European Journal of Business and Management
ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online)
Vol.7, No.28, 2015

Effect of Information and Communication Technology Investment on the Profitability of the Jordanian Commercial Banks

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Abstract

The objective of this research paper is to evaluate the effect of investment in information and communication technologies on the profitability and performance of the Jordanian commercial banks, whether it helps to improve sales or it helps to reduce the overall operating expenses. To arrive at this objective, the researchers used Cobb-Douglas production function as a proxy to measure these effects. The researchers used two measures of profit: ROA and ROE as dependent variables for this purpose, depending on the annual reports of the sample Jordanian commercial banks as a source for the raw data that was used in the analysis for the period between 2006 to 2013. SPSS was used as a statistical tool for the arrangement of data and mutable regression was used as a statistical tool for the analysis. From the analysis of the study, the following conclusion was reached: there is a positive effect of investment in information and technologies on the profitability and performance of the sample Jordanian commercial banks used in this research.
Keywords: Information and communication technology, Investment, Profitability, Commercial banks, Jordan.

Introduction

Information and communication technologies (ICTs) are now an integral part of organizational life in recent times. These technologies are being utilized in communications, decision making support, production or manufacturing and operation, and in administration or office work (Keramati, 2007). In general, such technologies have an undeniable impact on the various processes and dynamics in organizations. The impact of ICTs can be seen on both workers and organizations along the four dimensions: working time, working place(s), type of contract and work content (applied skills) (Gareis&Korte, 2002).

Recently, there has been a growing awareness on the significance of ICTs (Oladejo&Agbeja, 2012). This is, particularly, reflected in the growing investments in the information systems, and such investments, constitute a large part of firms' discretionary expenditures (Gu& Jung, 2013; Mithas et al. 2012).

Apparently, as Mithas et al. (2012) put it, "managers need to understand the likely impacts and mechanisms to justify and realize the value of their Information technology (IT) and related resource allocation processes". In this context, the impact of ICTs on profitability is of a particular importance. This is because; profitability is one of the most important factors for any successful business enterprise (Yang & El-Haik, 2003). It is a basic requirement and a necessary condition for developing and sustaining a business (Isaac, 2012; Pesonen, 2000; Bi & Zhang, 2008).

The information systems research has made a significant progress in relating information technology to firm performance and in demonstrating a relationship between IT and some aspect of firm value (Kohli& Grover, 2008; Mithas et al. 2012). However, on one hand, the current literature on the effects of information technology on profitability offers mixed and contradictory results, as some studies reported non-significant or negative IT contributions to business value, whereas, some other research found IT contributions very positive. This phenomenon has been referred to as ''IT productivity paradox'' or the "Solow computer paradox" (cf.Shu&Strassmann, 2005; Mithas et al. 2012). On the other hand, the literature also shows that, the effects of information technology on profitability may differ between industry sectors (for example, cf.Mithas et al. 2012). This class of literature suggests that, in order to advance and broaden our understanding of this difference as well as of the indicated paradox; it is important for researchers to continue investigating and exploring information-technology profitability relation, in the different sectors and in developed and developing economies. Hence, in this context, the present study is an effort to contribute to the literature in this area. It focuses on the banking sector and explores the impact of information technology on profitability in commercial banks in Jordan. ICTs have direct effects on how managers decide, plan and what products and services are offered in the banking industry. Such technologies have continued to change the way banks and their corporate relationships are organized worldwide and the variety of innovative devices available to enhance the speed and quality of service delivery (Agbolade, 2011).

Contribution of the Paper

This paper adds to the literature in two respects: on one hand, it addresses the banking industry, which is an intensive user of IT (Casolaro & Gobbi, 2007) and where there is the existence of what is called by "the profitability paradox" by Beccalli (2007). Indeed, empirical studies have shown inconsistency on the hypothesis that IT can improve bank's profitability (Ho & Mallick, 2006) and whether the level of investment in IT actually brings real benefits to the banks, is still a matter of debate in academic circles (Ugwuanyi & Ugwuanyi, 2013). This calls for the need for more analysis on IT productivity in the banking sector and in the service industry in general (Shu & Strassmann, 2005).

On the other hand, the country chosen for this study is The Hashemite Kingdom of Jordan, a developing Arab country whose banking sector have witnessed a great success in the last few years and this in turn created a high level of competition (Husni & Noor, 2011). In such an environment and for such an IT-intensive industry, this makes the question on the impact of IT on profitability, particularly important, since to the best of the authors' knowledge, this question has not been addressed much, if at all, in the literature; of relevance here is the banking sector in Jordan and indeed in the Arab world.

The rest of this paper is organized as follows. The first part outlines the contribution of the paper. The second part gives a brief overview of the Jordanian Banking industry. The third part presents a literature review. The fourth part explains the method and the data used in this study. The results obtained are presented and discussed in the fifth part. The last part includes the conclusion, limitations, and future work.

Literature Review

This part reviews relevant literature and findings of previous researches that addressed, the impact of information technology on the profitability in the banking sector. The studies conducted in the context of developed and developing countries, Jordan in particular, are presented herein to highlight the existing knowledge. As indicated earlier, the literatures investigating the effects of investments in information technology on profitability have been inconsistent with the hypothesis that IT can improve bank's profitability. As for the studies which addressed the indicated topic in developed countries, the paper of Gupta & Collins (1997) reported the results of an empirical study that evaluated the contribution of information systems to various productivity and efficiency measures in a bank. The paper used a survey that was mailed to the CIOs of all member banks of the Florida Bankers Association (FBA). It presented three main findings: First, there is a lack of rigorous analysis and theoretical framework that explores the link between IS investments and a bank's efficiency. Second, top IS professionals strongly feel the need to develop more rigorous cost-benefit methodologies that will help them sell the technology to top managements. Third, traditional measures of productivity, such as decrease in operating costs and increase in profits, continue to be the most popular measures of efficiency and return on investments, although these measures may not be suitable for information systems and technologies.

The study of Prasad & Harker (1997) examined the effect of IT investment on both productivity and profitability in the US retail banking sector. The paper concluded that additional investment in IT capital may have no real benefits and may be more of a strategic necessity to stay even with competitors. However, the results indicated that there are substantially high returns on increase in investment in IT labor, and that retail banks need to shift their emphasis on IT investment from capital to labor.

In their study on the contribution of information technology to banks' profit, the authors, Shu &Strassmann (2005) revealed that the data gathered in 1980 might not have pointed to a strong IT productivity in the banking industry, but their research using data from 12 US banks covering the period between 1989 to 1997 showed that IT is the only variable with positive marginal gain and its productivity is far better than labor. Holland, Lockett & Blackman (1997) argued that the broad competitive forces of information technology, globalization and deregulation destabilizes the banking industry, this leads to irrevocable changes and allow new entrants, disintermediation, innovation and customer changes on a much greater scale than has occurred in the past.

The research of Ho & Mallick (2006) analyzed how IT-related spending affect (both theoretically and empirically) bank profits via competition in financial services that are offered by the banks. The paper utilized a Hotelling model to examine the differential effects of the information technology (IT) on moderating the relationship between costs and revenue. The impact of IT on profitability was estimated using a panel of 68 US

banks over 20 years. The paper found that bank profits declined due to the adoption and diffusion of IT investment, reflecting negative network effects in the banking industry.

Casolaro&Gobbi (2007) analyzed the effects of investment in information technologies (IT) on the financial sector using micro-data from a panel of 600 Italian banks from the period between 1989–2000. Stochastic cost and profit functions were estimated allowing for individual banks' displacements from the best practice frontier and for non-neutral technological change. The results showed that both cost and profit frontier shifts were strongly correlated with IT capital accumulation.

As for studies on the topic concerned with the developing world, Mittal & Dhingra, (2007) used the method of Data Envelopment Analysis (DEA) to study the impact of computerization on Indian banks' profitability and productivity. Private sector banks, which took more IT initiative, were found to be more efficient in productivity and profitability parameters than public sector banks. The empirical study of Stella (2010) assessed the impact of ICTon the productivity of the Nigerian banking sector. The Transcendental Logarithmic Production function and the CAMEL rating were used for the study. The Results showed that bank output such as loans and other assets increased significantly with changes in expenditure on information communication technology. Information communication technology labor expenses impacted more on bank output than capital expenditure on ICT gadgets.

In Nigeria, Agbolade (2011) used a primary data sourced through a structured questionnaire administered to selected banks in the south-west region of the country and the Ordinary Least Square approach of econometric techniques was used to examine the nature of the relationship that exists between Banks Profitability and the Adoption of Information and Communication Technology. The data analysis showed that a positive correlation exists between ICT and banks' profitability in Nigeria. On the contrary, in their analysis of four Nigerian banks, using data generated from annual financial reports of the sampled banks for a seven-year period (2005 to 2011), and by applying ordinary least squares (OLS) statistics stated in a multiple form to data generated, (Ugwuanyi & Ugwuanyi (2013) suggested that a negative relationship existed between information technology expenditure and bank profitability, indicating that IT expenditures of all the studied banks do not increase bank profitability, but rather, decreases it insignificantly.

Also, a systematic keyword search of the published Arabic and English language literature, using various electronic databases, failed to identify any article dealing specifically with the impact of information technology on profitability in banks in the Arab countries. In relation to Jordan in particular, only one study wasfound, whereas, other studieswere mostly concerned with the impact of electronic banking services on the Profits. Mashal (2006) examined the effect of IT investment in productivity and profitability by analyzing data from the Arab Bank, one of the leading banks in Jordan, during the period between 1985 to 2004. The results indicated that there are substantial returns due to an increase in investment in IT capital, a fact which incentivizes the bank's management to shift its emphasis on IT investment from labor to capital.

Siam (2006) examined the effects of electronic banking on bank's profitability. The author concluded that the impact of electronic banking on bank's profitability will be a feature of the short run due to the capital investment by the banks on infrastructure and training, but, it will be positive in the long run. In the same regard, Khrawish & Al-Sa'di (2011) tested the effect of e-banking services provided by banks on the internet on the profitability of these banks. The regression analysis showed that, there is no significant impact of e-banking services on the profitability of recent adopter's banks in terms of ROA, and ROE. For early adopters, the results were much better than those for the early adopters, but still not significant with the profitability of these banks.

Methodology

This research investigated the relationship and the magnitude of investment in information technology and bank profit by using the basic model of Cobb-Douglas production function that was used by Weslely Shu and Paul A. Strassmann (2005), this was done after changing the and making some modification in the independent variables. In this paper, the researchers relied on the historic panel data of the Jordanian commercial banks. We chose five commercial banks (Arab Bank, Arab Banking Corporation, Housing Bank, Cairo Amman Bank and Capital Bank of Jordan) as sample data banks that have an investment budget related to information technology in their annual reports, (income statement and balance sheets) for the period between 2006-2013.

The model of this paper was structured in a way that showed the effect of IT investment in the sample banks on the profitability of these banks. The researchers used two equations of Cobb-Douglass production function to test the effect of IT investment on the profitability of the sample banks, the first equation is stated as follows:

1) $\ln Yit\ (ROA) = a + \beta\ \ln ITit + \beta\ \ln NIOEit + \beta\ \ln Bit + \beta\ \ln BSit + \beta\ \ln Cit + \beta\ \ln MPit + \beta\ \ln INit + \beta\ \ln Lit + vit$

And the second equation is as follows:

2) $\ln Yit\ (ROE) = a + \beta\ \ln ITit + \beta\ \ln NIOEit + \beta\ \ln Bit + \beta\ \ln BSit + \beta\ \ln Cit + \beta\ \ln MPit + \beta\ \ln INit + \beta\ \ln Lit + vit$

The dependent variables are calculated as follows:

1) The ROA is calculated as the ratio of net profit after tax divided by total fixed assets.
2) The ROE is calculated as the ratio of net profit after tax divided by total shareholder equities.

The independent variables were calculated as follows:

1) IT (technology investment) which include the investment in all information and communications technology and all expenses covering hardwares and softwares and any other related expenses.
2) NIOE: Non-Interest plus other operating expenses on IT equipment.
3) B : the total number of branches in Jordan and abroad.
4) BS: Bank size, which is measured by the core deposit (current, demand, and savings) accounts.
5) C : direct credit facilities.
6) IN : Interest expenses.
7) L : Employees and labor cost.
8) M : Management performance, which is measured by the ratio of credit on deposit.

Analytical result

To obtain the objectives of this research and before we run the regression analysis on the two equations to see the effect of ICT investment on the profitability of the sample of Jordanian commercial banks, we used the Variance Inflation Factor (VIF) and test variability allowed Tolerance between independent variables to clarify if there is a multicollinearity problem between the independent variables. Table 1 shows the correlation information of the independent variables of the sample banks.The test shows that there is a high correlation between some independent variables (Multicollinearity), depending on the Variance Inflation Factor (VIF) and variability allowed Tolerance test for each variable which should not exceed the inflation coefficient value of 10 and Tolerance should be greater than 0.05.As shown in Table 1, there is a multicollinearity between two independent variables (number of branches and bank size). This is not surprising, because multicollinearity is expected for turnover functions since in production relationships, output over time is a function of the amounts of various quantities of input employed (Hill, Griffiths & Jodge, 1997). Therefore, we concluded that there is no significant effect of Variance Inflation Factor problem with the reliability of the study model. Table 1 shows the result of this test.

Table 1. Multicollinearity test of the independent variables by using VIF& Tolerance Test

Variable	VIF	Tolerance
ICT Budget	7.625	.057
Non-Interest & Operating Expenses	6.221	.072
Number of Branches	13.702	.043
Bank size	11.936	.021
Direct Credit Facilities	9.312	.062
Management Performance %	8.214	.098
Interest Expenses	5.793	.073
Labor Cost	6.470	.052

Table 2 The descriptive statistic of the independent and dependent variables

	N	Minimum	Maximum	Mean	Std. Deviation
ICT Budget	40	674456.000	21644000.000	7972604.72500	6614093.460719
Non-Interest & Operating Expenses	40	11246503.000	344334000.000	98247288.25000	118349299.886219
Number of Branches	40	5	189	84.13	64.625
Bank size	40	82303498.000	7044753000.000	1755772713.07500	2102841093.199791
Direct Credit Facilities	40	240529765.000	10839672000.000	2786939867.00000	3698994728.197894
Management Performance %	40	43.8	93.2	58.345	11.8224
Interest Expenses	40	12436520.000	640236000.000	127410939.60000	171266777.781356
Labor Cost	40	5218072.000	191729000.000	53984213.00000	61803620.376968
Profitability (Return on Assets) ROA %	40	.1	2.6	1.510	.5320
Profitability (Return On Equity) ROE %	40	.7	18.5	10.927	4.4955
Valid N (list wise)	40				

In the first step of regression analysis, we used Equation 1 to assess the effect of IT investment and other independent variables on the output measure of ROA

1) $\ln Yit\ (ROA) = a + \beta\ \ln ITit + \beta\ \ln NIOEit + \beta\ \ln Bit + \beta\ \ln BSit + \beta\ \ln Cit + \beta\ \ln MPit + \beta\ \ln INit + \beta\ \ln Lit + vit$

And Table 3 shows the results of the statistical analysis of data on the factors that affected the ROA during the period between 2006-2013, and through the use of software (SPSS), and keep the definition of variables as it is according to the methodology of the study, the statistics contained in the table are as follows: representing the re3ression coefficient, and the values of "t", and "F" calculated, and notes from the table that form are statistically significant at the 5% level.

Table 3. Multiple regression result when output is (ROA)

Independent variable	βi	T-Value	Sig.
Constant	.045	.401	.488
ICT Budget	2.03	.935	.357
Non-Interest & Operating Expenses	1.03	598	.036
Number of Branches	1.029	.625	.537
Bank size	.087	.613	.911
Direct Credit Facilities	1.23	.327	.268
Management Performance %	1.025	.691	.945
Interest Expenses	.103	.471	.865
Labor Cost	2.040	.986	.056
F-Value	3.443		
Sig.	.0618		

And to understand the effect of the independent variable (ICT Investment)on the dependent variable (ROA) which explained the changes that may occur in the dependent variable, the researchers ran a single regression analysis, and Table 4 shows the result of this analysis. As indicated in Table 4, the variation (R) is 0.521, which means that all independent factors combined have a positive impact on the ROA, and R square, which explains what amount (27.1%) of change occur in the dependent variable (ROA), and adjusted R square, which indicated that 72.9% of the changes that occur in the independent variable occur as a result of other non-specific variables as shown in Table 4.

Table 4. Effect of ICT on the dependent variable ROA

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.521	.571	.383	.64816

Table 5 ANOVA analysis

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	39.691	9	6.301	29.021	.298
Residual	19.137	30	4.323		
Total	58.728	39			

Table 5 shows the calculated value of F (29.021), which is more than the critical value (2.51061) at the 5% level of significance, which means that the relationship between the independent variable, ICT and the dependent variable, ROA is positive. This means that ICT has a positive effect on the profitability of Jordanian commercial banks.

Table 6 The overall Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.947[a]	.897	.866	.1947

In the second step of regression analysis, we used Equation 2 to assess the effect of IT investment and other independent variables on the output measure of ROE:

2) $\ln Yit\ (ROE) = a + \beta\ \ln ITit + \beta\ \ln NIOEit + \beta\ \ln Bit + \beta\ \ln BSit + \beta\ \ln Cit + \beta\ \ln MPit + \beta\ \ln INit + \beta\ \ln Lit + vit$

Table 7 shows the results of the statistical analysis of data on the factors that affect the ROE during the period between 2006-2013, and through the use of software (SPSS), and keep the definition of variables as it is according to the methodology of the study, the statistics contained in the table are as follows: representing the regression coefficient, and the values of "t", and "F" calculated, and notes from the table that form are statistically significant at the 5% level.

Table 7 multiple regression result when output is (ROE)

Independent variable	βi	T-Value	Sig.
Constant	0.046	.391	.207
ICT Budget	2.035	.825	.269
Non-Interest & Operating Expenses	0.06	.646	.005
Number of Branches	0.04	.483	.324
Bank size	1.04	.722	.827
Direct Credit Facilities	1.08	.787	.056
Management Performance %	.056	.835	.972
Interest Expenses	0.03	.579	.567
Labor Cost	1.01	.573	.015
F-Value	3.474		
Sig.	.06		

To understand the effect of the independent variable (ICT Investment) on the dependent variable (ROE) which explains the changes that may occur in the dependent variable, the researchers ran a single regression analysis, and Table 8 shows the result of this analysis. And as indicated in Table 8 which shows the variation (R) as 68.8%, which means that all independent factors combined have a positive impact on the ROE, and R square,which explains what amount (47.3%) of the changes occur in the dependent variable (ROE), and adjusted

R square which indicated that 33.7% of the changes that occur in the independent variable occur as a result of other non-specific variables as shown in Table 8.

Table 8. Effect of IT Investment on the dependent variable ROE

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.688	.573	.337	.56868

As Table 8 shows the calculated value of F (29.021), which is more than the critical value (2.51061) at 5% level of significance, which means that the relationship between the independent variable, ICT and the dependent variable, ROA is positive. This means that ICT have a positive effect on the profitability of Jordanian commercial banks.

Table 9 ANOVA Analysis

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	45.761	9	6.763	32.603	.214
Residual	22.419	30	4.614		
Total	68.180	39			

Table 10 overall model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.973[a]	.946	.930	1.1891

Conclusion

This research revealed that ICT investment has a positive impact on the profitability of Jordanian commercial banks.This was specified by the regression and model summary in Tables 3, 4 and 5 for the first model when ROA represented output and Tables 7, 8 and 9 for the second model when ROE represented output. These tables showed that the coefficient of determination, R and the coefficient of multiple determination, R square explains the extent to which the independent variables affected the dependent variable which are relatively above 50%. As for F ratio and T test, they showed that our models fit. We therefore conclude that ICT investment in the sample Jordanian commercial banks increase profitability and performance.

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