achieve unbiased and consistent estimates of the parameters, two diagnostic tests are conducted in this study; the specification test and Hosmer-Lemesshow goodness of fit test.

Variables

Dependent Variable:

The dependent variable; SMEs' survival was measured in term of business performance (proxied by profitability).Profitability (PRT) is a dichotomous variable indicating the level of incubatees' business performance in terms profitability as a result of infrastructure support

received from technology incubation centre. PRT takes the value of 1 if performance is 'satisfactory' and 0 if 'unsatisfactory.

Independent Variables:

All the independent variables; working space (WSP), labs/workshop & equipment (LWE), electricity & water supply (EWS), security (SEC), and Sales growth (SLG) are dichotomous variables measured on scales of '1'and '0' denoting 'Yes' or 'No' to the proposed questions. The variables used in this study were adopted from works of Azih and Inanga (2014), Pena (2004), Mian (1996), Chen (2009), Lai and Lin (2015), and Khalid et al. (2011),Ozdemir and Sehitoglu (2013), Ruhiu et al. (2014) who have used similar variables in their studies. The variables have been adopted with some modifications in order to suit the objectives of this study very well. These variables are briefly explained below:

Working Space – This is the provision of free factory unit (called incubation unit) and office space for incubatees in the Technology Incubation Centre to operate their businesses conveniently.

Labs/Workshop and Equipment – This involves the provision of quality control lab and mechanical workshop to ensure that the products produced by incubatees are qualitative and meet the standard specified by regulatory agencies, and also enable them have access to machinery and equipment that are beyond their capability as start-up businesses.

Electricity and Water Supply – This involves the provision of steady power and water to incubatees to ensure continuous operation of their businesses.

Security – This involves the provision of 24 hour security services to ensure the safety of products and properties of the incubatees in the Technology Incubation Centre.

Sales Growth – This involves an expansion in the volume of incubatees' sales turnover.

MODEL SPECIFICATION

The econometric model used in this study is developed based on the "Theory of Economic Development through Entrepreneurship" developed regarding incubator by Brooks (1986). The theory postulates that, once extraneous factors that lead to early stage failure of small businesses (poor management, inability to find early stage financing, high overhead, etc.) are controlled or eliminated, the projected increased survival rate of new ventures should lead to increased employment and an expanded tax base (Brooks, 1986). Brooks further posits that the entrepreneurial process of conceiving new business concepts and then creating new firms based on these new concepts is the basis of economic growth. This theory is used to address the gap that occurs between conceiving the new business concept and actually instantiating the firm. Brooks contends that the incubator and the incubation process are used to narrow this gap.

Based on this theory, the infrastructure supports provided by the Technology Incubation Centres are aimed at controlling or eliminating the factors (that is, by reducing the overhead costs for start-up businesses) that lead to early stage failure of start-up businesses in order to make these businesses successful. The model developed for this study follow that incubatees' business performance (represented by profitability) is a function infrastructure supports received from the Technology Incubation Centre, as well as incubatees' sales growth. By a priori expectation, all the coefficients of the explanatory variables should be positive.

PRT = f (WSP, LWE, EWS, SEC, SLG) ……1

PRT = $\beta_o + \beta_1$WSP + β_2 LWE+ β_3EWS+ β_4 SEC + β_5SLG+ ε_t…….. 2

From the above equations, incubatees' business performance (with profitability as a proxy) is influenced by infrastructure support and incubatees' sales growth.

RESULTS AND DISCUSSION OF FINDINGS

Table 2: Logit Model, Probit Model and Marginal effects for Profitability

PRT	*Logit model*	*Marginal effects for logit model*	*Probit model*	*Marginal effects for probit model*
WSP	1.272 (2.100) 0.545	.079 (.187) 0.672	.610 (.946) 0.519	.095 (.192) 0.618
LWE	.435 (1.431) 0.761	.017 (.055) 0.760	.018 (.643) 0.978	.002 (.072) 0.978
EWS	.357 (2.076) 0.863	.015 (.101) 0.877	.149 (.916) 0.870	.017 (.117) 0.879
SEC	2.157 (1.772) 0.224	.203 (.282) 0.471	1.095 (.900) 0.224	.231 (.275) 0.401
SLG	5.842 (1.509) 0.000	.855 (.123) 0.000	3.156 (.716) 0.000	.853 (.124) 0.000
Constant	-5.487 (2.034) 0.007		-2.806 (1.036) 0.007	
LR chi2 (5)	38.30		37.93	
Prob > chi2	0.0000		0.0000	

Source: Field Survey 2016, computed using STATA 11

From the Table above, the p-value (P > chi2) of the likelihood ratio chi-square (LR chi2) is statistically significant at less than 5% level for both logit and probit models, which signifies that the models as a whole are statistically significant. That is, the independent variables joined together can significantly explain the variation in the dependent variable (profitability). Based on the result of logit and probit regressions, only 1 variable sales growth, out of the 5 independent variables is statistically significant to explain variation in the dependent variable (profitability).

From the marginal effects of logit and probit models in the table above, working space (WSP) is not statistically significant at 5% level, but it is positively related with incubatees' profitability considering its coefficients 0.079 and 0.095 for logit and probit models respectively. This implies that an improvement in the standard of working space by the technology incubation centre is associated with the probability that incubatees' businesses profitability will improve by 8% and; 10%. This is in line with the a priori expectation that all independent variables should have positive relation with the dependent variable in the model. Similarly, laboratory/workshop and equipment (LWE) is statistically insignificant at 5% level, but positively related with profitability. This implies that, any additional effort toward upgrading the standard of laboratory/workshop and equipment by the technology incubation centre and full utilization by incubatees is associated with the probability that incubatees' businesses profitability will increase by 2% (2%). This is also consistent with a priori expectation of the model.

Electricity and water supply (EWS) is positively related with profitability (PRT) considering its coefficients 0.015 and 0.017 for logit and probit models respectively. That is, any additional effort towards improving the supply of electricity and water by the technology incubation centre increases the probability that incubatees' profitability will increase by 2% (2%). This variable is not statistically significant, but it has a positive relationship with the dependent variable which conforms to the a priori expectation of the model.

Equally, security (SEC) is positively related with profitability (PRT) in both logit and probit model based on the coefficients of marginal effects, 0.203 and 0.231. This implies that, any additional effort towards improving the quality of security services by the technology incubation centre is associated with the probability that incubatees' businesses profitability will improve by 20% (23%). This is also not a significant variable but it consistent with a priori expectation of the model.

However, sales growth, unlike other independent variables, is statistically significant at less than 5% level in both logit and probit models and positively related with profitability based on marginal effects coefficients of 0.855 and 0.853. This implies that, an increase in incubatees' sales will increase the probability that incubatees' business profitability will increase by 86% (85). This is in conformity with the a priori expectation of the model. The findings in Table 2 discussed above imply that the infrastructure supports provided by the technology incubation centre are examined and found to have positive effects on incubatees' business profitability based on the fact that all the five independent variables tested reveal positive and insignificant relationship with the independent variable.

Diagnostic Tests For Logit And Probit Models Of Profitability (PRT)

Table 3: Specification Test for Logit Model of PRT

PRT	*Coefficient*	*Std. Err.*	*Z*	*P>|z|*	*[95% Conf. interval]*
_hat	1.505	.691	2.18	0.029	.150 2.859
_hatsq	-.182	.207	-0.88	0.378	-.589 .223
_cons	.802	1.226	0.65	0.513	-1.602 3.206

Source: Field survey 2016, computed using STATA 11

Table 4: Specification Test for Probit Model of PRT

PRT	*Coefficient*	*Std. Err.*	*Z*	*P>|z|*	*[95% Conf. interval]*
_hat	1.193	.446	2.67	0.008	.317 2.068
_hatsq	-.163	.298	-0.55	0.584	-.748 .421
_cons	.276	.623	0.44	0.657	-.944 1.497

Source: Field survey 2016, computed using STATA 11

Table 3 and 4 above depict the results of specification test for logit and probit models of profitability as a function of infrastructure supports; working space (WSP), laboratory/workshop and equipment (LWE), electricity and water supply (EWS) and security (SEC), as well as sales growth (SLG).

From the above results, the p-values of _hat in logit and probit models are 0.029 and 0.008 which are both statistically significant at less than 5% level. The p-values of _hatsq are 0.378and 0.584 in logit and probit models which are highly insignificant at all level. This implies that, both logit and probit models are correctly specified. Hence, the models are suitable for estimation.

Table 5: Hosmer-Lemeshow Goodness of Fit Test for Logit Model of PRT

	Statistics
Number of observations	70
Number of groups	6
Hosmer-Lemeshow chi2(8)	14.74
Prob > chi2	0.3149***

***: Denotes statistical significance at 1%

Source: Field survey 2016, computed using STATA 11

Table 6: Hosmer-Lemeshow Goodness of Fit Test for Probit Model of PRT

	Statistics
Number of observations	70
Number of groups	5
Hosmer-Lemeshow chi2(8)	3.84
Prob > chi2	0.2796***

***: Denotes statistical significance at 1%

Source: Field survey 2016, computed using STATA 11

Table 5and 6 above depict the results of Hosmer-Lemeshow goodness of fit test for logit and probit models of profitability as a function of infrastructure supports; working space (WSP), laboratory/workshop and equipment (LWE), electricity and water supply (EWS) and security (SEC), as well as sales growth (SLG).

From the results obtained in table 5 and 6 above, the probability values for logit and probit models are 0.3149 and 0.2796 which are below 0.5 indicating a low goodness of fit for both logit and probit models. This indicates a low probability that the null-hypothesis for both models (which states that the goodness of fit of the model is not well represented by the data generating process) will be accepted.

CONCLUSION AND RECOMMENDATIONS

Infrastructure supports; working space, laboratory/workshop and equipment, electricity and water supply, and security provided by the technology incubation centre to its incubatees influence their business performance in term of profitability positively but not significantly. Sales growth is the only significant determinant that influences profitability, and this implies that the more the expansion in sales growth, the more the incubatees' business is likely to be profitable.

In summary, the findings of this study confirmed that all the infrastructure supports offered by the technology incubation centre to incubatees have positive effects on incubatees' business profitability. This implies that the technology incubation programme is an important policy tool to enhance the development and growth of start-up enterprises through the supports provided by technology incubation centre.

The study recommends that quality control laboratory and mechanical workshop of the technology incubation centre should be well equipped and upgraded to the best standard and full utilization of same by incubatees should be ensured. This will assist incubatees to produce qualitative products that can compete favorably in the market thereby improving the level of their business profitability. Electricity and water supply in the Technology Incubation Centre

needs to be improved for the benefits of incubatees. This will assist incubatees to minimize their cost of production and make more profits..

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