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Some Contributions of I.C.T. To The Research Findings of Tertiary Institutions In Nigeria Towards Smes

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----------ABSTRACT----------
This study assessed the potential of information communication technologies (ICTs) in contributing to research and development by looking into the effectiveness of radios, television sets, mobile phones and the internet and in the dissemination of the outcome of researches. Effectiveness is measured in terms of accessibility, timeliness as well as relevance. Specifically, the study determined the relationship between industries' socio-economic characteristics and access to information through ICTs. It further described the complementarities between ICTs in the enhancing improvements observed of the quality of information available to small and medium enterprise (SMEs). Lastly, the research established the researchers' perception of the effectiveness of ICTs in the dissemination of research findings.
Keywords: *Information Communication Technology, instrument development, infrastructure, entrepreneurs, SME, tertiary institution.*

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I. INTRODUCTION

There exists an increasing interest in implementing the findings of researchers in the innovation of industries, particularly small and Medium Enterprises (SMEs). This could be as a result of the growing awareness of the fact that the industries concerned are lagging behind in innovation. Moreover, there is a need to encourage future public investments in such researches from the implementation of the findings of previous publicly funded ones. In order to earn the assent of industries towards research findings, it is necessary to identify some of the inherent potential barriers, develop the strategies to overcome them, rectify the problems and implement the outcomes. Specific interventions that can be used to promote change in practice include using computerized decision support systems, developing educational programmes, communicating research findings to industries and entrepreneurs, and developing strategies for organizational change.

Interests in how best to promote the uptake of research findings have been fueled by a number of factors including the well documented disparities between industries and research evidence of effective interventions. Examples include interventions in the management of research information and research findings. In the United Kingdom the advent of the academic research and development programme has led to greater involvement of research officers in setting priorities. It has also led to the establishment of programmes to evaluate different methods of promoting the implementation of research findings. The concept of pay back on research has also been developed, resulting in a framework that can be used to access the benefits arising from researches. This study is to explore the contributions of ICTs to the accessibility and utilization of research findings of Tertiary Institutions in Nigeria which would be channeled towards satisfying entrepreneurs' needs as regards the readiness of ICT's application. The objectives are to:

1. highlight the challenges faced by the ICT providers.
2. propose a more effective model of ICT utilization towards contributing to the access and utilization of research findings.

Relevance of the study

The results of the study will be relevant to students, researchers, academics – especially those undertaking study topics focusing on industries, ICTs, and research findings, most especially in Nigeria. From a policy perspective, the findings of the study could help ICT providers, policy makers, leaders, information providers, research officers, rural community leaders, administrators and the Nigerian Government develop better strategies in addressing challenges faced by the industries and entrepreneurs in applying ICTs in the access and utilization of research findings. The entrepreneurs stand to benefit from the recommendations of this research as they are aimed at improving their output as well. These issues on the significance need examination

to ascertain their impact on the success of ICTs' application in accessing and utilizing research findings by the industries and entrepreneurs in Nigeria. The overall aspiration is that the industries and entrepreneurs in Nigeria should have better access and utilization of research findings that would set in motion and sustain rapid development, thus contributing to the body of knowledge in this regard.

II. MATERIALS AND METHODS

This should be informative enough to enable readers to interpret the results obtained. Particular attention should be paid to the design, analysis and statistics.

Related Work

Information and Communication Technology enhances and supports business reform from the usual traditional method of conducting business to an automated method. This corroborates the findings of Andersen and Foss (2005), which reveals that ICT provides an organization with a richer endowment of diverse competencies that enhance the organization's ability to innovate and create strategic opportunity. It further comments that the use of ICT can enable computer-mediated communication amongst managers in multinational organizations. Moreover, Udo and Edoho (2000) highlight that ICT contributes to enhancing business operations. It can enhance the internal exchange of rich and tacit information, can enhance communication, and facilitate the knowledge creation and innovation processes in many enterprises including SMEs (Ion and Andreea, 2008).

III. DISCUSSION OF FINDINGS

Researcher's strength

In the first section of the questionnaire the number of employees in each of the participating SMEs was identified. Of the 68 SMEs that were sampled, 84% were classified as small enterprises, having between 11 and 49 employees while 16% were classified as medium enterprises, having between 50 and 199 employees as shown in Table 1.

Table 1: Size of SMEs

Size	Number	Percentage
11-49 employees	57	84%
50-199 employees	11	16%

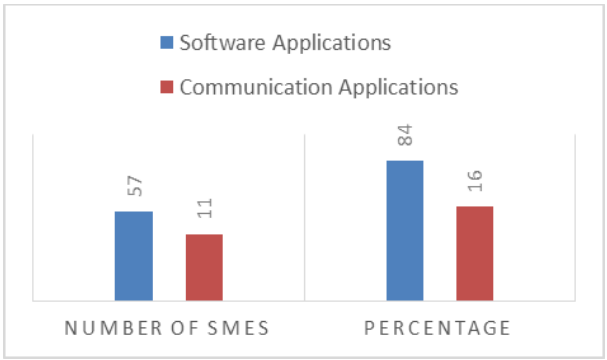

Figure 1: Bar chart of SMEs in terms of their employee sizes

Instrument development/selection: The most popular ICT facilities were chosen for the study. We consider their purchase costs and cost of maintenance, charges for airtime and electricity/telephone bills. We note that the Multipurpose Telecentres (MTCs) cannot afford all costs nor would the SMEs be able to pay for the services offered by the MTCs. Consequently, the MTCs would be underutilized which would finally affect the access and utilization of research findings. The facilities used include:

(1) Community radios
(2) The Internet
(3) Public address systems
(4) Digital Video Displays (DVDs)
(5) CD-Roms
(6) Video Cassettes
(7) Radios/ Radio Cassettes
(8) (Traditional Radio Receivers)
(9) Satellite dish (DSTVs)

(10) Mobile Phones
(11) Fixed phones
(12) Television sets

Socio-Economic make-up of Respondents

Two hundred and forty respondents from three wards of Lagos namely; Gbagada/Oshodi, Badagry and Ikorodu were involved in the study. The socio-economic characteristics of these SMEs respondents are described (Table 2) to provide a background for discussion of the results. The characteristics described include age, sex, marital status and education level of the respondents from SMEs.

Table 2: Socio-economic characteristics of the respondents

Variable	Categories	Percentage
Age	15-25	6.3
	25-34	27.2
	34-45	24.8
	45-54	28
	54-64	6.9
	65 and above	5.8
Sex	Male	32.1
	Female	47.9
Educational level attained	No formal education	8.1
	Primary	81.6
	Ordinary level	7.3
	advanced level	0.5
	Tertiary	0.7
Marital status	Married	61.7
	Single	21.5
	Divorced	6.9
	Widow/widower	9.8

Source: Survey data, 2016. The age category is according to UN standard international age classification (1982) basing on economically active group, by occupation: Categorization for education level is based on the education system of Nigeria

The results in Table 2 show that over 60% of the respondents are 44 years or lower. This means there is more likelihood that the people who have their major economic activities within the SMEs lie within this age bracket. From the results it was also noted that a fairly good number of respondents (32.9%) were in the age between 45 to 64 years. This is also a working group that most likely would have the responsibilities of catering for dependants as well as likely to earn high income in anticipation for such a purpose. About 5% of the respondents are 65 years and above. It is important to note that the respondents in this group may lack enough energy to engage in productive activities; hence they are fewer in number. The results further indicate that about 58% of the respondents were females while the males were 42%. This shows that both males and females are involved in working in SMEs. Both males and females are equally participating in production because of their almost equal increase in responsibilities. The results also show some sense of gender equality.

Table 3: Levels of Education

Levels of Education	Number	Percentage (%)
Primary School	3	5
Secondary School	25	42.4
Technical College	32	50
Bachelor's Degree	28	48.5
Master's Degree	4	7.5
Doctoral Degree	1	1.5

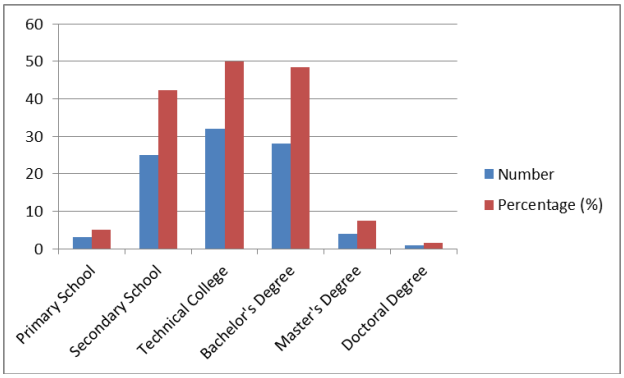

Figure 2: Levels of Education

Table 4: Industry (sector) of Participants (SMEs)

Industry (sector) of Participants (SMEs)	Number	Percentage (%)
Engineering	4	6
Hospitality/Grocery/Food Processing	8	12.1
Financial Service/Stockbroking/Risk Management	7	10.6
Wholesale/Retail	6	9
Construction/Real Estate	1	1.5
Medical/Pharmaceutical	2	3
Telecommunications/Communication	4	6
Oil and Gas	9	14
Education	1	1.5
Legal Practice	1	1.5
Manufacturing	8	12.1
Transport/Haulage/Freight	11	16.6
Others	4	6

Table 4: Industry/Sectors of Participants

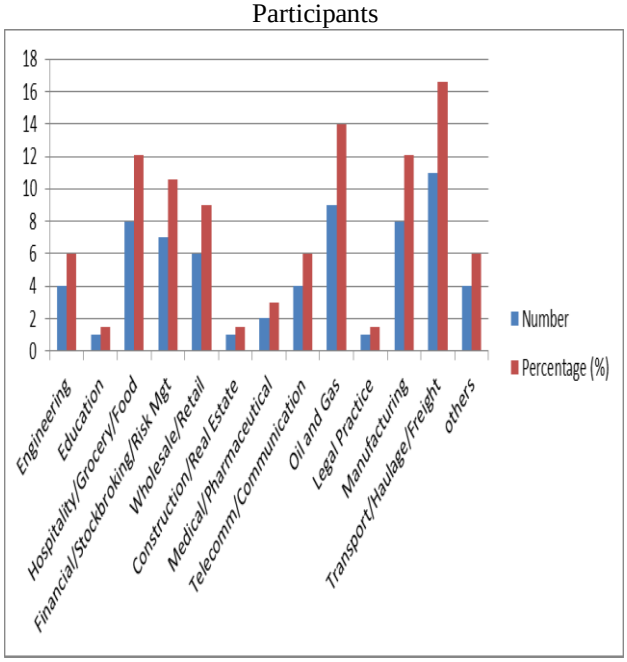

Figure 3: Industry/Sectors of Participants

Looking at the chart above, 6% of the firms were identified as engineering firms; also, 6% were identified as telecommunications/ communication companies as well as firms from a combination of other sectors. The largest numbers of SMEs that participated in the study were those of transport/haulage/freight companies having 16.6% which probably results from the inclusion of firms around the Apapa sea port (the largest sea port in Nigeria) in the study.

Complementarities of ICTs in enhancing access to quality information to SMEs:
Coverage of radio, television, mobile phone and internet:

The Respondents (240 of them) were asked to rank the ICTs in terms of coverage, i.e. the content and distance it covers. About 75% of the SMEs ranked radio as the leading ICT in terms of coverage and 17.2% ranked the internet. Mobile phones and television sets almost tied in their rankings of 12.6% and 12.9%, respectively.

Table 5: Rank of ICT in terms of coverage ($n = 240$)

Type of ICT	**Percentage of SMEs and their respective ranking for the different ICT ($n = 240$)**		
	1st	**2nd**	**3rd**
Radio	74.1	16.7	9.2
Mobile Phone	12.6	60	27.4
Television	12.9	22.5	64.6
Internet	17.2	33.6	49.2

Source: Survey data, 2016

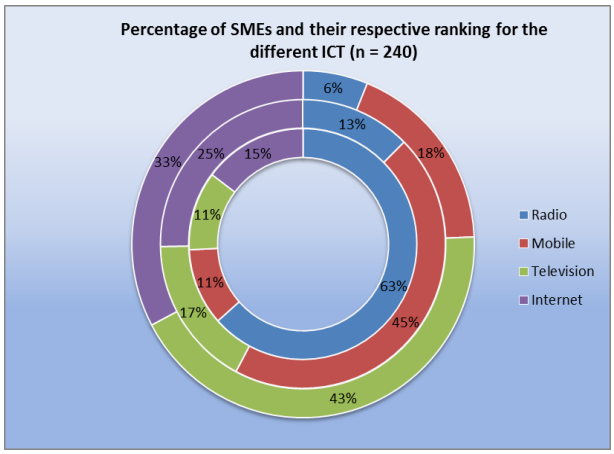

Figure 4: Rank of ICT in terms of coverage

Table 6: Types of ICT applications in SMEs

Types of ICT Applications	**Number of SMEs**	**Percentage**
Software Applications	8	12.6
Communication Applications	6	8.5
Software and Communication Applications	26	45
None	25	31.8
Missing data*	1	1.3

Note: The missing data represents one company which indicated they had computers but did not specify the types of applications they had in place.

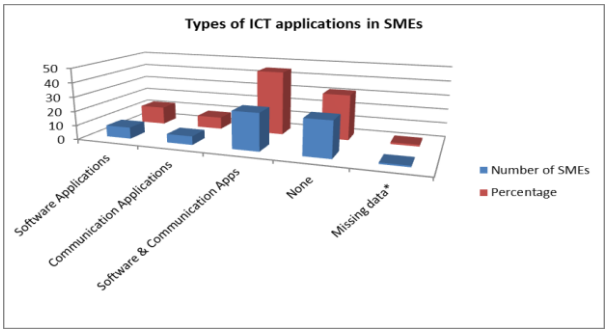

Figure 5: Types of ICT applications in SMEs

*The missing data represents one company which indicated they had computers but did not specify the types of applications they had in place.

Model specification

The empirical model used for this study may be expressed algebraically as a linear function

$$f(X_1, X_2, \dots, X_7) = \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_7 X_7 + \varepsilon$$

of the seven variables $X_1, X_2, \dots, X_7$, where the constant constants $\beta_1, \beta_2, \dots, \beta_7$ are the quantifying factors for the variables and ε is a constant representing any quantity resulting in an error. The variables represent the qualities necessary for the use Information and Communication Technology which we shall christen ICT adoption (ICTA).

$ICTA$ = ICT Adoption
X_1 = Infrastructure
X_2 = Skills and training
X_3 = Internet Service Provider cost
X_4 = Electricity supply
X_5 = Management support
X_6 = Government policies
X_7 = Security level
ε = Error term

The study also reveals that government policies; management support; level of security; maintenance cost; skills and training and investment cost predict ICT Adoption by SMEs with $r = (0.734, 0.780, 0.699, 0.675, 0.500 \text{ and } 0.32)$, respectively. This indicates that government's prices on structure and uncertain taxation rules inhibit ICT adoption by SMEs and this is in line with Asrafi and Murtaza (2008) statement that some of the ICT adoption challenges in developing countries include legal and regulatory issues, weak ICT strategies, lack of research and development, excessive reliance on foreign technology and ongoing weaknesses in ICT implementation. Furthermore, the inability of managements to behold the benefits of ICT adoption, maintenance cost, and lack of skills, training and investment costs also inhibit ICT adoption by SMEs in Nigeria. And this also in line with Grover (1993) which asserts that customers' willingness to use internet technology and conduct online transactions in Nigeria is further hindered by inadequate security, high illiteracy rates, lack of rigorous systems and restrictions in global markets.

Variable	β	t	$sig.$	R^2	F	p
Government policies	0.003	0.103	Pns			
Management support	0.232	2.785	$P < 0.01$			
Level of security	0.128	3.220	$P < 0.05$			
Infrastructure	0.614	10.386	$p < 0.01$			
Skills and training	0.078	1.235	Pns			
Investment cost	0.093	2.206	$P < 0.05$			
Maintenance cost	0.130	2.273	$P < 0.05$	0.832	$P < 0.01$	133.6

Table 7 shows that the predictors' variables (infrastructure, skills and training, investment cost, maintenance cost, government policies, management support and level of security) were significant joint predictors of ICT adoption by SMEs in Nigeria. The predictor variables jointly explained 93.2% variance of ICT adoption by SMEs. Infrastructure ($\beta = 0.614$; $t = 10.386$; $P < 0.01$); investment cost ($\beta = 0.093$; $t = 2.206$; $P < 0.05$); maintenance cost ($\beta = 0.130$; $t = 2.273$; $P < 0.05$); management support ($\beta = 0.232$; $t = 2.785$; $P < 0.01$) and level of security ($\beta = 0.130t = 3.220$; $P < 0.05$) were significantly independent predictor of ICT adoption by SMEs in Nigeria.

Relevance of ICT

The results of the case studies suggest that SMEs currently utilizing ICT achieve a great deal of competitive advantage as ICT provides an opportunity for firms to offer better quality services to customers. SMEs endeavor to adopt ICT for the purpose of business enhancement for example, having intranet enhances effective communication between departments and branches of the same company. ICT also helps to enhance a company's interactivity with customers thereby enhancing the overall business of the company. ICT can further be used to enhance knowledge acquisition from external sources. ICT enhances and supports business reform

from the usual traditional method of conducting businesses to an automated method. This corroborates the findings of Andersen and Foss's (2005), which state that ICT provides an organization with a richer endowment of diverse competencies that enhance the organization's ability to innovate and create strategic opportunities. It further maintains that the use of ICT can provide enablement to computer-mediated communication amongst managers, e.g., in multinational organizations. It can also enhance the internal exchange of rich and tacit information. Such ICT enhanced communication can facilitate the inherent knowledge creation and innovation processes in many enterprises including SMEs. Moreover, Edoho (2000) and Ion and Andreea (2008) highlight maintain that ICT contributes to enhancing business operations.

Recommendations

The globalization of businesses has increasingly drawn SMEs into global value chains through various types of cross-border activities. Many entrepreneurs now understand the importance of globalization; therefore gaining access to global markets of research findings has become a strategic instrument for the furtherance the development entrepreneurship. In Nigeria, there is therefore an urgent need to provide the required enabling environment for the development of SMEs to enable them play a role in the economic transformation of the country. For these SMEs to prosper, they require a conducive business environment, access to research findings, proper policies and regulations, adequate infrastructural facilities, access to short and long-term funding at reasonable rates among others. As SMEs continue to grow, they require connectivity to research findings, export markets and the world economy. Therefore, for Nigerian SMEs to succeed, they need maintain sustainable development that involves concerted effort amongst the various parties concerned, such as the government, ISPs, banks and other leasing companies, research findings services, consulting and training firms as well as local business associations. The responses obtained from the survey and case studies have assisted in identifying some common or fundamental issues that impede against the adoption of ICT, its effective utilization and the further adoption of sophisticated ICT solutions in Nigerian SMEs. The most prevalent issues that were identified from the survey and case studies are discussed. Also, recommendations on strategies that can assist in solving the existing problems are presented.

IV. CONCLUSION

The volume and degree of ICTs usage may not be equally distributed among the case studies because of differences in the availability of ICTs facilities, computer and information literacy techniques to use ICTs, state of availability of infrastructure and ability to acquire the ICTs. Federal Institute of Industrial Research Oshodi will be the most ICT utilizing case study because of the existence of functional internet information Technology division and a sufficient number of Information Technology staff and well exposed research officers. With ICT statuses of institutes such as these, one can deduce that research officers had not benefited much from ICTs and were still accessing information through traditional means and are therefore affected by the challenges posed as a result of such methods.

The results of the case studies suggest that SMEs currently utilizing ICT achieve a great deal of competitive advantage as ICT provides an opportunity for firms to offer better quality services to customers. SMEs endeavor to adopt ICT for the purpose of business enhancement for example, having intranet enhances effective communication between departments and branches of the same company. ICT also helps to enhance a company's interactivity with customers thereby enhancing the overall business of the company. ICT can further be used to enhance knowledge acquisition from external sources.

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REFERFENCES

[1]. **Andersen, T and Foss, N. J**. 2005 'Strategic opportunity and economic performance in multinational enterprises: The role and effects of information and communication technology' *Journal of International Management*, vol 11, no. 2, pp. 293-310.

[2]. **Udo, G. J., and Edoho, F. M.** 2000. Information technology transfer to African nations: An economic development mandate. *The Journal of Technology Transfer*, *25*(3), 329-342.

[3]. **Ion, P., and Andreea, Z. 2008.** Use of ICT in SMES management within the sector of services. *Analele Universităţii Din Oradea*, 483.

[4]. **Ashrafi, R., and Murtaza, M.** 2008. Use and impact of ICT on SMEs in Oman. *Electronic Journal of Information Systems Evaluation*, *11*(3).

[5]. **Grover, V., 1993.** An empirically derived model for the adoption of customer-based interorganizational systems. *Decision sciences*, *24*(3), pp.603-640.

[6]. **Udo, G.J. and Edoho, F.M.,** 2000. Information technology transfer to African nations: An economic development mandate. *The Journal of Technology Transfer*, *25*(3), pp.329-342.