Non-parametric analyses on Strategic Investment in Technology and Companies' Growth in Nigeria

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Abstract

Certainly, one of the most dominant themes that take the frontline in academic and professional discuss nowadays is technology adoption strategy and how it shapes organizations. In this study the potency of strategic organizational expenditure on technology is used in an attempt to explain growth witnessed by firm in Nigeria. Specifically the study investigates how a strategic investment in technological ability by firms determines their growth. By using non-parametric analyses of the data generated from a sample of companies operating in Nigeria, the study reveals a significant relationship between strategic acquisition and adoption of technology resources and firms' growth; it also discusses the implications of these findings and some of the theoretical issues associated with firms' growth. The provisional conclusion is that strategic acquisition and adoption of technology by firms in Nigeria is contributing to growth and that strategic investment in technology is the potent driver of the growth process.

Keywords: *Strategic, Investment, Growth in Nigeria*

1. Introduction

The current global competition, technological changes and customers' sophistication are forcing many companies to adapt technology into many aspects of their business activities. As a consequence, organizations strategically invest in hard and soft technologies to gain competitive advantage in the local, regional as well as international markets. The term growth in this context is primarily concerned with improving strategic position of organization in terms of competitiveness. As observed by Harari (1999) and Godfrey (2008) globally competition has intensified exponentially facilitated by the enormous opportunities generated by the emergence of technologies which also allow real-time world-wide linkups and massive production, thus, making businesses to gain the power of being significant players in many market segments around the world. Investment in Technology acquisition and adoption affects organization and employee effectiveness generally. Adaptability and responsiveness to technological changes are essential for organizations to survive, thrive and effectively be able to meet present and future challenges (Farahmand, 2013). Hence, it becomes imperative for business organizations in Nigeria to be futuristic in terms of strategic investment in technology adoption activities for their own survival. This fact underscores the importance of the analysis of the effects of rapidly changing technologies within the Nigeria's business environment and global market place as well.

Consequently, this study explores the relationship between strategic investment in new and emerging technologies and its attendant effects on general growth of some companies with a view of unraveling the dynamics between the variables based on managers' judgment on the subject matter.

2. Literature Review

Understanding technology investments (TI) has been a central concern in technology management research and practice for decades. A substantial body of research has been conducted to establish technology effects on organizational growth. Many of these studies have described technology investments as distinct, substantial, highly important, and quite risky projects which enable the organizations to better and more quickly respond to external and internally-sourced uncertainty. The technology investment decisions of organizations are normally linked to the stages of technology adoption and diffusion process within the organization. In view of that, the literature review first considers the concept of technology adoption, diffusion and the technology life cycle. It further went to explore the processes of technology investment as well as organizational growth.

2.1 Technology Acquisition, Adoption and Diffusion

Primarily, studies on technology acquisition and adoption have been hinged on the technology adoption model developed by Davies (1989) and technology Diffusion by Rogers (2003) which have been generally described as systems theories that model how users come to acquire, accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their investment decision about how and when they will use it, notably; Perceived usefulness of the technology on performance, Perceived ease-of-use of the technology i.e. less effort requirement. The technology adoption models have been continuously studied and expanded, with two major upgrades by Venkatesh and Davies (2000), Venkatesh (2000) and (Chuttur, 2009).

Specifically, work in the area of technology diffusion was done by Rogers (1995) who describes diffusion of technology or an innovation as the process by which it is communicated through certain channels over time among the members of a social system. It is generally assumed that this theory also holds for organizations as a social system on its own. Furthermore, Rogers (2003) states that the rate of adoption, i.e. the relative speed with which technology innovation is adopted, depends on the opinion of the organization about the relative advantage, the compatibility, the complexity, the trialability and the observability as characteristics of the technology. Furthermore, Kwon and Zmud (1987), Klein and Sorra (1996), Agarwal and Prasad (1997) and Venkatesh, et. al., (2003) provide insight on the relationship of organizational innovation and information systems implementation by identifying a number of variables that contribute to the successful introduction of a technological innovation in an

organization. These variables are categorized into individual variables, organizational variables, innovation variables, and task-related variables, where the contribution of each variable to the successful implementation of the innovation depends on the specific situation. As the decision on technology investment exceeds individual decision-making and individual task-related activities, it becomes imperative to consider the process of Technology investment as well as factors that affect technology usage in an organization as important.

2.2 Strategic Technology Investment

The main presumption of strategic technology investments is based on the belief that organizational success lies in the way managers adopt technology to create value for the organization (Rai, Patnayakuni, and Patnayakuni, 1997; Chiesa et al. (2007). Organizations use technology in their operations to generate the greatest business – oriented performance outcome and profits, (Brynjolfsson and Hit, 1996; Ngai and Wat, 2006). To establish the relationship between technology investment and its effects on organizational growth, understanding the strategic technological investment decisions process becomes imperative. Strategic technological investment decision seeks to maximize the companies' competitiveness and innovative position by maximizing the degree of technological sophistication within and across the organizations distinctive processes. Previous research work of Fisher, et.al., (2000) reveals that technology diffusion model can influence technology investment decision-making strategy while the works of Jordon (2002), Giuliana and Paul (2005), Wickart & Madlener (2006) and Gimmon and Levie (2010) identify cost reduction as the crucial reason for organizations to invest in technology.

Some of the considerations that are taken in strategic technology investment decision include, among others, what are the advantages and disadvantages of the technology, who are the main beneficiaries? Will the technology have other applications? What will the proposed new technology cost to build and operate? What risks are associated with the proposed new technology? What people, materials, tools, knowledge and know-how will be needed to build, install and operate the proposed new technology? What will be done to dispose safely of the neo technology's waste materials?

2.3 Types of Technology Investment

Major factor that makes technology investment decision dynamic in nature is the changes in the type of technology used by organizations. A typology of technology investment consist of two forms: Hard technology investment involves the purchase of the physical systems or tools such as machinery, equipment, software programs, databases and systems (Yu, 1996; Drejer, 2000; and Byrne and Marx, 2011). While soft technology refers to the skills and knowledge of the workforce, training and development and research and development. Faulker and Albertson (1986); Byrne and Marx, (2011)**;** Akubue (2000) view appropriate hard technology as "engineering techniques, physical structures and machinery that meet a need defined by a community and utilize the material at hand or readily available. It can be built, operated and maintained by the local people with very limited outside assistance (e.g. technical, material or financial). It is usually related to an economic goal. Therefore, technological investment, whether soft or hard, develops organizational competence level. Increased organizational competence level is more likely to improve productivity and profitability.

2.4 Organizational Growth

The study of organization growth and development begins with the nature of organization itself. Scholars like Thompson and McHugh (1995) and Seelos and Mair (2010) view organization as consciously created arrangements to achieve goals by collective means. So, organization can be said to be a collection of people working together in a division of labour to achieve a common purpose. The aim of any organization is to produce a good or service, hence, large and small business produce consumer goods and services such as automobiles, appliances and accommodation. Non-profit organizations produce services which public benefits such as health care, education and judicial processing. In the views of Schermerhorn et. al., (1995) organizations require technology, people, equipment and facilities, information, raw materials and funds in order to produce some useful goods and services. Organizations are a necessary element of civilized life because they are social institutions that reflect certain culturally accepted value and needs, they can accomplish objectives more efficiently than when an individual attempts to do that, they create, preserve important knowledge, and they provide their employees with career and a source of livelihood.

Generality of experts view organizational growth as something for which most companies strive, regardless of their size in order to accommodate the increased expenses over time. Similarly, Weinzimmer, Nystrom, and Freeman (1998) view growth as a derivative of another successful strategy which may be deliberately sought to facilitate the achieving of management goals and also make organization less vulnerable to environmental influences as larger organizations tend to be more stable and less likely to go out of business. One of the distinct operational models for organizational growth as suggested by Child and Kieser (1981) and Legros, Newman & Proto (2006) is that technology advancements can stimulate growth by providing more effective methods of production and improved managerial techniques which in turn facilitate an atmosphere that promotes growth. Based on the above, study tested the hypothesis that '*Strategic technology investment has positive effect on organization's growth'.*

3. Methodology

The data were collected through a comprehensive survey of conveniently and randomly selected 100 firms as sample belonging to the transport, Construction, food and beverages subsectors only. From the sampled firms 10 questionnaires were provided and filled by middle, senior staff across all departments as well as top management staff of each company. In all, a total of 893 questionnaires were returned out of which 17 were not useful leaving a total of 876 as a working response size; from this, only 672 respondents provided information on the technology investment portion of the questionnaire.

In the process of instrument development the two constructs used (technology investment and organizational growth) are latent in nature, and thus, have to be operationally defined, on one hand,

technology investment as investment in machinery, internet, computer hard and software, mobile phones technologies, component parts, appliances, office equipment and technologies, licenses, copyrights , furniture and stationeries. On the other hand, organizational growth represented by increase in efficiency from economy of scale, success of product line, industry competitiveness, physical expansion, sales volume, market share, net profit, ability to withstand market fluctuations, employee retention, motivation of workforce, effective teamwork, powerful management , value system in performance quality, responsibility to stakeholders, responsibility to society, training and development. Content validation was assessed through the theoretical basis for the indicators in literature. Furthermore, the guidelines for writing questions presented by Taylor-Powell, (1998) and Bednar and Westphal, (2006). were followed. For all questions in the questionnaire, a 5-point scale was used to facilitate the use of statistical analysis without recoding. The instrument was divided into two parts, each concerned with a specific subject.

The firms provided responses on the scale with values ranging from a minimum of 1 and a maximum of 5 indicating level of technology investment, and organizational growth. By so doing the responses were scaled in the following patterns: - 1 represents Very Low; 2 represents Low; 3 represents Moderate; 4 represents High; 5 represents Very High level of technology investment. While for organizational growth, 1 signifies Very Low; 2, Low; 3, Moderate; 4, High; 5, Very High levels. Primary analysis adopted the use of descriptive statistical analysis of the data using the frequency distribution of responses of firms in providing information on technology investment and organizational growth. Chi-square was used to test the hypothesis earlier formulated.

4. Results and Discussions

As earlier discussed, companies routinely acquire emerging key technologies in order to meet production as well as competitors' challenges. In so doing, sizable amount of funds are expended with a view to strengthening their technological capabilities. In most instances, investment in purchase of key technologies at the industry level constitute major strategic investment; accordingly firms were asked to indicate the level of investment committed to purchases of emerging technologies in terms of degree and level of usage and their responses are shown in Tables 1 and 2.The results enumerate prominent technology components with levels of their acquisition and usage in day-to-day operations of the companies which will be compared to organizational growth indicators vis-à-vis their visibility and impact on growth of the companies.

4.1 Measuring Technology Investment Strategy

As shown in Table 1In general terms, the largest distributions of the companies 264 (39.29%) have indicated a very high level of strategic investment in technology acquisition and adoption, followed by 240 (35.71%) that adopted a high level of technology investment strategy. Moderate investment level strategy was reported by 162 (24.11%) companies. Low and very low investment levels have been demonstrated in the frequencies of 6 (0.89%) and 0 (0.00 %) firms respectively.

Table 1: Level Technology Investments

SN	Item	Very Low	Low	Moderate	High	Very High
1	Internet services & Facilities	0	0	12	12	36
2	Computer Systems	0	0	6	30	24
3	Data & Software programs	0	0	6	30	24
4	Telephone, Cell phones, Com. Devices	0	0	18	24	18
5	Licensing/Copyright	0	0	24	18	6
6	Patent	0	6	12	18	6
7	Production Machinery	0	0	12	12	36
8	Components and parts	0	0	18	12	30
9	Appliances	0	0	18	12	24
10	Office machines	0	0	12	30	18
11	Furniture	0	0	12	18	24
12	Consumables/Stationeries	0	0	12	24	18
Total	**672(100%)**	0(0%)	6(0.89%)	162(24.11%)	240(35.71%)	264(39.29%)

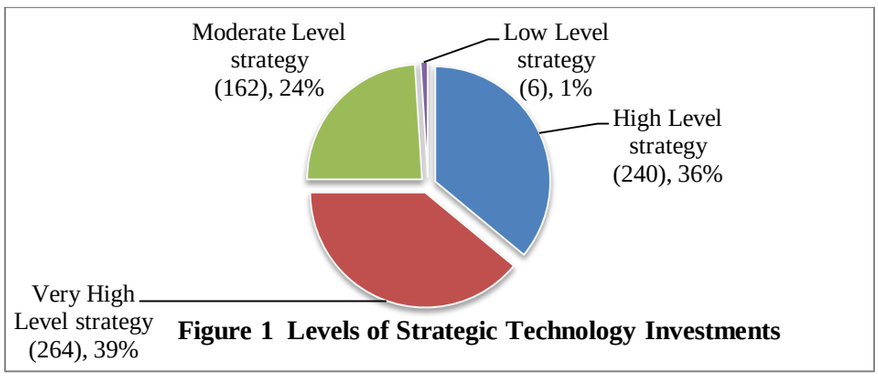

Figure 1 Levels of Strategic Technology Investments

Alongside the data in the table 1, figure 1 gives a pictorial view of contents of levels strategic investment in technology from responses received given by companies, Very low investment level is not captured on the pie chart because it didn't receive any response. Other variables are presented with total responses received as well as their percentages.

4.2 Measuring Growth Experienced by Companies

Achieving growth is considered significant by companies and is directly generated from strategic investment in technology which are also linked to competitiveness. To measure the extent of growth due to technology investment strategies, companies were asked to indicate the levels of recorded by them and their response are provided in Table 2. The items used as parameters to measure organizational growth are similar to those provided in many previous works and encyclopaedia on organizational growth.

Indeed the information on responses of companies in the table exhibits that the highest frequency of 456 (52.0%) of the companies have experienced high growth changes consequent to the strategic acquisition and adoption of technology. This is followed by 198 (22.6%) companies with moderate growth level and 192 (21.9%) recorded very high level. Only 30 (3.4%) companies recorded low level, while none of the sample companies indicated experiencing very low growth level. Similarly, figure 2 also gives a pictorial view of contents of levels of responses on growth received from companies, very low growth is not captured on the pie chart because it didn't receive any response. The remaining variables are presented with total responses received as well as their percentages.

Table 2 Companies' Growth indicators

SN	Indicator	Very Low	Low	Moderate	High	Very High
1	Efficiency from economy of scale	0	0	18	12	24
2	Success of product line	0	0	18	24	18
3	Industry competitiveness	0	0	6	30	18
4	Physical expansion	0	0	6	24	24
5	Sales volume	0	0	0	36	18
6	Market share	0	0	12	30	12
7	Net profit	0	0	18	24	12
8	Ability to withstand market fluctuations	0	0	6	30	12
9	Employee retention	0	0	24	18	12
10	Motivation of workforce	0	12	12	30	0
11	Effective teamwork	0	6	6	36	12
12	Powerful management team	0	6	12	36	0
13	Quality performance	0	0	12	36	6
14	Responsibility to stakeholders	0	0	6	42	6
15	Responsibility to society	0	0	30	30	0
16	Training and development	0	6	12	18	18
	Total 876(100%)	0(0.0%)	30(3.4%)	198(22.6%)	456(52.0%)	192(21.9%)

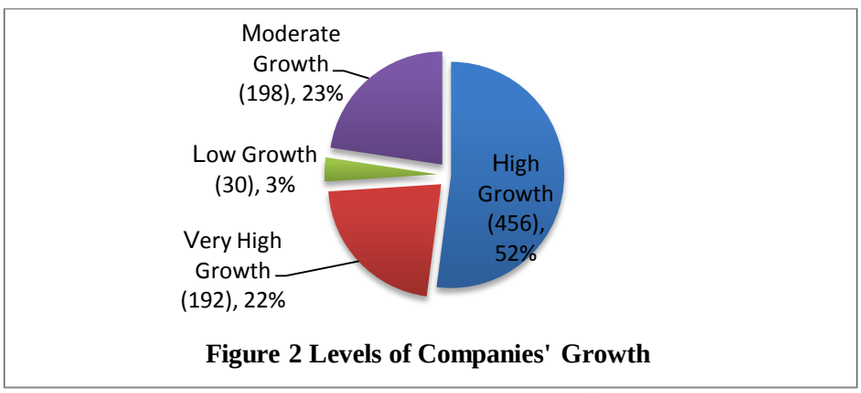

Figure 2 Levels of Companies' Growth

4.3 Hypotheses Testing

The non-parametric statistical analysis adapted to obtained models with significant associations between the independent and the dependent variable is chi-square test. In doing so the Hypotheses formulated is tested using the chi-square (X^2) method. It helps in acceptance or rejection of outcome of the study based on the decision rule.

The model is given as: $x^2 = \sum\left(\frac{fo-fe}{fe}\right)$ - - 1

Where: x^2 = chi-square, Σ = summation, fo = Observed frequency, fe = Expected frequency. The decision rule is to accept the hypothesis that 'Technology investment has positive effect on organization's growth' if computed x^2 is more than or equal to critical (tabulated) value based on the response summary on the variables are provided in table 3 and the calculated values in table 4.

For strategic technology investment; Computed x^2= 13.751, Df = (R-1) (C-1) = (4-1) (2-1) = 3 x 1= 3. Using 10% (0.10) level of significance, Computed x^2=13.751 Tabulated x^2=6.251. While for *companies' growth*; Computed x^2= 8.54, Df = (R-1) (C-1), = (4-1) (2-1) = 3 x 1= 3. Using 10% (0.10) level of significance, Computed x^2=8.54 Tabulated x^2=6.251

In both cases Comparison between calculated and computed chi-square above indicates that computed chi-square is greater than tabulated chi-square, hence the decision to accept the hypothesis that strategic investment in technology positively affects organizational growth.

5. Conclusion

With the help of non-parametric statistical analysis, the study identified possible relationships between the variables. The descriptive statistics are interpreted as percentages that indicate expected change in the indicator given an increase in the investment variable. i.e., scores on the companies' growth are generally predicted by increase in the level of technology investment factor. Frequencies are interpreted as corresponding relationships and their values as proportions of explained variance. In general terms majority of the firms that have strategically invested very highly in technology have correspondingly registered high level of growth. Similarly, the chi-square test establishes a strong statistical relationship between investment in technology and companies' growth. Hence, strategic Investments in technology re-position firms in the marketplace by supporting their competitiveness and general performance industry because whenever new technologies are introduced in the companies, they change the nature of operations and garner competitive benefits especially for early adopters (Dos Santos & Peffers 1995). It is thus concluded that strategic investments in technology contribute directly to company performance in line with the conclusion of Samabmurthy, Bharadwaj & Grover (2003).

Organizational growth on the other hand, has the potential to companies with a myriad of benefits, including greater efficiencies from economies of scale, greater ability to withstand market fluctuations, increased survival rate, greater profits, and increased prestige for organizational members. Many companies desire growth because it is seen generally as a sign of success and progress. Organizational growth is, in fact, used as one indicator of effectiveness for businesses and is a fundamental concern of many practicing managers in Nigeria.

Table 3 summary on responses by staff level

	Very Low	*Low*	*Moderate*	*High*	*Very High*	*Total*
			Strategic Technology Investment			
Middle Mgt Staff	0	4	105	154	190	488
Top Mgt Staff	0	2	57	86	74	184
Total	0	6	162	240	264	**672**
			Companies Growth			
Middle Mgt Staff	0	20	130	336	150	636
Top Mgt Staff	0	10	68	120	42	240
Total	0	30	198	456	192	**876**

Table 4 Calculated Chi-square values for the variables

fo	*fe*	*fo-fe*	*(fo-fe)*	$\frac{(fo-fe)}{fe}$
		Strategic Technology Investment		
4	4.36	-0.36	0.130	0.030
2	1.64	0.36	0.130	0.079
105	117.64	-12.64	159.770	1.358
57	44.36	12.64	159.770	3.602
154	174.29	-20.29	411.684	2.362
86	65.71	20.29	411.684	6.265
190	191.71	-1.71	2.924	0.015
74	72.29	1.71	2.925	0.040
				X^2=13.751
		Companies' Growth		
20	21.78	-1.78	3.168	0.145
10	8.22	1.78	3.168	0.385
130	143.75	-13.75	189.063	1.315
68	54.25	13.75	189.063	3.485
336	331.07	4.93	24.30	0.073
120	124.93	-4.93	24.30	0.195
150	139.40	10.6	112.36	0.806
42	52.60	-10.6	112.36	2.136
				X^2=8.54

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