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## The Impact of Information and Communication Technology Investments on the Performance of Lebanese Banks

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R.M. Mahboub<sup>1</sup>

**Abstract:**

*Previous research on the relationship between investment in information and communication technology (ICT) and bank performance (BP) have been obviously disagreeing. This is because some posit a positive relationship and some argue to the contrary.*

*Thus, this research contribute to the ongoing debate regarding the contribution of ICT to BP by looking at the impact of ICT investments on the performance of a sample of 50 Lebanese banks for the period 2009-2016.*

*Secondary data were collected from the annual report for each bank. CAMELS model is chosen as the dependent variable, while ICT investments (adoption of automated teller machines (ATM), mobile banking (MB), internet banking (IB), telephone banking (TB), debit and credit cards (BC) and point of sale (POS) terminals) is the independent variable.*

*Using multivariate OLS model, the results demonstrate that the application ATM, IB, TB and POS terminals does not significantly affect banks performance. However, the application of MB and offering BC to customers significantly and directly affects performance of banks in Lebanon.*

*Thus, banks in Lebanon are recommended to find a way to increase interest of Lebanese consumers in MB applications and attract more customers by offering them a range of BC tailored to fit their preferences.*

**Keywords:** *ICT, Bank Performance, CAMELS, Lebanon.*

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<sup>1</sup>Beirut Arab University, Beirut, Lebanon, [r.mahboub@bau.edu.lb](mailto:r.mahboub@bau.edu.lb)

## **1. Introduction**

Today's business environment is extremely vigorous and encounters quick changes as a consequence of creativity, universal competition, rapid disseminating of knowledge, continual technology advancement, innovation, increased consciousness and demands from customers (Agbolade, 2011; Talegeta, 2014). Thus, business firms, specifically the banking industry, are required to react rapidly to the dynamics of quick changing customers' anticipations (Nigussie, 2015; Grima *et al.*, 2016; Grima and Caruana, 2017). Hence, to be able to remain alive and surpass in this fierce universally competitive market, every bank must embrace ICT in its business operations to enhance the efficiency and effectiveness of services provided to customers, ameliorate business processes, as well as to improve managerial decision making and working group cooperations (Luka and Frank, 2012; Adesola *et al.*, 2013; Thalassinou *et al.*, 2012; 2013b).

Thus, the latest developments in the technological world of the latest decade of the twentieth century has enforced the banks to adopt ICT as a strategy for their continuous growing in an extended competitive environment (Juma, 2013). The usage of ICT in banking operations is named electronic (e) - banking (Victor *et al.*, 2015). This tendency have bring about outstanding changes in the manners banks are run in modern times (Binuyo and Aregbesola, 2014). In this manner, the introduction of ICT has altered hand operated and traditional forms of carrying out business and is being substituted by the highly developed technology that is depend on automatism and linkage of computers and other computerized machines (Adesola *et al.*, 2013). Therefore, new delivery technologies along e banking products like IB, MB, POS terminals and numerous ATM products are currently substituting the traditional delivery methods (Mensah, 2016; Ozen *et al.*, 2014).

Various studies have revealed converting the banking system from traditional to automated based have promote support in business operations and aid as competitive advantage for realizing higher efficiency; branch productivity; control of operations; customer service; accurate fund transfer; risk management; maintaining customer; real time information system; diminishing human errors; diminution of branch offices; lessening the number of branch staff, enhancement in service delivery; and minimizing of cost by substituting paper based and labor intensive methods with computerized processes (Aliyu *et al.*, 2012; Wondimu, 2013; Sarji, 2017). This will enhance the performance of banks, reducing the costs, and rising profits (Sumra *et al.*, 2011; Kosinova *et al.*, 2016; Japparova and Rupeika-Apoga, 2017).

On the other hand, some researchers such as Saatcioglu *et al.* (2001), Malhotra and Singh (2009), Wondimu (2013) and Okibo and Wario (2014) contend that despite e banking has a benefit; it also has major pitfalls that can harm BP and lessen service quality. Thus even though e banking provides new opportunities to banks, but it also raises numerous challenges as the innovation of IT applications; the blurring of market boundaries; the breaking of industrial barriers; the potential of fraud on

customers' account; the entry of new competitors; the development of new business models; the staff challenges; and the great direct and indirect costs such as training costs, installations costs, and service costs (Saatcioglu *et al.*, 2001; Kipasha, 2013; Ibrahim and Muhammad, 2013; Okibo and Wario, 2014; Thalassinos *et al.*, 2013a; Vovchenko *et al.*, 2017). These circumstances will slash the profitability of banks.

Hence, the association between ICT investments and performance has attracted the attention of researchers in numerous countries in latest times (Binuyo and Aregbeshola, 2014). However, the results from previous studies on the relationship between investment in ICT and business performance have been obviously disagreeing (Ibrahim and Muhammad, 2013). Thus, whether the amount of investments in ICT certainly carries actual benefits to the banks or not is still a matter of interest in academic circles (Binuyo and Aregbeshola, 2014). This is because while some postulate a positive relationship between ICT investments and performance (Becchetti *et al.*, 2003; Hernando and Nunez, 2004; Indjikian and Siegel, 2005; Moriones and Lopez, 2007; Badescu and Ayerbe, 2009) some others contend to the contrary (Malhotra and Singh, 2009; Willy and Obinne, 2013).

There is a necessity for additional studies to contribute to the continuing debate on the nature of the relationship between ICT investments and BP specially in developing countries. Consequently, this research aims at closing the research gap by looking at the impact of ICT investments that have on the performance of one of the leading sectors in the Lebanese economy, namely its banking sector to understand its important influence on their operations to guarantee their growth and profitability.

The rest of the research is organised as follows: section 2 presents a review of related literatures, the components of the conceptual framework and development of hypotheses. The research methodology is discussed in section 3 while section 4 presents the research findings and analysis of the findings. Finally, section 5 presents the conclusions, limitations and future research.

## **2. Literature Review and Hypotheses Development**

There is a rapid growing literature on ICT and BP (Dehghan *et al.*, 2015; Asia, 2015; Mensah, 2016; Siddik *et al.*, 2016; Vekya, 2017; Kiragu, 2017). However, most of the literatures exist were carried out at the developed countries, leaving the developing countries extremely beyond despite the thorough employment of the ICT in the banking sector of these countries (Ogunyomi and Obi, 2016). Despite the likely benefits of ICT, there is debate about whether and how their investments enhance BP (Malhotra and Singh 2009; Karim and Hamdan, 2010; Leckey *et al.*, 2011; Agbolade, 2011; Sumra *et al.*, 2011). The results from prior literatures of the impact of ICT on the performance of the banking sector in both developed and less developed countries yields conflicting results (Ibrahim and Muhammad, 2013).

Thus, it is at the center of such varied conclusions that creates and entails the need to make a study from a Lebanese context to establish the impact of ICT investments on BP. Therefore, this research will address the following research question: What is the impact of ICT investments on financial performance of banks in Lebanon?

Numerous efforts have been made to explore the impact of e banking on BP (Table 1). For instance, Siam (2006) aimed at investigating the effect of e banking on bank's profitability of twenty Jordanian banks based on a questionnaire that was disseminated over the twenty working banks in Jordan. The findings of the study are the effect of e banking on banks profitability will be attribute of the short run owing to the capital investment by the Jordanian banks on infrastructure and training but will be positive on the long run.

Furthermore, Hernando and Nieto (2007) aimed at identifying and assessing the effect of the adoption of a transactional web site on financial performance using a sample of seventy-two commercial banks operating in Spain over the period 1994-2002 based on data take out from the regulatory database of Banco de España. The results found that the effect on BP of transactional web adoption takes time to come into sight. The adoption of the internet as a delivery channel comprises a gradual diminution in overhead expenses. This effect is significant after one and a half years after adoption. The cost cutting translates into an enhancement in banks' profitability, which becomes significant after one and a half years in terms of return on assets (ROA) and after three years in terms of return on equity (ROE).

Similarly, Onay *et al.* (2008) investigated the effect of IB on financial performance of fourteen commercial and savings banks in Turkey following the approach of Hernando and Nieto (2007) for the period between 1996 and 2005 based on a dataset that is extracted from income statements and statements of financial position found in the Bank-Scope Database for Turkish banks. The findings provide some confirmation that investment in ebanking is a gradual process. The IB has had a positive impact on the performance of the banking system in Turkey in terms of ROE only with a lag of two years approving the findings of Hernando and Nieto while a negative effect is detected for one year lagged dummy.

In the same vein, Malhotra and Singh (2009) seek to investigate the effect of IB on BP in India. Using information drawn from the survey of eighty-five scheduled commercial bank's websites, during the period of 1998-2006, the results show that nearly 57 percent of the Indian commercial banks are providing transactional IB services. The results specify also that there is no significant relationship between adoption of IB by banks and their performance. Thus, the adoption of IB was a cause beyond the lesser profitability of these banks, as IB in new private sector were running with greater cost of operations, thus influencing negatively the profitability of these banks.

In addition, Karim and Hamdan (2010) studied the impact of information technology (IT) on enhancing the performance of all the fifteen Jordanian banks for the period of 2003-2007 using bank data. The results showed that there is an effect on the usage of MIS in Jordanian banks in the market value added (MVA), earnings per share (EPS), ROA, net profit margin (NPM). The results also indicated that there is no effect of the usage of MIS in Jordanian banks to enhance the ROE.

Moreover, Leckey *et al.* (2011) attempt to determine and document the extent to which investment in IT by banks in Ghana can impact their profitability using the Balanced Scorecard (BSC) framework based on an extensive panel dataset of fifteen banks sampled from the Ghanaian banking industry over a 10-year period (1998-2007). The results demonstrated that banks that keep high levels of investments in IT enlarged ROA and ROE.

Besides, Agbolade (2011) investigated the nature of the association that exist between banks profitability and the adoption of ICT for a sample of three banks in south-west Nigeria through a structured questionnaire directed to ninety personnel. The results revealed that a positive correlation exists between ICT and banks profitability in Nigeria. This indicates that a marginal change in the level of the investment and adoption of ICT in the banking industry will result to a proportional increase in the profit level.

Likewise, Sumra *et al.* (2011) aimed at investigating the effect of e banking on the profits of Pakistani banks based on a survey conducted by interviewing the managers of twelve bank in Pakistan. The findings indicated that ebanking has increased the profitability of banks largely as well as it has allowed the banks to meet their costs and obtain profits even in the short period.

Khrawish and Al-Sa'di (2011) aimed to assess the impact of e banking services offered by banks on the internet on the profitability of these banks during the period 2000-2009. For the sample used all domestic banks in Jordan divided into 3 groups (early adopters of the service, recent adopters of the service, and non-internet service providers) based on the financial and operational data disclosed in the annual reports of these banks. The results indicated that there is no significant effect of e banking services on the profitability of recent adopter's banks in terms of ROA, and ROE. It gives a signal of high expenses and cost associated with executing these services. The study further demonstrated that margins significantly influenced by the e banking services.

As well, Willy and Obinne (2013) assessed the impact of IT investment on bank returns for a sample of four banks in Nigeria. By depending greatly on historic data that were extracted from annual financial reports of the sampled banks for a seven-year period from 2005 to 2011. The findings suggested that IT expenditure has a negative relation with bank profitability demonstrating that IT expenditures of all the studied banks do not increase bank profitability, but rather declines it insignificantly.

Inparallel, Kholousi (2013) aimed at examining the association between e banking and banks profitability in all nine banks of Tehran Stock Exchange during 2006-2010 based on a data collected from using financial reports and Rahavard- Novin software. The main findings indicated that electronic services growth has a notable effect on banks profitability increase. This effect has the greatest value in ROA and the smallest value in NPM. Thus, banks must renovate and update banking electronic services and afford customers with simple access to these services.

Adesola *et al.* (2013) examined the effect of ICT on the Nigerian banks operations regarding speed of banking operations, efficient service delivery, workers' performance and bank's profit level, using United Bank for Africa (UBA) Plc. as a case study. Based on the usage of a self-designed structured questionnaire that was directed to fifty staff of ten branches of UBA Plc; the findings demonstrated the use of ICT contributed significantly to the speed of banking operations, efficient service delivery, workers' performance and bank's profit level.

In the same way, Ogare (2013) aimed to establish the impact of ebanking on the financial performance of forty-four commercial banks in Kenya based on a data attained from the central bank of Kenya and from audited financial statements of commercial banks for the period 2008 to 2012. The results demonstrated that ebanking has a strong and significant impact on the profitability of commercial banks in the Kenyan banking industry. Thus, there exists positive relation between ebanking and BP.

Alike, Binuyo and Aregbeshola (2014) evaluated the effect of ICT on the performance of four biggest banks in South African using bank annual data over the period 1990–2012 using the orthogonal transformation approach. The results indicated that the usage of ICT increases return on capital employed (ROC) as well as ROA of the South African banking industry. The study realizes that more of the contribution to performance be from ICT cost efficiency contrasted to investment in ICT.

More than that, Jegede (2014) examined the impact of ATM on the performance of five Nigerian banks based on a questionnaire that served 125 employees of the five chosen banks in Lagos State. The findings revealed that the utilization of ATM terminals have averagely enhanced the performance of Nigerian banks due to the alarming rate of ATM fraud. The Nigerian banks are aggressively encouraging issuance and usage of ATM cards, credit cards, debit cards, and smart cards to improve their performance and destroy competition.

By the same token, Victor *et al.* (2015) investigated the effect of ICT and financial innovation on the performance of selected eleven commercial banks in Nigeria over the period 2001 to 2013 based on a data collected from the banks' annual reports and CBN fact-books. The results revealed that an increase in banks' profitability

performance increases commercial banks' ROE. However, investments in e banking services and ATMs do not certainly enhance banks' performance.

Also, Dehghan *et al.* (2015) aimed to evaluate the impact of the implementation of main banking services (IB, MB, TB, POS, ATM, and electronic money (EM)) on profitability of twenty-four branches grades 1, 2 and 3 in Mashhad- Iran over a period from 2010 to 2012. Based on a data that were extracted from financial reporting programs and analytical software utilized in the banks. The results demonstrated a significant association between the application of IB and ATM and profitability, while there is no significant association between the application of TB, MB, POS, and EM and profitability.

Along with, Asia (2015) investigated the contribution of ebanking towards performance of banking institutions in Rwanda based on a case study of Bank of Kigali for a period of five years from 2008 to 2012. The study was based on a questionnaire embracing forty-four of bank of Kigali employees from head office specifically from the department of accounting and finance, audit and IT. The results revealed that e banking system like ATM, pay direct, electronic check conversion, mobile telephone banking and E transact has a great effect on BP as they increase profitability, decrease bank cost of operations, and increase bank asset and bank efficiency.

Aside from, Mensah (2016) examined the effect of ICT on the performance of twenty selected rural banks in Ghana utilizing annual financial data stream from 2011 to 2014. Using panel data regression, the results revealed that ICT cost efficiency has a significant impact on the performance of the rural banks. The results further indicated that investment in ICT has little effect on the performance of the rural banks. Thus, as opposed to investing in new ICT facilities, the rural banks can use their existing capacities by altering the financial products and services they provide to their customers and this will have more impact on their performance than making new investment taking into consideration competition from the rural banking industry.

What's more, Siddik *et al.* (2016) empirically examined the effect of ebanking on the performance of a sample of thirteen private commercial banks in Bangladesh over the period of 2003 to 2013 based on questionnaires that were delivered to the respective banks' head office or MIS department through personal visits. The findings show that ebanking starts to contribute positively to banks' ROE with a time lag of two years while a negative effect was found in initial year of adoption. Overall, empirical findings of the study approve some findings in previous studies that e banking has gradual positive effect on BP.

Nevertheless, Vekya (2017) sought to identify the effect of ebanking on the profitability of forty-three commercial banks in Kenya for the period of nine years from 2007 to 2015 based on a census survey. Findings from multiple regression

revealed that there is positive significant association between ATM transactions and bank profitability. Additionally, the study found a positive significant association between POS transactions and bank profitability. The study reached at the conclusion that mobile transactions do not influence performance of commercial bank.

Identically, Kiragu (2017) aimed to examine the effect of e banking in Kenya on the financial performance of the top five Kenyan banks providing ebanking based on personal interviews with 60 respondents in addition to the application of both open-ended and closed questionnaires. The key findings revealed that bank profits have riseexcessively after the introduction of e banking in the banks included in the study.

**Table 1. Summary of Previous Research Studies**

<b>Researcher (s)</b>	<b>Time Period</b>	<b>Country</b>	<b>Sample Size</b>	<b>Data Collection Method (s)</b>	<b>Key Findings</b>
<b>Siam (2006)</b>	–	Jordan	20 Banks	Questionnaire	The impact of e banking on banks profitability will be feature of the short run.
<b>Hernando and Nieto (2007)</b>	1994-2002	Spain	72 Commercial Banks	Database of Banco de España	The impact on BP of transactional web adoption takes time to appear.
<b>Onay et al. (2008)</b>	1996-2005	Turkey	14 Commercial & Savings Banks	Income Statements & Balance Sheets	The IB has a positive effect on the performance of the banking system.
<b>Malhotra &amp; Singh (2009)</b>	1998-2006	India	85 Commercial Banks	Survey	No significant association between adoption of IB by banks & their performance.
<b>Karim &amp; Hamdan (2010)</b>	2003-2007	Jordan	15 Banks	Bank Data	There is an impact on the use of MIS on MVA, EPS, ROA & NPM.
<b>Leckey et al. (2011)</b>	1998-2007	Ghana	15 Banks	BSC Framework	Maintain high levels of investments in IT increased

					ROA & ROE.
<b>Agbolade (2011)</b>	–	Nigeria	3 Banks	Questionnaire	A positive correlation exists between ICT & banks profitability.
<b>Sumra et al. (2011)</b>	–	Pakistan	15 Banks	Interview	E banking has increased the profitability of banks.
<b>Willy &amp; Obinne (2013)</b>	2005-2011	Nigeria	4 Banks	Annual Financial Reports	IT expenditure has a negative relation with bank profitability.
<b>Kholousi (2013)</b>	2006-2010	Iran	9 Banks	Financial Reports & Rahavard-Novin Software	Electronic services growth has a remarkable impact on banks profitability.
<b>Adesola et al. (2013)</b>	–	Nigeria	10 Branches of UBA Bank	Questionnaire	Usage of ICT contributed significantly to the bank's profit.

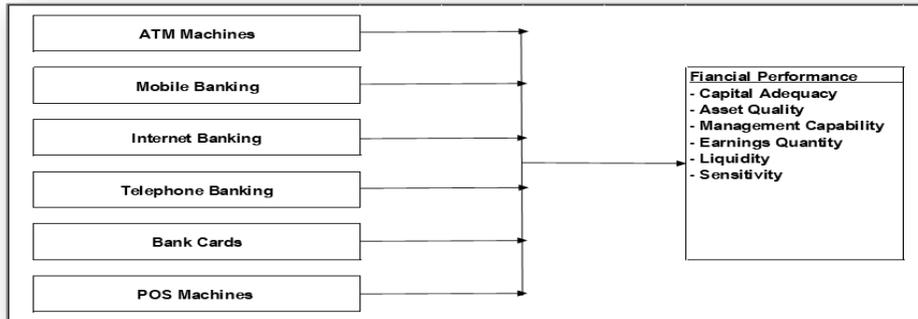
**Table 1.** *Summary of Previous Research Studies (Continue)*

<b>Ogare (2013)</b>	2008-2012	Kenya	44 Commercial Banks	Central Bank & Audited Financial Statements	There exists positive relation between e banking & BP.
<b>Binuyo &amp; Aregbesho la (2014)</b>	1990-2012	South Africa	4 Biggest Banks	Orthogonal Transformation Approach	The use of ICT increases ROC & ROA.
<b>Jegede (2014)</b>	–	Nigeria	5 Banks	Questionnaire	The deployment of ATM terminals have improved the performance of Nigerian banks.
<b>Victor et al. (2015)</b>	2001-2013	Nigeria	11 Commercial Banks	Banks' Annual Reports & CBN Fact-Books	Investments in e banking services & ATMs do not improve BP.

<b>Dehghan et al. (2015)</b>	2010-2012	Iran	59 Branches in Mashhad	Financial Reporting Programs & Analytical Software	A significant relation between IB & ATM & profitability, as well insignificant relation between TB, MB, POS, & EM & profitability.
<b>Asia (2015)</b>	2008-2012	Rwanda	Kigali Bank	Questionnaire	Banking system has a great impact on BP.
<b>Mensah (2016)</b>	2011-2014	Ghana	20 Rural Banks	Annual Financial Data	Investment in ICT has little impact on the performance of the rural banks.
<b>Siddik et al. (2016)</b>	2003-2013	Bangladesh	13 Commercial Banks	Questionnaire	E banking has gradual positive impacts on BP.
<b>Vekya (2017)</b>	2007-2015	Kenya	43 Commercial Banks	Census Survey	There is a positive significant relation between ATM & POS transactions & bank profitability.
<b>Kiragu (2017)</b>	–	Kenya	5 Top Banks	Interview & Questionnaire	Bank profits have gone up after the introduction of e banking.

*Source: Developed by the Researcher*

Based on the insights obtained from discussion and review of the literature, the following conceptual framework displaying the relationship between independent variables and dependent variable was generated (Figure 1). It could be realized from the explained empirical literatures that the impact of ebanking on the performance of banks provides diverse evidences and thus inconclusive. Some scholars noticed positive impact, some perceived negative while other researchers have observed mixed conclusions. Nevertheless, the newest studies appear to find a positive relationship with BP. It could be contended that as the intensity in the usage of ICT increases, the financial performance of multichannel banks is possible to enhance. Consequently, after a comprehensive and extensive review of literature, and to confirm the above findings the following hypotheses were developed:

**Figure 1.** Conceptual Framework

*Source:* Developed by the Researcher

- H<sub>1</sub>:** There is a positive relation between adoption of ATM banking and banks performance in Lebanon.
- H<sub>2</sub>:** There is a positive relation between adoption of internet banking and banks performance in Lebanon.
- H<sub>3</sub>:** There is a positive relation between adoption of mobile banking and banks performance in Lebanon.
- H<sub>4</sub>:** There is a positive relation between adoption of telephone banking and banks performance in Lebanon.
- H<sub>5</sub>:** There is a positive relation between offering bank cards and banks performance in Lebanon.
- H<sub>6</sub>:** There is a positive relation between offering POS service and banks performance in Lebanon.

### 3. Research Methodology

#### 3.1 Population and Sample Size

For the purpose of this research, the sample used comprises by fifty selected banks out of sixty-five banks in Lebanon. Thus, compared to the population, the sample is quite big, which makes it acceptable for drawing inferences (Table 2). The research employed purposive sampling technique to choose the required sample of banks from all banks operated in the country. The selection criteria put by the researcher was first, the banks are operated in Lebanon, second the banks have websites, and third they publish annual reports in their websites for a period of eight successive years from 2009 to 2016 because this is the period that witnessed the major growth of e banking services in Lebanon.

**Table 2.** Population and Sample Size

	Population	Sample
Lebanese Banks S.A.L.	32	29
Lebanese Banks S.A.L. Arab with Control	7	7
Arab Banks	7	5
Foreign Banks	3	1
Investment Banks	16	8
<b>Total</b>	<b>65</b>	<b>50</b>

Source: ABL, 2018.

### 3.2 Sources of Data

For the purpose of this research, the researcher has used secondary data sources to examine the impact of ICT investments on financial performance among banks. Data for the research were therefore retrieved from the annual reports of the banks under consideration for a period spanning from 2009 to 2016. The data for relevant variables comprises deposits, equity, investments, assets, admin expense, interest income, net income, cash, cash equivalents, current liabilities, doubtful debts, loans, number of debit and credit cards and number of ATM devices.

### 3.3 Measurement of Variables

*Dependent Variable:* A close look at the literature of firm performance demonstrates that various measures have been adopted by the researchers to measure the performance (Al Matari *et al.*, 2014). Among them are ROA, ROE, NPM, EPS, ROC, MVA and Net Profit. Although these measures are frequently used in previous studies, this research has used CAMELS model- the newest tool today- to measure the financial performance (FP) (the dependent variable) of the banking sector following Fu Qiang and Sajid (2014), Asia (2015), as well as Muhmad and Hashim (2015). This model is very effective, efficient and precise to be utilized as a performance evaluator in banking industries and to predict the future and relative risk (Rostami, 2015). CAMELS stands for Capital adequacy (CA), Asset quality (AQ), Management capability (MC), Earning quantity and quality (EC), Liquidity (LQ), and Sensitivity (SN) (Singh and Jain, 2017). Thus, the FP was measured in this research based on six variables of the CAMELS models. First, a sub rating for each variable of each individual annual report was calculated by the following formulas: CA: total deposits/total equity (Ishaq *et al.*, 2016); AQ: total investments/total assets (Singh and Jain, 2017); MC: admin expenses/interest income (Ishaq *et al.*, 2016); EC: net income/total assets (Karapinar and Dogan, 2015); LQ: cash and cash equivalents/current liabilities (Ishaq *et al.*, 2016); and SN: doubtful debts/loans (Rostami, 2015). Second, a composite rating of each individual annual report was computed. Third, rating from one to five was allocated for each composite rating of each individual annual report (Table 3).

**Table 3.** Composite CAMELs Ratings

Rating	Composite Range	Description
1	1.00-1.49	Strong
2	1.50-2.49	Satisfactory
3	2.50-3.49	Fair
4	3.50-4.49	Marginal
5	4.50-5.00	Unsatisfactory

Source: Ahsan, 2016.

*Independent Variable:* Since the aim of this research is to investigate the impact of ICT investments on bank financial performance, thus ICT investments is the independent variable. It was measured by: adoption of ATM - the number of ATM systems install by the banks (Abebe, 2016), it takes the value of one if the number of ATM  $\geq 9$  (median) and the value of zero if the number of ATM  $< 9$ . Adoption of MB - it takes the value of zero if the MB activities is not adopted and one if the MB is adopted (Halili, 2014). Adoption of IB - it takes a value of one if the bank has adopted IB activities otherwise it takes the value of zero (Malhotra and Singh, 2009). Adoption of TB - it takes the value of one if the bank has adopted TB activities otherwise it takes the value of zero. Offering BC - the number of debit and credit cards issued by the banks (Ogare, 2013), it takes the value of one if the number of cards  $\geq 6$  (median) and the value of zero if the number of cards  $< 6$ . Installation of POS - it takes the value of one if the bank has offer the service of installing POS machines otherwise it takes the value of zero.

## 4. Emperical Findings

### 4.1 Descriptive Statistics

This section presents the descriptive statistics of each dependent and independent variables included in this research. The dependent variable of this study is FP (measured by CA, AQ, MC, EC, LQ, and SN) and the independent variable is ICT investments (measured by IB, MB, TB, BC, ATM and POS). The total observation for each dependent and independent variable is 400 (data for 50 banks operating for the period 2009-2016). The descriptive statistics include minimum, maximum, mean and standard deviation of all research variables. Accordingly, the summary statistics for all variables are presented below in Table 4.

**Table 4.** Descriptive Statistics of Variables

	N	Minimum	Maximum	Mean	Std. Deviation (SD)
<b>ATM</b>	400	.00	1.00	.5100	.50053
<b>MB</b>	400	.00	1.00	.5400	.49902
<b>IB</b>	400	.00	1.00	.7000	.45883
<b>TB</b>	400	.00	1.00	.2000	.40050
<b>BC</b>	400	.00	1.00	.5200	.50023
<b>POS</b>	400	.00	1.00	.4200	.49418
<b>FP</b>	400	.00	1.00	.5900	.49245

Source: SPSS (20) Outputs.

Table 4 shows that the average and the SD of ATM is 0.51 and 0.50 respectively with a range of one as a maximum and zero as a minimum. This demonstrates that, about 51% of the banks have more than nine ATM machines available at all their branches that provide their clients 24-hour access to their accounts.

The average and the SD of MB is 0.54 and 0.49 with a range of one as a maximum and zero as a minimum. This demonstrates that, about 54% of the banks in Lebanon have applied ICT to their operations through easy to access MB applications.

On the other hand, the average and the SD of IB was found to be 0.70 and 0.45 with a range of one as a maximum and zero as a minimum. Thus, IB has the highest mean score. That is about 70% of the banks have applied ICT to their operations through IB. Then it seems that IB is the highest e-banking service offered by most banks operating in Lebanon.

The lowest mean is detected for TB. Its average and the SD were found to be 0.20 and 0.40 with a range of one as a maximum and zero as a minimum. Then it seems that TB is not used widely.

Moreover, the results indicate that the average and the SD of BC is 0.52 and 0.50 with a range of one as a maximum and zero as a minimum. This reveals that about 52% of the banks in Lebanon offer more than six different types of bankcards (debit and credit cards) to suit the lifestyle requirements of their customers.

Furthermore, the average and the SD of POS is 0.42 and 0.49 with a range of one as a maximum and zero as a minimum. This implies that about 42% of the banks offer their clients the service of installing POS machines that allow them to make their payments using their debit or credit card.

Lastly, FP has an average and SD of 0.59 and 0.49 with a range of one as a maximum and zero as a minimum. This shows that about 59% of the banks in Lebanon have satisfactory performance levels.

#### **4.2 Correlation Analysis**

Table 5 shows that all the independent variables have a significant positive relationship with each other (Pearson's correlation coefficients stand between 16.9% and 54.0%), except for the relationship between POS with ATM and MB (Pearson's correlation coefficients stand respectively at 6.4% and 5.4%). Furthermore, Table 5 shows significant positive relation between FP and MB (Pearson's correlation coefficients stand at 29.1%) as well as between FP and IB (Pearson's correlation coefficients stand at 16.4%). These results reveal the existence of a low correlation between independent variables (the correlation does not exceed 54.0%) and propose that multi-collinearity is not a matter as the VIF values for the predictors are lower than the threshold value of "3.3" (Kock and Lynn, 2012).

**Table 5. Correlation Matrix of Variables and VIF Test**

	<i>ATM</i>	<i>MB</i>	<i>IB</i>	<i>TB</i>	<i>BC</i>	<i>POS</i>	<i>FP</i>	<i>VIF</i>
<i>ATM</i>	1	.259**	.493**	.340**	.540**	.064	-.085	1.691
<i>MB</i>	.259**	1	.447**	.361**	.238**	.054	.291**	1.357
<i>IB</i>	.493**	.447**	1	.327**	.419**	.292**	.164**	1.741
<i>TB</i>	.340**	.361**	.327**	1	.280**	.182**	.061	1.286
<i>BC</i>	.540**	.238**	.419**	.280**	1	.169**	.094	1.502
<i>POS</i>	.064	.054	.292**	.182**	.169**	1	.091	1.147
<i>FP</i>	-.085	.291**	.164**	.061	.094	.091	1	

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

Source: SPSS (20) Outputs

### 4.3 Regression Analysis

Multiple regression analysis was conducted to examine the impact of ICT investments on financial performance of banks operating in Lebanon. The model is as follows:

$$FP = \beta_0 + \beta_1 ATM + \beta_2 MB + \beta_3 IB + \beta_4 TB + \beta_5 BC + \beta_6 POS + \varepsilon$$

where: FP: Financial Performance; ATM: Automated Teller Machines; MB: Mobile Banking; IB: Internet Banking; TB: Telephone Banking; BC: Bank Cards; POS: Point of Sale Terminals. The findings of regression analysis are summarized in subsequent Tables 6-8.

**Table 6. Model Summary**

<i>Model</i>	<i>R</i>	<i>R Square</i>	<i>Adjusted R Square</i>	<i>Std. Error of the Estimate</i>
1	.376 <sup>a</sup>	.142	.128	.45975

a. Predictors: (Constant), POS, MB, ATM, TB, BC, IB

Source: SPSS (20) Outputs.

The findings of the model indicate R of 0.376, R square of 0.142 and adjusted R square of 0.128. This implies that 14.2% of the variations in overall FP of banks operating in Lebanon is explained by the independent variables of the study (adoption of ATM technology, adoption of MB, adoption of IB, adoption of TB, usage of BC and adoption of POS system).

**Table 7. ANOVA<sup>a</sup>**

<i>Model</i>		<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
<i>1</i>	<i>Regression</i>	13.693	6	2.282	10.797	.000 <sup>b</sup>
	<i>Residual</i>	83.067	393	.211		
	<i>Total</i>	96.760	399			

a. Dependent Variable: FP

b. Predictors: (Constant), POS, MB, ATM, TB, BC, IB

Source: SPSS (20) Outputs.

The ANOVA findings from Table 7 indicate F calculated of 10.797 and p-value of .000; this is an indicator that the overall regression model was significant in predicting the impact of ICT investments on FP of the banks in Lebanon.

Table 8. Coefficients<sup>a</sup>

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	.412	.046		8.948	.000
	ATM	-.275	.060	-.279	-4.592	.000
	MB	.286	.054	.290	5.331	.000
	IB	.124	.066	.115	1.872	.062
	TB	-.038	.065	-.031	-.582	.561
	BC	.127	.056	.129	2.250	.025
	POS	.044	.050	.044	.878	.381

a. Dependent Variable: FP

Source: SPSS (20) Outputs.

Table 8 shows that the coefficient of ATM has the negative unexpected sign (-.275) and it is significant (.000). This signifies that ATM is significantly negatively influencing the performance of the banks operating in Lebanon. Hence, hypothesis 1 is rejected. This result corroborates the results of the works of Benedict (2013), Shehu *et al.* (2013) and Farouk *et al.* (2013) but oppose Hung *et al.* (2012), Gichungu and Oloko (2015) as well as Jenevive and Anyanwaokoro (2017) who found ATM banking had positively impacted on the bank FP. This result implies that when there is a unit increase in the adoption of ATM technologies, the performance of banks operating in Lebanon will decrease by .275. This is maybe due to the cost of maintenance and the slight amount they charge customers for utilizing ATM which may not essentially offset the amount spent in purchasing and maintaining such machines. Besides the latest initiative by several banks to cease charging their customer when they take out from their own ATM or another bank's ATM, the financial consequence of purchasing and maintaining the ATM machine exclusively lies on banks and not on customers. This may cause the banks in deeping their hands into the banks profit to cater for such overhead cost. Furthermore, the likely explanation for the observed association is that the costs accompanying with ATM, which contains electronic infrastructures, continuing maintenance, depreciation and employees training are greater than the revenues from ATM services in the Lebanese banks (Farouk *et al.*, 2013).

The coefficient of MB is positive (.286) and significant (.000). This indicates that there exists a positive significant relationship between MB and the FP of banks in Lebanon. This suggests that when there is a unit increase in the adoption of MB, the performance of banks will increase by .286. Therefore, hypothesis 2 is accepted.

This result confirms the results of Mutua (2010), Kithaka (2014) and Munyoki (2015), but contradict with Vekya (2017) and Jenevive and Anyanwaokoro (2017) who found a negative relationship between MB transactions and bank profitability. Thus, based on the findings of the study it can be concluded that MB provides banks numerous opportunities for growing revenues. Specifically, it has resulted in more profits for the banks through commission incomes and gradual drop in overhead expenses especially staff and marketing expenses; it has lessened the transaction costs for banks and customers and it has allowed banks to aid more clients within a shorter time as well as enhancing operations and decrease costs (Mwange, 2013).

The coefficient of IB is positive (.124) and insignificant (.062). This reveals that there exists a positive influence of adopting IB on the FP of the banks, but it is not statistically significant. This finding indicates that the adoption of IB does not influence financial bank's performance. Consequently, hypothesis 3 is rejected. This result supports the work of Sathye (2005), Malhotra and Singh (2009) as well as Khrawish and Al-Sa'di (2011) but confutes the results of Monyoncho (2015), Mateka *et al.* (2016) and Barasa *et al.* (2017) who revealed that IB has positive influence on the FP of the banks. This result can be explained by the fact that banks in Lebanon use internet services as an aggressive business strategy to obtain market share rather than for achieving profits (Arnaboldi and Claeys, 2008).

The coefficient of TB is negative (-.038) and insignificant (.561). This indicates that there exists a negative influence of adopting TB on the FP of the banks, but it is not statistically significant. This finding demonstrates that the adoption of TB does not influence financial bank's performance. Accordingly, hypothesis 4 is rejected. Similar results were observed by Al-Hawari (2006) as well as Al-Hawari and Ward (2006), and contradictory results obtained by Asia (2015) as well as Kihara (2015) who concludes that there is a relationship between TB and FP. This result can be explained by the fact that in a world with seven billion persons, five billion have mobile phones and two billion have bank accounts (Halili, 2014). This seems that TB have been replaced by MB due to its convenience, access to the service regardless of time and place, privacy and savings in time and effort (Bhatt and Bhatt, 2016).

The coefficient of BC is positive (.127) and significant (.025). This points out that there exist a positive significant association between offering different types of bankcards and the FP of the banks in Lebanon. This suggests that when there is a unit increase in BC usage, the performance of banks operating in Lebanon will increase by .127. Therefore, hypothesis 5 is accepted. Same results are obtained by Aduda and Kingoo (2012), Kyalo (2014) as well as Muiruri and Ngari, (2014). This finding reveals that debit cards and credit cards are able of generating few incomes for banks in Lebanon because of the convenience they offer to bank customers (Ogare, 2013). These cards are also affordable to both the banks and the customers and they do not need much maintenance costs both at acquirement and when in operation. This makes cards quite attractive as a tool for carrying out transactions for

customers and the banks. This great usage of cards appeals commission income for the bank, which increases the bank profits (Agboola, 2006).

The coefficient of POS is positive (.044) and insignificant (.381). This indicates that there exists a positive influence of offering the service of installing POS on the FP of the banks, but it is not statistically significant. This finding demonstrates that offering clients the service of installing POS machines does not influence financial bank's performance in Lebanon. Subsequently, hypothesis 6 is rejected. This finding concurs with the findings of Alber (2011), Dehghan *et al.* (2015), Abebe (2016), and Jenevive and Anyanwaokoro (2017). However, complementary findings were found by Meihami *et al.* (2013), Njogu (2014), and Vekya (2017) which argued that POS has a positive relationship with the performance of the banks. This result can be clarified by the fact that the usage of POS terminals couldn't have been analyzed independently, as it is affected by other available forms of payments, level of competition among banks, kinds of products to be bought and transaction size (Alber, 2011).

## **5. Conclusions, Limitations, and Future Research**

The research aimed to look at the impact of the ICT investments that have on the FP of fifty banks operated in Lebanon for the period from 2009 to 2016. Specifically, the research was meant to establish whether there exists a relationship between the dependent variable, FP measured by CAMELS framework and the independent variables consisting of number of ATM machines, adoption of MB, IB, TB, number of debits and credit cards issued to customers, and offering POS services, as components of ICT investments.

The achieved results indicate that the application of MB and offering debit/credit cards to customers significantly and directly affects the performance of the banks in Lebanon. Thus, banks should focus to find a way to increase interest of Lebanese consumers in MB applications by marketing these applications in a way that increases the rate of consumer usage and adoption. Further, banks should compete to attract more customers by offering them a range of bank cards -especially tailored to fit their preferences and needs- that allow them to enjoy a list of privileges and numerous services both locally and internationally.

On the other hand, the achieved findings of this research demonstrate that the application of other core banking services such as ATM, IB, TB and POS terminals does not significantly affect the performance of the banks in Lebanon. These results yield a powerful evidence that the costs of adopting these applications by Lebanese banks exceed their benefits. It seems that banks are investing greatly in new technologies to take advantage of new IT and digital solutions to make their operations more efficient, comply with regulators while at the same time increasing interaction with customers in order to sustain competitiveness without taking into

consideration banks' performance. Thus, banks are recommended not to exaggerate in spending on ICT investments.

Hence, this research is an important contribution to the literature due to its findings. It will assist policy makers to formulate policies that improve optimal utilization of ICT resources rather than go into additional investments. However, this research is not beyond limitations. This research was done solely on a sample of banks operated in Lebanon. Future research can be extended to other financial markets such as capital and insurance companies in order to recognize the implication of e-banking on the overall financial markets in Lebanon. Similar studies can also be done for other banks in other countries. The current research fully employed secondary data and the analysis was fully based on financial data. However, secondary data obtained from financial reports of banks can have potential bias. Thus, future research is recommended to substantiate secondary data by primary data such as interviewing. The current research uses only some representative financial ratios from factors of the CAMELS model, the financial ratios included in the research may not be comprehensive and sufficient to evaluate the bank's CA, AQ, MA, EC, LQ, and SN. Therefore, for the future researcher is recommended to consider additional financial ratios.

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