EVALUATION OF THE EFFECTS OF INVESTMENTS IN INFORMATION TECHNOLOGY (IT) ON PRODUCTIVITY OF NIGERIAN BANKS

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ABSTRACT

The broad objective of this study was to evaluate the impact of investments in information technology (IT) on Nigerian banks while the specific objective was to evaluate the effects of investments in IT on overall productivity of Nigerian banks. The data used for the study were sourced from the financial reports of some selected banks over a five year period (2000-2004). The statistical analysis tools used for the determination of the main objective of the study (i.e. determination of the relationship between investments in IT and productivity) were: two-stage least squares, ordinary least square and analysis of variance (ANOVA). When the loans, deposits and net income were taken as measures of output, R^2 were 0.959 and 0.837; adjusted R^2 were 0.955 and 0.8222 and were both significant ($P<0.001$). The conclusion drawn from the study was that investments in IT made positive contributions on overall output and it was an indication that, such investments can enhance efficient performance of workers in the banking sector.

Key words: Banks; Investment; Information Technology

INTRODUCTION

Productivity is the fundamental measure of technology contribution. While major success stories exist, so do equally impressive failure stories (Kemerer and Sosa, 1991). The lack of accurate quantitative measures for output and value added as a result of investment in IT made difficult the job of would be assessor(s) of the impact of investments in IT. Previous repots showed that scholars and policy makers lacked conclusive evidence that the high level of spending on IT by business improves productivity, leading to the coining of the term "IT Productivity Paradox" (Brynjolfsson, 1993a). Morrison and Berndt (1990) stated that additional investments contributed negatively to productivity; they observed that the estimated marginal benefits of IT investments are lower than the estimated marginal cost". Loveman (1994) and Barua et al. (1991) posited that there are 220 conclusive evidences that refuted the hypothesis that investments in IT are inconsequential to productivity. However, there are studies (Lichtenberg, 1995 and Brynjolfsson and Hitt, 1996) that revealed that investments in IT contributed significantly toward productivity.

The evidences on the impact of IT investments on bank productivity have been mixed. Despite all these, banks have spent millions of naira in information technology, having their products and services basically supported by it (Brynjolfsson and Hitt, 1998, 2000).

In many services and manufacturing sector of the economy, computers have led to significant changes in the way products are produced and delivered (Lichtenberg, 1995). Given this indispensable use of IT devices in virtually all financial sectors, it becomes imperative to examine the implications of IT investments on bank operations. The study was carried out on some banks in the South West geopolitical zone of Nigeria. The study was of a five year period (2001-2004).

INFORMATION TECHNOLOGY AND BANK OPERATIONS

Information Technology (IT) has been defined as the modern method of handling information by electronic means which involves access to: storage processing, transportation or transfer and delivery (Agboola, 1998). Information Technology utilizes computer based system as well as telecommunication technologies for storage, processing and communication (Adetayo, et al., 1999).

The Nigerian Banking Act of 1969 defines a banker as a person who carries on banking business. The amended act of 1970 defines banking business as the business of receiving monies from outside sources as deposits and lending monies to outside sources as loans or overdraft as contained in the gazette of the Central Bank on banking business (Onanuga and Oshinloye, 1999). Talabi and Onanuga (1998) stated that banks in their lending operations cannot afford to disregard good credit appraisals when lending money out to customers.

There is need to access the character of the borrower, the purpose of the loan sought, amount requested, means of repayment and of great

importance the security or collateral presented by the borrower (Talabi and Onanuga, 1998). Information technology system can be employed to un-ravel the afore-listed information. The application of IT in banking services has been made possible by the advent of technology breakthrough. The applications of the technology breakthrough into wide areas of the banking sector have brought relief for many bank executives.

The banking services that have been revolutionized through the use of IT include: account opening, processing of various transactions and update of bank records (Oyebisi et al., 2000). Information Technology did provide self-service facility such as automated teller machines (ATM), which allow customer can withdraw money outside the banking hall. Automated teller machines enable banks to provide services to customers where banks lack branches (Patrick, 1985). Information technology also allows transactions to be conducted on line and also enables customers check their past and present transactions. Customers can also use make requests such as cheque books and credit cards from their banks on line.

The aspect of IT that deals with customer account mandate maintenance enables banks to detect forgery and safeguard against making payments on wrong mandate from a customer's account. With the use of IT, some banks now have computerized credit ratings and are in possession of programs that can determine when to forward the next cheque booklets to customers. Banks are also in position to quickly furnish customers with account balances when requested.

Thus IT allows banks to get closer to their customers (Gill, 1996) and safeguards the interest of both customers and their banks and enables banks to be in the position to deliver banking business at affordable costs to customers. International Monetary Fund (IMF) conference of 1989 attests to the many advantages of IT. In the conference it was observed that IT can transform banking business in a positive direction.

RESEARCH METHODOLOGY

The data used for the study were generated from both primary and secondary sources. The primary source comprises questionnaires and interview schedules while the secondary source consists of annual reports of some selected banks.

Primary source: The questionnaire was designed to elicit information on the available IT related devices and amount spent in IT. The questionnaires were administered to heads of the system department (IT devices) and computer engineers because they are crucial to the choice technologies to be procured and operated. The heads of system department and computer engineers have first hand knowledge, information and valuable experience on the utilization of IT devices.

The questionnaire was divided into two main sections. The first section was designed to obtain information on the personal data of the respondents while the second was used to determine the extent of the use of IT devices. The respondents were expected to indicate the degree of use of IT devices. Interview method was particularly relevant to this study because the sample population used was not large and the respondents were located within a narrow geographical area. A structured interview guide consisting of 15 questions was designed for this purpose.

Secondary Source: The secondary data were sourced from the financial statements of banks and the Nigeria Deposit Insurance Company (NDIC) reports. The NDIC provides annual financial statement of 89 banks in Nigeria. However, due to the fact that banks are usually not able to report extensive historical expenditure data, the data were restricted to that of IT expenditure data over a five year period (2001-2004). Ten banks (Guaranty Trust Bank PLC (GTB), Trans-International Bank PLC (TIB), Intercontinental Bank PLC (INTB), Union Bank Nigeria PLC (UNION), WEMA Bank PLC (WEMA), Diamond Bank PLC (DIAMOND), Fidelity Bank PLC (FIDELITY), Standard Trust Bank PLC (STB), Co-operative Bank, PLC (COOP) and Oceanic Bank PLC (OCEANIC)) were chosen for the study.

ANALYTICAL TECHNIQUES

The collected data were sorted, coded on a spreadsheet and subjected to both descriptive and inferential statistics to carry out the t-test, chi-square, regression analysis and analysis of variance (ANOVA) using the Statistical Package for Social Sciences (SPSS). The means were used as indicators of central tendency in quantitative variables that have frequency distribution. A software application the Cobb-Douglas function which incorporates the two least squares regression scheme was developed and used to carry out regression analysis.

The model complements the results obtained of from the use of SPSS. The equation for the model reads: $Q = f[C, K, S, L]$, this means $Q = \alpha + \beta1\ [C] + \beta2\ [K] + \beta3[S] + \beta4\ [L] + e$ where α = constant, Q = output of the firm, C = information technology capital, K = non-information technology capital, S = information system labour expenses and L = non-information system labour expenses. $\beta1$, $\beta2$, $\beta3$ and $\beta4$ are associated output elasticities and e represents the error term. This model was used to determine the relationship between IT investments and productivity.

PRODUCTIVITY MEASUREMENTS

For the productivity analysis, the sum of total loans and deposits for each year were used as a representative of output [dependent variables] while investments in IT capital, non-IT capital, IT labour

and non-IT labour were used as inputs [independent variables]. The Cobb-Douglas function used four parameters as inputs. These were IT components of capital, IT components of labour, the non-IT components capital and the non-IT components of labour. The four outputs parameters used were: Total loans and deposits, net income, return on assets and return on equity. The function made a relative comparison about contribution to output and the resulting marginal products. Arising from above was the Brynjolfsson and Hitt (1996) productivity-oriented hypotheses: Hypothesis 1: Investments on IT do not make positive contribution to output; Hypothesis 2: Investments on IT do not make positive contribution to output after deduction of depreciation. This study put to test the two hypotheses using the methods of data collection previously enumerated.

RESULTS

Table 1 shows the averages of investments in IT capital, IT labour, non-IT capital and non-IT labour in Year 2000 to be: ₦357.9, ₦49.8, ₦1644.3 and ₦878.0 millions, respectively.
During the same year, the average of the ten banks for loans and deposits was ₦31435.4, while the average of the banks revenues (net Income) was ₦908.8 millions.
Table 2 shows that the sampled banks have an average of ₦48795.4 millions as loans and deposits while ₦1371.3 millions was the mean of their revenues for the Year 2001. The means of the investments of the ten banks in IT capital, IT labour, non-IT capital and non-IT labour in 2001 were found to be ₦488.3 million, ₦119.2 million, ₦1942.2 millions and ₦1466.5 millions, respectively.

Table 1.   Data of records of loans and deposits, net income, returns on assests, returns on equities, IT capital, IT labour, non-IT capital and non-IT labour [₦ million] of the selected banks in Year 2000

Banks	Loans and Deposits	Net Income	ROA	ROE	IT Capital	IT Labour	Non-IT Capital	Non-IT Labour
UNION	120909	3127	2.48	29.41	796	232	7205	4415
COOP	13761	205	1.72	16.8	49	23	564	362
STB	11738	226	1.73	22.11	68	7	282	129
TIB	46149	1096	2.72	42	333	41	1135	644
FIDELITY	10463	208	2.07	22.52	58	9	346	167
OCEANIC	18931	972	4.51	45.12	315	61	1805	1162
DIAMOND	37124	1875	3.86	54.75	1429	53	2049	751
WEMA	24836	252	1.11	10.36	253	30	1659	463
INTB	23185	997	4.2	35.46	176	34	960	546
GTB	7528	130	1.54	15.45	102	8	438	141

Source: Years 2000 Banks Annual Report
Nb: ROA and ROE mean returns on assets and returns on equities, respectively.

Table 2.   Data of records of loans and deposits, net income, returns on assests, returns on equities, IT capital, IT labour, non-IT capital and non-IT labour [₦ million] of the selected banks in Year 2001

Banks	Loans and Deposits	Net Income	ROA	ROE	IT Capital	IT Labour	Non-IT Capital	Non-IT Labour
GTB	7654	78	0.98	8.46	150	18	586	294
TIB	12125	430	3.27	34.75	90	20	295	227
INTB	34615	1178	3.16	34.09	438	70	1422	808
STB	75136	1848	3.06	45.98	620	112	1584	1285
OCEANIC	30461	2063	6.38	39.57	349	72	2145	1360
COOP	17251	277	1.84	20.40	58	31	787	371
UNION	207902	5032	2.34	36.52	1127	744	8169	8568
FIDELITY	11654	401	3.15	30.81	158	18	601	287
DIAMOND	47514	1783	3.72	48.71	1629	55	2149	866
WEMA	41842	620	1.60	23.86	264	52	1684	599

Source: Year 2001 Banks Annual Report

Table 3 shows that banks considered in the study recorded an average of ₦59208.5 millions for loans and deposits, while the average for their revenues was ₦1506.3 millions in Year 2002. The means of the banks investments in IT capital, IT labour, non-IT capital and non-IT labour were ₦805.2, ₦168.9, ₦2322.7 and ₦1529.3 millions, respectively.

In Year 2003, a sum of ₦72123.1 millions was obtained as the average of the loans and deposits of the ten selected banks while the average of their revenues for the same year was ₦1873 millions (Table 4). The averages of the amount h ten

banks invested in IT capital, IT labour, non-IT capital and non-IT labour were ₦835.2, ₦270.9, ₦2397.4 and ₦1839.5 millions, respectively.

Table 5 shows that a sum of ₦91379.7 millions was the average of the loans and deposits of the sampled banks for the last year (Yr 2004) of the study, while the average of their revenues for the same period was ₦2111.2 millions. The averages of the amount spent by the banks in IT capital, IT labour, non-IT capital and non-IT labour are ₦975.7 millions, ₦426.7 millions, ₦2696.1 millions and ₦2156.8 millions, respectively.

Table 3. Data of records of loans and deposits, net income, returns on assests, returns on equities, IT capital, IT labour, non-IT capital and non-IT labour [₦ million] of the selected banks in Year 2002

Banks	Loans and Deposits	Net Income	ROA	ROE	IT Capital	IT Labour	Non-IT Capital	Non-IT Labour
UNION	249833	4726	1.79	15.6	1841	784	9506	7060
COOP	20698	462	2.72	19.09	59	45	929	399
STB	82669	1994	2.86	33.5	875	217	2163	1588
TIB	15238	424	2.93	19.02	102	36	502	362
FIDELITY	17215	540	3.45	28.16	238	42	661	423
OCEANIC	50807	2186	4.1	33.4	1471	124	1745	1421
DIAMOND	49077	1312	2.48	28.57	2082	122	2983	1402
WEMA	47638	1482	3.56	39.32	693	95	2037	852
INTB	48187	1882	3.74	25.15	491	189	2011	1387
GTB	10723	55	0.48	2.84	200	35	690	399

Source: Year 2002 Banks Annual Report

Table 4. Data of records of loans and deposits, net income, returns on assests, returns on equities, IT capital, IT labour, non-IT capital and non-IT labour [₦ million] of the selected banks in Year 2003

Banks	Loans and Deposits	Net Income	ROA	ROE	IT Capital	IT Labour	Non-IT Capital	Non-IT Labour
UNION	287907	6600	2	20.16	2195	993	9017	7281
COOP	22263	185	0.95	21.13	188	86	1240	626
STB	96661	3034	3.32	32.81	815	342	2162	2103
TIB	19211	149	0.077	6.27	138	51	499	373
FIDELITY	24063	857	3.81	34.06	263	82	721	602
OCEANIC	62241	2818	4.34	35.34	526	200	2015	1476
DIAMOND	56660	513	0.87	10.47	2367	180	2921	1624
WEMA	64502	1448	2.36	20.06	730	194	2266	1419
INTB	71908	2569	3.6	29.98	930	493	1933	2244
GTB	15815	557	2.47	23.53	200	88	1200	647

Source: Year 2003 Banks Annual Report

Table 5.   Data of records of loans and deposits, net income, returns on assests, returns on equities, IT capital, IT labour, non-IT capital and non-IT labour [₦ million] of the selected banks in Year 2004

Banks	Loans and Deposits	Net Income	ROA	ROE	IT Capital	IT Labour	Non-IT Capital	Non-IT Labour
UNION	320923	7750	2.11	21.54	2729	1673	9672	8781
COOP	28697	371	1.55	13.2	151	150	1169	847
STB	136549	4170	3.06	20.84	750	463	2436	2428
TIB	22309	521	2.59	18.16	187	135	661	468
FIDELITY	30292	914	2.6	25.96	247	270	761	762
OCEANIC	93205	3287	3.78	31.72	457	258	2227	1527
DIAMOND	61834	357	1.24	13.3	3007	412	3145	1890
WEMA	91680	967	1.35	12.02	934	688	3133	2334
INTB	94122	2137	2.45	23.78	1044	135	2164	1769
GTB	34186	638	2.03	23.78	251		1593	762

Source: Year 2004 Banks Annual Report

Table 6. Results of the correlation analysis and summary of models

Model	R	R-square	Adjusted R-square	Standard error of estimate
1	0.979[a]	0.959	0.955	14753.00482

ANOVA[b]

Model	Sum of Squares	DF	Mean Square	F	Sign
Regression	2.28E + 1	4	568986554	261.421	.000a
Residual	9.79E + 09	45	217651150.84		
Total	2.37E + 11	49			

a.   Predictor: [constant], NONITLAB, ITCAP, ITLAB and NONITCAP
b.   Dependent variables: Net Income
     Coefficient a

Model	Un-standardized Coefficient B	Standardized Coefficient Std. Error	Beta	T	Sig
Constant	4705.642	3179.759		1.480	0.146
IT Capital	-1.360	4.240	-0.15	-0.321	0.750
IT Labour	104.189	17.280	0.458	6.030	0.000
Non-IT Capital	12.071	4.313	0.407	2.799	0.0008
Non-IT labour	5.521	5.690	0.163	0.970	0.337

Table 6 presents the results of the SPSS. Loan was the dependent variable while investment on IT-capital, IT-labour, Non-IT capital and non-IT labour were the independent variables. The explained variance (R^2) tells us how much of the variance in Y is accounted for. The regression model was highly significant and the R^2 was 0.959 while the B value of the un-standardized coefficient was 4705.642.

DISCUSSIONS

The significant level of the regression model was an indication that the model did not improve prediction. The 0.458 value obtained signifies that a one unit change in IT capital can result in a change of 0.458 in dependent variable (loan) while the 0.4174 value implies that a change of one unit in IT capital will result in a change of 0.4174 in the dependent variable [net income].The standardized regression coefficient shows IT labour as a variable that possesses the highest explanatory power. The last part of the table shows the estimated regression coefficients, standard errors of the estimates, t-values and significant level. Both

standardized and un-standardized coefficients are reported. 4705.642 is the B value of the un-standardized coefficient. Note that the intercept (Bo) is not reported when standardized regression coefficients are estimated. Inspection of the standardized regression coefficients shows that IT labour is the variable possessing the highest explanatory power. The reported value (0.458) means that change of one standard unit in IT capital results in a change of 0.458; standard unit in the dependent variable (loan). It can be deduced from the high positive R^2 [0.959] and adjusted R^2 of 0.955 that the output and input parameters did affect one another to a very large extent and thus satisfy the necessary conditions of Hypothesis 1 that there is positive correlation between the inputs parameter and outputs measure, the null hypothesis is thus rejected. It can be concluded from the high positive R^2 0.83696 and adjusted R^2 of 0.8224, that outputs and inputs parameters in this study did influence each other to a very large extent, which thus satisfy the necessary conditions Hypothesis two that there exist a correlation between the inputs and outputs

parameters and outputs measures; the null hypothesis is thus rejected.

CONCLUSIONS

The findings from the impact of IT investments on productivity of banks showed a significance relationship between IT investments and banks' productivity. However, IT- capital was found to have a negative impact while Non-IT capital gave a significantly positive contribution to output. The intensity of usage of IT devices in Nigerian banks was observed to be high, however, the level of use of the devices varied. The following conclusions were thus drawn from the findings of the study: The banks in the study area used only a small fraction of their total stock of capital as IT capital. Thus IT capital was negative and not significant to the performance of the banks. Hence, increasing the share of IT capital would lead to increasing the contribution of IT capital to productivity. This will invariably generate the need for more information system workers (IT labour) in banks. The study thus showed that IT investments contributed positively to productivity of the banks studied as was revealed in their outputs. The IT labour was the most profitable of all the independent variables considered and indicates that productivity will be on the increase if banks invest more in IT labour.

REFERENCES

Adetayo, J. O., Sanni, S. A. and Ilori, M. O. (1999). The Impact of Information Technology on Product Marketing. A Case Study of Multinational Company in Nigeria. Technovation, Elgervier Science Ltd. pp 58-100.

Agboola, A. A. (1998). Computers in Business Administration. Prospects and problems in Nigeria. Journal of Social and Educational Research, Vol. 1, No. 1, pp 20-50.

Barua, A., Kriebel, C. and Mukhopadhyay, T. (1991). Information Technology and Business Value. An analytical and empirical investigation. Information System Research, Vol. 6, No 1, pp 3-23.

Brynjolfsson 1993a. The productivity paradox of information technology. Communication of the ACM 35 (December) 66-67.

Brynjolfsson, E. and Hitt, L. M. (1996). Paradox Lost? Firm level Ecisence on Returns to Information Systems Spendings. Management Science, Vol. 142, No. 4, pp 541-558.

Brynjolfsson, E, and Hitt, L. M. (1998). Beyond the Productivity Paradox. Computer has Catalyse for Bigger Changes. Communication of the ACM, Vol 41, No 8, pp 49-55.

Brynjolfsson, E. and Hitt, L. M. (2000). Beyond Computation. Information Technology Organizational Transformation and Business Performance. Journal of Economic Perspectives, Vol. 14, No. 4 pp 23- 48.

Gill, G. (1996). Banking on a High-Tech Future. Chartered Institute of Bankers. Bankers Books, Emmanuel House, 4-9 Burgate Lane, Canterbury, Kent. Vol. 2, No. 4, p 20.

Kemerer, C. F. and Sosa, G. L. (1991). Systems Development Risks in Strategic Information Systems. Information and Software Technology, 33 (3 & 127) 212-223.

Lichtenberg, F. R. (1995). The Output Contributions of Computer Equipment and Personnel. A Firm Level Analysis. Economics of Innovations and New Technology, Vol. 3, pp 201-217.

Loveman, G. W. (1994). An Assessment of the Productivity Impact on Information Technologies. Research Studies I. J. Allen and M. S. Scoth Morton [eds] Oxford University Press New York.

Morrison, C. G. and Berndt, E. R. (1990). Asessing the productivity of information Technology Equipment in the US manufacturing Industries. National Bureau of Economic Research Workn Paper 3582.

Onanuga, A. T. and Oshinloye, M. O. B. (1999). Practice of Banking. A complete course text on banker-customer relationship, securities for bank lending and specialist bank services. Tunigraphic Print and Co, Ago-Iwoye.

Oyebisi, T. O., Ilori, M. O., Ogwu, L. O. and Adagunodo, E. R. (2000). A study on the assimilation of Information Technology in selected banks and insurance firms in Nigeria. Nigeria Financial Review, Vol. 9, No. 1, pp 57-69.

Patrick, F. (1985). Plastic and Electronic Money. New payment system and their implications. Washington D. C.

Talabi, S. A. and Onanuga, A. T. (1998). Lending Principles and Practices. (A complete course test on bank lending administration and control}: Ago-Iwoye, Tony Chris Nig. Enterprise.