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FULL-LENGTH ARTICLE

Study of Information and Communication Technology (ICT) maturity and value: The relationship

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Abstract A key challenge within the service industry is how the benefits from ICT adoption and diffusion (ICT value) relate to the degree of adoption and diffusion of ICT (ICT maturity). This challenge has resulted in the uncertainty of value generation from investments on ICT leading to ICT mis-planning and disaster. This paper unraveled this uncertainty by measuring the ICT maturity and value of service firms listed in the Nigerian Stock Exchange (NSE) and established the relationship between them. The Value Added Intellectual Coefficient (VAIC) model was adopted to measure the value of ICT in the service firms while the ICT Maturity model of Small-and-Medium Enterprises (SMEs) was used to measure their ICT maturity. The relationship between these two service variables was established by correlation analysis. The result showed that the Nigeria service industry is comfortably web based in ICT maturity with an index of about 0.76. The ICT value index was estimated to be about 4.60, an indication that ICT's potentials are not effectively utilized in Nigeria for service delivery. The final analysis showed that, there is a negative-weak correlation between ICT maturity and ICT Value in the Nigeria service industry. This shows that the benefit from ICT adoption and diffusion is not traceable to the degree of ICT adoption and diffusion in the service industry.

1. Introduction

In the 21st century, Information and Communication Technology (ICT) became a strategic asset for service organizations to deliver innovative services and achieve sustainable competitive advantage. The importance of ICT based innovation in productivity improvements and competitiveness is huge [1]. With the constant decline in labor productivity since the mid-90s (partly attributed to the lack of ICT related

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investment), it is also evident that the higher productivity and growth rates observed in the United States of America and Europe result from the greater adoption and diffusion of ICT into all segments of their economy [2]. As with the developed nations of the world, the service industry is the largest contributor to the wealth of the Nigerian economy; presently the largest in Africa and 26th largest in the world. It accounts for about 51% of Nigeria's gross domestic product – GDP [3].

The service industry is extremely information-intensive and knowledge-based and therefore requires a full embrace of ICT, if they are to remain competitive [4]. Despite the embrace of ICT by the industry, particularly over last decades, investments are still inward looking with predominantly pockets of improvements that have failed to bring about sustainable competitive advantage. For example, Salah [5] showed that 75% of ICT investments in the service industry did not meet their business objectives and presented evidence that projects were abandoned, significantly redirected or kept alive despite business integration failure. According to Sessions [6], the annual cost of ICT failure Worldwide is around USD 6.18 trillion when taken into account not only the direct costs of the investment itself but also the indirect costs associated with lost opportunities. These significant failures and missed opportunities have direct cost on businesses and have led to the dissolution in the strategic benefits of ICT; resulting in decreasing levels of future investments in ICT [7–9]. This is further fueled by the fact that business executives do not fully recognize the functionality and full value of ICT to the business while on the other hand; ICT personnel do not possess an understanding of the business and its strategic objectives [10]. In many cases, ICT is still considered by the management of service organizations as purely a cost cutting tool or a utility that is owned and managed by their ICT departments.

The adoption and diffusion of ICT within the service industry strongly varies among sectors. Over the last decade, the regional and national policies particularly focused on stimulating ICT adoption by the small and medium sized enterprises, the SMEs [11–13]. This sector structurally lags behind the ICT diffusion rates of large firms especially those in the telecommunications and banking industries which are of the highest ranks in e-readiness and ICT growth rates [14–16]. Although from a scale perspective this might not seem a problem *per se*, the more fundamental problem observed is the low awareness, or even mistrust, of SME firms about the potential benefits of ICT [17].

This problem, of over-critical and sceptical attitude toward the potential benefits of ICT, is not only a problem of SME firms; it actually draws back to the uncertainty when investing in ICT from both the cost and the benefits perspective. Although the 'productivity paradox' and 'IT doesn't matter' discussions have passed, still the number of studies that reported failure of the ICT adoption and implementations remains large [18]. Quite ironically, the national governments that firmly stimulate the uptake of ICT represent organizations that particularly seem to fail in getting value from ICT. The Dutch government for example, struggled with several public examples of ICT disasters and missed-planning [19].

A key challenge therefore within the service industry is to improve the understanding of how managers actually perceive the benefits from ICT adoption and diffusion (ICT value), and how this relates to the actual level of ICT adoption and diffusion (ICT maturity) reminiscent of the productive investments on ICT. This paper addressed this challenge.

The value of ICT to service industry in both context and perspective could be used as a basis for exploring its service systems [20] as well as to uncover the contribution of ICT to the tripod goal of service organizations: profitability, staff productivity and customer satisfaction [21]. Besides, "Measuring this value will help improve management control over ICT driven organization" [21]. Ekuobase [21] highlighted in sufficient details the ICT value measurement models.

ICT maturity models are increasingly being applied within the field of service science, both as an informed approach for continuous improvement and as a means of self or third-party assessment of service organization [22]. Since the introduction of the first ICT maturity model: Nolan's model in the 1970s [23,24], different ICT maturity models have been developed. ICT maturity models when applied to service department(s) can show how structured, ordered and focused they are toward the provision of service(s) to their customer (s); using ICT facilities [25]. Furthermore, it can guide in the continuous improvement of ICT facilities and services of a service department(s) [26,27].

As closely linked as the role of these service science tools (i.e. ICT maturity and value models) are, we are not aware of any research work that has investigated the relationship between their outputs (i.e. ICT maturity and value). We are aware of researches that measured the ICT maturity of service firms [28–34]. We are also aware of efforts at estimating the contributing value of ICT in some service firms [35–45].

1.1. Related work

The research noted the work of Batenburg and Constantiou [46] that explored the relationship between the e-business maturity and the perceived benefits from ICT at the firm level. The motivation for their work was the increasing knowledge about organizational adoption of ICT and economic analysis of ICT in the organizational context. The objectives of the work were to investigate the relationship in terms of its strength and stability and to explore the conditions which may influence this relationship. In their work, a survey approach was used and according to their findings, the correlation between the e-business maturity and the perceived benefits from ICT adoption is indeed positive, significant and stable over countries, firm size and age. Further findings according to them, confirmed the hypothesis that intra-organization adaptations due to ICT moderate the positive correlation between a firm's e-business maturity and perceived benefits from ICT.

We are also not unmindful of the work done by Okogun et al. [47], entitled "on economic value of ICT investment in Nigeria: is it commensurate?" They were motivated by the amount of money/capital that countries spend on ICT and yet they continue to ask questions like: What are we getting from this money invested? Are there any progress? Is there any difference between when we invested and when we did not invest in ICT? In the case of Nigeria, are the huge investments made by both private and public sectors on ICT commensurate in terms of their return on investments? The specific objective of their work was to evaluate the contribution of ICT investment to economic growth in Nigeria. In their

study, secondary data source was employed for the research methodology. The empirical results according to their findings, suggest that ICT investment has a significant impact on Nigeria's economic growth during the periods reviewed, suggesting good payoffs from the investment.

The two research works tried to find a relationship between ICT investment and the benefit from such investment. The gaps in these works are that, they misconstrued ICT investment for ICT maturity, economic benefit of ICT for value of ICT and also did not make use of appropriate Service Science metrics (i.e. models) in line with the service science experts' global best practices. Their emphasis was only on the tangibles whereas in modern service industry and Service Science, emphasis is on both tangibles and intangibles [39]. Considering the fact that these researchers are management scientists, one could wonder a little about their myopic understanding of ICT value and maturity. This work examined from a modern and holistic perspective, ICT value and maturity and attempts to establish their relationship in line with service science experts' global best practices. This work is also completely different from the work of Chan et al. [48] which concerned itself with the relationship between knowledge management and intellectual capital efficiency.

The uncertainty of value generation from productive investments on ICT and the associated relationship with the maturity of its adoption and diffusion within the service industry is therefore a topic that has not been given adequate attention. This research gives this attention, exploring the benefits (value) of ICT adoption and diffusion and how it relates to the maturity of ICT adoption and diffusion in the service industry.

2. Materials and method

This study adopted the quasi-experimental research methodology. After a successful consultation with the 72 service firms listed in the Nigeria Stock Exchange (NSE) to seek for permission to use their firms as a research case study, a total of 28 service firms gave consent but only 23 of them actually participated (returned at least a validly completed questionnaire) in the data gathering process which took place from the period of April 14th to May 15th, 2015. The 23 firms were as follows: Expert Edge Software, Main Street Bank, Bank of Industry, Skye Bank PLC, Zenith Bank PLC, Keystone Bank Limited, Access Bank PLC, Guaranteed Trust Bank PLC, First Bank Nigeria PLC, Union Bank PLC, Fast Credit Limited, Information Technology Transfer, Petrodata Management Services, Digital Communication Company, CHAMS PLC, Computer Warehouse Limited, ETISALAT Nigeria, Visaphone Communications Limited, Airtel Nigeria, MTN Nigeria, SMILE Communications, STACO Insurance PLC and Zenith Insurance. The research took two independent paths which later coalesced into the third and final part of the research.

2.1. ICT maturity measurement

The first path of the study measured the ICT maturity of the service firms by adopting the ICT maturity model of SMEs. The ICT maturity model of SMEs was adopted not only because it has been improved to handle any category of enterprises but also because it is simple, quantifiable and strongly aligned with modern business enterprises [28,48]. This path began with a questionnaire survey meant to capture the necessary data needed to measure the ICT maturity of the service firms. The questionnaire modeled after the ICT Maturity Model of SMEs [28] is a three-part document. The first part introduced the questionnaire and contains demographic data (name and type) of firms and respondent's managerial positions.

The second part consists of 50 indicator questions grouped under the four major factors of observable capabilities of SMEs: **I**nfrastructure (eleven indicator questions), **A**pplication (thirteen indicator questions), **H**uman Resource (twelve indicator questions) and **P**olicy (fourteen indicator questions). The third part of the questionnaire captures the respondents' contacts (mobile phone numbers and e-mail addresses). The questionnaire, an adaptation with similar connotations and indicator value as the one used by Pham [28] and Pham et al. [49], was validated and approved for this study by the research leader. A sample questionnaire is contained in Appendix A.

The questionnaires were randomly distributed, in company of the protocol officers of the various firms, to the respondents (organization's staff) in person; across the levels of management. As a result of the very busy schedule of the respondents, the questionnaires could not be filled and collected immediately after distribution; it sometimes took several days of attempts to get the distributed questionnaires back. A total of 252 questionnaires were distributed, nine questionnaires per firm. The firms' protocol officers were specifically instructed that the nine questionnaires will be distributed three per level of management namely operational, middle and top management level; to influence the survey tour guide they offered. This is to avoid a possible pitfall of a related research by Chan et al. [48] for companies in mainland China where one questionnaire per firm was administered which may be prejudiced by the respondent's position. Distributing three questionnaires per managerial level did not only degrade the effect of position prejudice but also weakened chances of biasness within a managerial level.

The average time a respondent spent on the questionnaire was about 15–20 min. Due to administrative protocols and the high traffic in Lagos, Nigeria, a maximum of five firms could be visited in a day. The second researcher carried out the questionnaire survey under the strict monitoring of the research leader via mobile phone calls and location tracking. A total of 156 questionnaires were validly completed and returned. The questionnaires were then sorted and coded using the indicator stage value as proposed by Pham [28].

The ICT maturity index (ICTMI) was calculated using the formula in Eq. (1) as proposed by Pham [28]. To the best of our knowledge, the Pham [28] implementation model is the only quantitative means of implementing the ICT maturity model of SMEs. A similar work by Pham et al. [49] also made use of the Pham [28] model.

$$\text{ICTMI} = \alpha I + \beta A + \gamma H + \theta P \tag{1}$$

where $0 \leqslant I,\ A,\ H,\ P,\ \text{ICTMI} \leqslant 1$ and $\alpha + \beta + \gamma + \theta = 1$; and

$$I = \frac{\sum_{l=1}^{4}\left(\frac{\sum_{t=1}^{n_l} I_{lt}}{n_l}\right)}{4}, \quad A = \frac{\sum_{l=1}^{4}\left(\frac{\sum_{t=1}^{m_l} A_{lt}}{m_l}\right)}{4},$$
$$H = \frac{\sum_{l=1}^{4}\left(\frac{\sum_{t=1}^{p_l} H_{lt}}{p_l}\right)}{4}, \quad P = \frac{\sum_{l=1}^{4}\left(\frac{\sum_{t=1}^{q_l} P_{lt}}{q_l}\right)}{4} \tag{2}$$

where I_{lt}, A_{lt}, H_{lt} and P_{lt} are indicators of stage l; n_l, m_l, p_l and q_l are number of respective indicators of stage l; $1 \leqslant l \leqslant 4$. In particular, '$I$' stands for infrastructure sub-ICTMI; 'A' for Application sub-ICTMI; 'H' for Human Resource sub-ICTMI and 'P' for Policy sub-ICTMI.

Since no information of weighting I, A, H, P is given, we let

$$\alpha = \beta = \gamma = \theta = 0.25 \tag{3}$$

i.e. the four observable capabilities of SMEs (sub-ICTMIs) were equally weighted.

Thereafter, the results of ICTMIs were mapped to the ICT maturity levels using the stratification proposed by Pham [28] as follows: Inactive (0.0–0.2), Basic (0.2–0.4), Substantial (0.4–0.6), Web based (0.6–0.8) and Knowledge oriented (0.8–1.0).

2.2. ICT value measurement

The second path of the research realized the ICT value of the service firms. Here, we adopted the Value Added Intellectual Coefficient (VAIC) model [21,48,50–52]. The VAIC model also known as the Value Creation Efficiency Analysis model is one of the ICT value measurement models. Others include the Tobin's Q, Intangible Asset Monitor, Calculated Intangible Value, IC-Index, Technology Broker and Skandia Navigator models but the VAIC model stands out in terms of popularity, generality, standardization, objectivity, verifiability and cognizance [21].

The VAIC model considers company's ability to add value through:

$$\text{VA} = \text{OUT} - \text{IN} \tag{4}$$

where VA is the Value Addition from the current year's resources, OUT = Total Sales (revenue from sales of goods and services), and IN = Cost of bought in materials, components and services/inputs.

The input (IN) includes all expenses incurred in earning the above revenue except employee cost. Alternatively, the Value Added can be calculated as

$$\text{VA} = \text{OP} + \text{EC} + D + A \tag{5}$$

where OP = Operating Profit, EC = Employee Cost, D = Depreciation and A = Amortization.The VA Eq. (5) is simple to use, is precise, accommodate intangibles and is generally accepted as a more realistic approximation of Eq. (4) [52].

The first measure of the model is "value added efficiency through capital employed" and is calculated as follows:

$$\text{VACA} = \text{VA}/\text{CA} \tag{6}$$

where VACA is the efficiency of physical capital employed by the firm. It is obtained by dividing value added (VA) by the capital employed (CA); CA = net book value of total assets.

Alternatively, CA can also be calculated as

$$\text{CA} = \text{Common Stock} + \text{Preferred Stock} + \text{Retained Earnings} + \text{Company Reserves} + \text{Long Term Debts}.$$

The model gives central role to human capital; therefore, employee expenses are not treated as cost. This calculation of the model shows how much VA is created by each unit of currency spent on employees. Pulic [50] argued that salary of an employee is usually determined on the basis of their performance by market forces. So, it is logical to measure human capital on the same criteria.

Second measure of the model which shows the ability of human resources in creating value is given by VAHU and is calculated as follows:

$$\text{VAHU} = \text{VA}/\text{HC} \tag{7}$$

VAHU represents the Human Capital Efficiency of a firm, where value addition is divided by cost of Human Capital (HC). The cost of human capital is treated as investment rather than expense and calculated as

$$\text{HC} = \text{Total salaries and wages (Direct labour} + \text{Indirect labour} + \text{Administrative} + \text{Marketing and Selling salaries)}.$$

The third measure of the model is Structural Capital (SC) efficiency which shows the contribution of SC in value creation.

$$\text{STVA} = \text{ST}/\text{VA} \tag{8}$$

where STVA is the structural capital efficiency of the firm and is calculated through dividing cost of structural capital by value added (VA). The ST is calculated by subtracting HC from the VA:

$$\text{ST} = \text{VA} - \text{HC} \tag{9}$$

Finally, the cumulative IC efficiency of all three components of VAIC is calculated by adding capital employed, human capital and structural capital efficiencies:

$$\text{VAIC} = \text{VACA} + \text{VAHU} + \text{STVA} \tag{10}$$

VAIC calculated by Eq. (10) indicates the overall corporate value creation efficiency of a firm. VAIC does not provide money value of Intellectual Coefficient (IC). It simply adds the three efficiency factors of IC and calculates efficiency index that shows how IC of a company contributes toward value addition. As an index, the higher the VAIC value the better the perceived efficiency and value creation ability of the firm.

In using the VAIC model, we made use of Audited Financial Report (AFR). We could not have access to the AFRs of some of the firms that participated. Although we requested for their AFRs during the field work exercise, most firms declined access while others referred us to their web sites. A total of 14 out of the 23 firms that participated in this survey had their AFRs online and as such were used to calculate their VAIC indexes. This accounts for about 60.87% of responses for the secondary source data. Ideally, the latest AFR of these firms to the year of this investigation, considering the period data was captured for their ICT maturity measurement i.e. the AFRs for 2014, should have been used but only four (17.39%) of the 23 firms that participated in this survey had their 2014 AFRs online. Thus, the research opted for the 2013 AFRs. From these AFRs, the required VAIC data were extracted and the ICT value indexes for the respective firms were calculated on the Microsoft Excel Spreadsheet.

2.3. Analysis of results

In this final part of the study, the calculated ICT maturity index of firms with calculated VAIC value was extracted and comparatively analyzed with their respective VAIC values scaled up by a factor of 10 using the Pearson correlation. Statistical Package for Social Sciences (SPSS) 17 was used for the correlation analysis.

The average of the firms' ICT maturity indexes was taken as the ICT maturity index of Nigeria service industry. Similarly, the average of their ICT value indexes was taken as the ICT value index of the Nigeria service industry.

3. Results and discussion

Table 1 captures the firms' type and managerial level of the respondents in the respective firms' type that took part in the questionnaire survey for measuring the ICT maturity of the Nigeria service industry.

Table 1 shows the spread of the respondents across managerial levels and firms' type as well as the number of firms per firm type that took part in the survey. Most of the firms and respondents were from the Banking sector (45.51%) and the respondents had a good spread across the three managerial levels with the operational level accounting for 43.59% of the respondents.

Table 2 captures the sub-ICTMI, ICTMI and quantized ICTMI of the 23 service firms in the order of occurrence of service types as shown in Table 1 using Eqs. (1)–(3); to map the calculated ICTMIs indexes to the ICT maturity levels of SMEs, they were quantized by a factor of 2.5. The service firms are denoted as F_i, $i = 1(i)\ 23$.

In Table 2, service firms with similar activities were gathered together. For example, it is easy to see from Table 2 that firms F3 and F4 carry out insurance activities and that only firm F22 is involved in consultancy services. Table 2 shows that the average ICT maturity of service firms in Nigeria is 0.763256 which by Pham [28] stratification is web based. Thus, we can state that the ICT maturity of the Nigerian service industry is about 0.76 i.e. web based. Table 2 also shows that the infrastructure (hardware), application (software) and policy capabilities of the Nigeria service industry are more advanced than the human capability required to effectively use/implement them.

Table 1 Summary of service firms' type and operational levels of respondents.

Type and no. of firms under this type (no. of firms under this type in bracket)		Operational management	Middle management	Senior management	Total type	% Type
Consultancy and services	(1)	3	3	3	9	5.77
Banking	(10)	31	24	16	71	45.51
Technology	(5)	18	8	7	33	21.15
Telecommunications services	(5)	12	11	7	30	19.23
Insurance	(2)	4	4	5	13	8.33
Total	(23)	68	50	38	156	100.00
% of managerial Level		43.59%	32.05%	24.36%	100.00%	

Table 2 The sub-ICTMIs, ICTMI and quantized ICTMI of selected service firms in Nigeria.

Firms	F22	F1	F2	F5	F6	F8	F13	F15
Sub-ICTMIs								
I	2.421296	2.150463	2.0625	2.004167	1.895833	1.9875	2.157407	1.786458
A	2.479167	2.282407	2.375	2.158333	2.270833	2.1625	2.333333	2.0625
H	1.851852	1.694444	1.958333	1.458333	1.333333	1.408333	1.75463	1.59375
P	2.222222	2.333333	2.479167	2.0875	2.458333	1.99375	2.423611	1.871094
ICTMI	2.243634	2.115162	2.21875	1.927083	1.989583	1.888021	2.167245	1.828451
Quantized ICTMI	0.897454	0.846065	0.8875	0.770833	0.795833	0.755208	0.866898	0.73138
	F17	F20	F21	F7	F9	F16	F18	F19
Sub-ICTMIs								
I	2.210648	1.981481	2.197917	2.372917	1.78125	2.44213	1.0625	2.141667
A	2.37963	2.027778	2.072917	2.383333	1.96875	2.395833	1.875	1.395833
H	1.671296	1.726852	1.777778	1.9	1.338542	1.819444	0.666667	0.883333
P	2.291667	2.09375	2.192708	2.48125	1.515625	2.180556	2.260417	1.45
ICTMI	2.13831	1.957465	2.06033	2.284375	1.651042	2.209491	1.466146	1.467708
Quantized ICTMI	0.855324	0.782986	0.824132	0.91375	0.660417	0.883796	0.586458	0.587083
	F10	F11	F12	F14	F23	F3	F4	Average
Sub-ICTMIs								
I	1.078125	1.95	1.759259	2.333333	1.395833	1.401786	2.013889	1.938624
A	2.229167	2.391667	2.321759	2.361111	2.5	1.702381	1.583333	2.161416
H	0.791667	1.683333	1.25463	1.75	1.208333	1.511905	1.3125	1.493447
P	1.554688	1.95	2.246528	2.177083	1.375	1.46875	1.791667	2.039074
ICTMI	1.413411	1.99375	1.895544	2.155382	1.619792	1.521205	1.675347	1.90814
Quantized ICTMI	0.565365	0.7975	0.758218	0.862153	0.647917	0.608482	0.670139	0.763256

Table 3 Extracted VAIC data and value added for service firms in Nigeria.

S/N	Service firms	OP	EC	*A*	*D*	CA	VA
1	F11	64,548	15,113		68,267	541,462	147,928
2	F10	42,707	8670	2820	16,458	119,771	70,655
3	F8	100,462	19,625		9273	328,073	129,360
4	F9	634,176	215,273	6410	86,763	8,192,348	942,622
5	F14	8,399,595	5,149,391	809,093	3,798,455	49,592,696	18,156,534
6	F17	94,108	56,864	844	9015	472,622	160,831
7	F4	570,017	1,083,424	29,086	732,418	3,009,111	2,414,945
8	F13	31,365,396	25,937,818		7,780,207	245,181,997	65,083,421
9	F1	10,555,989	9,218,987		1,725,640	69,374,870	21,500,616
10	F5	52,528	54,264	1082	8517	373,572	116,391
11	F7	632,099	1,243,327	39,827	398,147	5,275,047	2,313,400
12	F16	132,922	322,023	14,420	54,234	892,342	523,599
13	F15	1,306,728	14,269,510	441,150	3,762,196	36,012,845	19,779,584
14	F2	4201	38,519		3060	187,784	45,780

Table 4 Calculation of VAIC value for Nigerian service industry.

S/N	Service firms	VA	SC	VACA	VAHU	STVA	VAIC
1	F11	147,928	132,815	0.273201	9.788129	0.8978354	10.9591659
2	F10	70,655	61,985	0.589917	8.149366	0.8772911	9.61657412
3	F8	129,360	109,735	0.394302	6.591592	0.8482916	7.83418643
4	F9	942,622	727,349	0.115061	4.378728	0.7716232	5.26541288
5	F14	18,156,534	13,007,143	0.366113	3.525958	0.7163891	4.6084597
6	F17	160,831	103,967	0.340295	2.828345	0.6464363	3.81507635
7	F4	2,414,945	1,331,521	0.802544	2.228993	0.551367	3.5829048
8	F13	65,083,421	39,145,603	0.265449	2.50921	0.6014681	3.37612711
9	F1	21,500,616	12,281,629	0.309919	2.33221	0.5712222	3.21335181
10	F5	116,391	62,127	0.311562	2.144903	0.5337784	2.99024351
11	F7	2,313,400	1,070,073	0.438555	1.860653	0.4625542	2.76176249
12	F16	523,599	201,576	0.586769	1.625968	0.3849816	2.59771877
13	F15	19,779,584	5,510,074	0.549237	1.386143	0.2785738	2.21395391
14	F2	45,780	7261	0.243791	1.188504	0.1586064	1.59090149
National ICT value index							4.60

Table 5 ICT Maturity and ICT Value of some service firms in Nigeria.

S/N	SERVICE FIRMS	ICT Maturity[a]	VAIC
1	F11	7.975	10.9591659
2	F10	5.653645833	9.61657412
3	F8	7.552083333	7.83418643
4	F9	6.604166667	5.26541288
5	F14	8.621527778	4.6084597
6	F17	8.553240741	3.81507635
7	F4	6.701388889	3.5829048
8	F13	8.668981481	3.37612711
9	F1	8.460648148	3.21335181
10	F5	7.708333333	2.99024351
11	F7	9.1375	2.76176249
12	F16	8.837962963	2.59771877
13	F15	7.313802083	2.21395391
14	F2	8.875	1.59090149

[a] The ICT maturity index using linear weighting normalized by a factor of 10 to put it on the same scale as the value index.

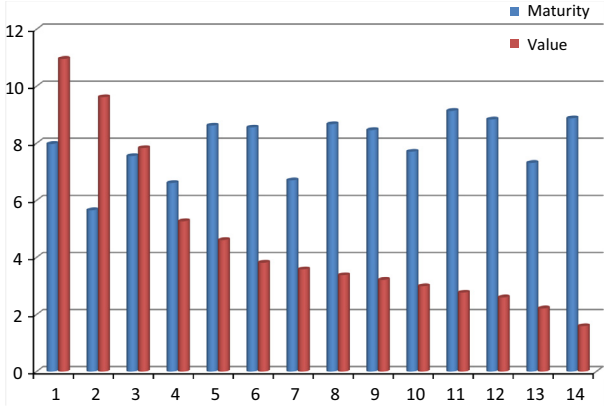

Figure 1 Column chart of ICT Maturity and ICT Value of some Nigeria Service Firms.

Thereafter, the VAIC parameters were extracted from the available AFRs of firms that participated and employing the VAIC equations, the VAIC value for the service firms was calculated. The VAIC parameters, as extracted from the available AFRs of firms that participated in the survey, are shown in Table 3.

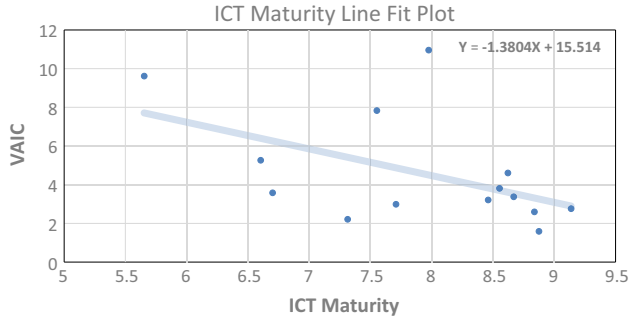

Figure 2 Scatter diagram of ICT Maturity and ICT Value of some Nigeria Service Firms.

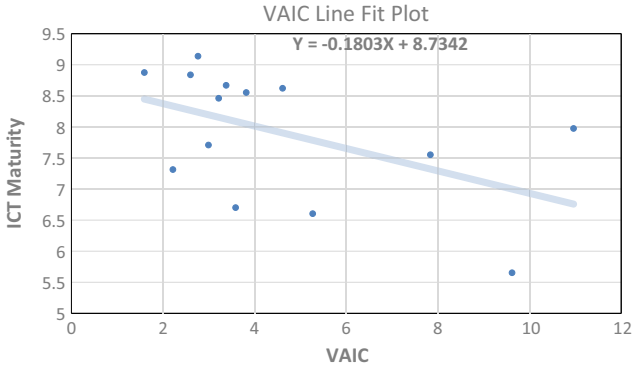

Figure 3 Scatter diagram of ICT Value and ICT Maturity of some Nigeria Service Firms.

It should be noted that some firms grouped both Amortization (*A*) and Depreciation (*D*) under depreciation and thus had their amortization cell empty. Employing the VAIC equations, the results in Table 4 were realized.

Table 4 shows that the value creation efficiency or capability of the Nigeria service industry ranges from as low as 1.6 to 11.0; with the telecommunication sector at the peak. The higher a firm's ICT value index the more effective the firm utilizes ICT for service delivery. The average VAIC value for the service firms is 4.60. It is therefore safe to conclude that the value index of ICT in the Nigeria service industry is about 4.60. The implication of this is that the contribution of ICT to the service delivery efficiency and value creation abilities of the Nigeria service industry is poor.

Table 5 captures the ICT maturity and ICT value for some Nigeria service firms and is graphically represented as column chart for clearer appreciation in Fig. 1. From Fig. 1, we could not observe any noteworthy pattern or relationship between the two service variables. This lack of association between the ICT maturity and value of the service firms in Nigeria led to a plot of Scatter diagram for the two variable data in Table 5; as shown in Figs. 2 and 3. Fig. 2 suggests a negative correlation between ICT Maturity (as independent variable) and ICT Value (as dependent variable) while Fig. 3 also suggests a similarly negative correlation between ICT Maturity (as dependent variable) and ICT Value (as independent variable). The points in the Scatter diagrams suggest a weak linear association between ICT maturity and value; with no non-linear suggestion.

Table 6 Correlation analysis of ICT Maturity and ICT Value of Nigeria service industry.

		ICT Maturity	ICT Value
ICT Maturity	Pearson correlation	1	**−.499**
	Sig. (2-tailed)		.069
	N	14	14
ICT Value	Pearson correlation	**−.499**	1
	Sig. (2-tailed)	.069	
	N	14	14

Table 7 Correlation analysis of ICE and VAIC in Nigerian service industry.

		ICE	VAIC
ICE	Pearson correlation	1	.997**
	Sig. (2-tailed)		.000
	N	14	14
VAIC	Pearson correlation	.997**	1
	Sig. (2-tailed)	.000	
	N	14	14

** Correlation is significant at the 0.01 level (2-tailed).

To be concrete, Pearson Correlation Coefficient analysis was run on both variable pairs using SPSS and this is shown in Table 6.

The correlation analysis showed a negative and weak correlation between ICT maturity and ICT value which implies a negative-weak relationship exists between the ICT maturity and ICT value in the Nigeria service industry. This result is not far from that of Chan et al. [48] which reported a very weak correlation between Knowledge maturity and Intellectual Capital Efficiency of firms in mainland China. Intellectual Capital Efficiency (ICE) is strongly correlated with ICT value as shown in Table 7.

It is safe to conclude therefore that there is a negative-weak correlation between ICT maturity and ICT Value in the Nigeria service industry i.e. one should neither expect a higher value from ICT in a service firm as the ICT maturity of the firm improves nor expect lower value with lower ICT maturity. It is evident therefore that the benefit from ICT adoption and diffusion is not traceable to the degree of ICT adoption and diffusion in the service industry.

4. Conclusion

Ordinarily, it is believed that the value of ICT in a service firm will be dependent on the degree of ICT adoption and diffusion in the firm but unraveling this relationship has remained a key challenge within the service industry leading to ICT misplanning and disaster. The Value and Maturity of ICT in the Nigeria service industry has been calculated and how they relate analyzed using Pearson correlation. The study established that the Nigerian service industry has an ICT maturity index of about 0.76 which shows that the industry is web based and made evident that the human resource capability of the industry is the least developed. The study also established that the ICT value index is about 4.60 an indication that ICT's potentials are not effectively utilized in Nigeria for service delivery.

The final analysis shows that there is a negative-weak correlation between ICT maturity and ICT Value in the Nigerian service industry. It is now evident that the benefit from ICT adoption and diffusion is not dependent on the degree of ICT adoption and diffusion in the service industry.

4.1. Contribution and significance

The major contribution of this research to knowledge is that the uncertainty surrounding how ICT value relates to ICT maturity has been unraveled i.e. the contributing value of ICT in a service firm is not traceable to the maturity of ICT in the service firm. Policy makers, managers and Information Technology (IT) experts now have a clear understanding of how the benefits from ICT adoption and diffusion (ICT value) relate to the actual level of ICT adoption and diffusion (ICT maturity).

This can help guide investments on IT and make it more value oriented and better aligned with business objectives. In particular, managers of service firms are now certain of value generation from investments on ICT and thus better positioned toward a sustainable improvement of ICT based service delivery in their various organizations.

4.2. Future direction

The lack of significant association between ICT maturity and value may suggest that there may be other intervening variables yet to be identified in the relationship between them. Future effort will be directed at identifying these variables. Assigning equal weights to the four major observable capabilities of the industry (*I*, *A*, *H* and *P*) is a drawback of this study, as this may not be the case in reality. Future efforts will also be directed at realizing realistic weights for the four capabilities. This research can also be expanded to cover all the industries in a nation, in order to holistically estimate the nation's degree of ICT adoption as well as the contributing value of ICT to the nation's economy.

Appendix A

Information and Communication Technology (ICT) Maturity Assessment

Questionnaire

GENERAL INSTRUCTIONS

Please answer the questions by drawing a circle around an appropriate number or alphabet in the space provided.

Please use the code where appropriate:

Yes definitely (Y); Yes, but not **S**ignificantly (S); No, but **P**robably within the next 5years (P); **N**o (N).

Unless specifically instructed otherwise, please answer all questions, one answer per item.

1. What is the name of the organization on whose behalf you are answering this Questionnaire?

2. What is the type of organization being assessed?

Automobiles/ Transport	1
Banks	2
Capital Goods	3
Chemicals	4
Construction ,Building, Materials and Steel	5
Consumer Goods	6
Insurance	7
Consultancy and Services	8
Oil and Gas	9
Pharmaceuticals	10
Technology	11
Telecommunications Services	12
Utilities	13
Retailers and Distributors	14
Other (please specify below)	15

3. Please specify the level of management being assessed?

Operational level	1
Middle management	2
Senior management	3

SECTION1 ICT INFRASTRUCTURE INFORMATION

1.1 Number of fixed telephone. (a) 1 – 10 (b) 11 – 50 (c) 51 – 100 (d) 101 – 200 (e) over 200
1.2 Number of business mobile devices (a) 1 – 10 (b) 11 – 50 (c) 51 – 100 (d) 101 – 200 (e) over 200
1.3 Number of computers (a) 1 – 10 (b) 11 – 50 (c) 51 – 100 (d) 101 – 200 (e) over 200
1.4 Type of Internet access. (a) No Internet (b) Dial up (c) ADSL (d) ISDN (e) cable modem (f) Leased line (g) Satellite (h) Others _____
1.5. Have Local area network (LAN). Y; S; P; N
1.6. Internet bandwidth (mbps). (a) Unknown (b) < 8mbps (c) < 16mbps (d) < 32mbps (e) >= 32mbps
1.7. Secure Internet Server/ Hosting. Y; S; P; N
1.8. Security & backup system. Y; S; P; N
1.9. Wide area network (WAN). Y; S; P; N
1.10 Wireless LAN/ wifi Internet. Y; S; P; N
1.11. Company information/services could be accessed through WAP/ i-mode access. Y; S; P; N

SECTION2 ICT APPLICATION INFORMATION

2.1. Standard application software. (a) Not use (b) Office software (c) CAD/CAM (d) Database (e) others _____
2.2. Using Internet for getting information. Y; S; P; N
2.3. Website presence…….. Y;S; P; N
2.4. Internet Services which is used or provided (a) No service (b) Searching (c) Ordering (d) Purchasing (e) Marketing & sale (f) Customer support (g) intra-communications (h)inter-communications (i) Others_____
2.5. Online payment system. Y; S; P; N
2.6. Customer understanding/e-Marketing. Y; S; P; N
2.7. E-mail/ IM for communication. Y; S; P; N
2.8. Forum/ Social Network for cooperate use Y; S; P; N
2.9. Remote Meeting/ Voice Conference. Y; S; P; N
2.10 Using services through Intranet/ Extranet. Y; S; P; N
2.11. Management Information Systems. (a) No use (b) Finance-Accounting (c)Human Resource Management (d) Document Management (e)Assets Management (f) Inventory Management (g) Decision Support System (DSS)
2.12. Integrated Information Systems. (a) SCM (b) ERP (c) CRM (d) others_____
2.13.Knowledge Systems (a) Business Intelligent (b)Knowledge Base/KMS (c) Expert systems (d) other_____

SECTION3 ICT HUMAN RESOURCE INFORMATION

3.1 ICT training. (a) Usually (b) Sometime (c) Rarely (d) Never
3.2 Number of employees using a computer. (a) 1 – 10 (b) 11 – 50 (c) 51 – 100 (d) 101 – 200 (e) over 200
3.3 Number of employees using the Internet. (a) 1 – 10 (b) 11 – 50 (c) 51 – 100 (d) 101 – 200 (e) over 200
3.4 Royalty payment & receipt. (a) No (b) The total amount is (NGN)_____
3.5 Patent/license application. (a)No (b) Number of application is_____
3.6 Company spending on R&D (NGN/year): _____
3.7 Capacity for innovation. Y; S; P; N
3.8 Number of IT specified employee. (a) 1 – 10 (b) 11 – 50 (c) 51 – 100 (d) 101 – 200 (e) over 200
3.9 Separate IT department with Asst. Director/Director. Y; S; P; N
3.10 Number of Business specified employee (a) 1 – 10 (b) 11 – 50 (c) 51 – 100 (d) 101 – 200 (e) over 200
3.11 Employees with self-learning skill (a) 1 – 10 (b) 11 – 50 (c) 51 – 100 (d) 101 – 200 (e) over 200
3.12. Capacity for Expertise Reuse. Y; S; P; N

SECTION4 ICT POLICY INFORMATION

4.1 ICT investment budget/development budget (NGN/year): (a) 5% (b) 5% – 15% (c) 16% - 30% (d) over 30%
4.2 Quality policy. (a) No quality policy (b) ISO (c) CMMI (d) Others _____
4.3 Privacy policy. Y; S; P; N
4.4 Regulatory quality. (a) Good (b) Fair (c) Not Good (d) Bad
4.5 Security policy. Y; S; P; N
4.6 Piracy policy. Y; S; P; N
4.7 Upgrade ICT hardware/ software. (a) Annually (b) 2-year period (c) 3-year period (d) No policy
4.8 Assessment effectiveness. (a) Good (b) Fair (c) Not Good (d) Bad
4.9 ICT policy in company strategy. Y; S; P; N
4.10. In your organization, the following Information management tools and services have been institutionalized:

1	Inventory of information entities	Y S P N
2	Information management systems	Y S P N
3	Databases	Y S P N
4	Information service / Library	Y S P N

4.11. Knowledge Management based on ICT use is a priority. Y; S; P; N

Contact Name / Position _____

Contact e-mail (to get survey result) _____

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