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A Framework for Evaluating the Effectiveness of Information Systems at Jordan Banks: An Empirical Study

Ahmad Mashhour, PhD
Associate professor of Information Systems/IT College, University of Bahrain,
Postal Address: **Information Systems University of Bahrain, PO Box 32038**
Email: **mashhour@itc.uob.bh**
Dr. Ahmad Mashhour is an associate professor of Information Systems at the University of Bahrain since last academic year 2005/2006. Formerly, he has taught many information systems courses for graduate and undergraduate levels at Jordan institutes. His areas of interest are: E-business, Distance Education & E-Learning, and Modeling information system.

Second Author's Name: **Zakaria Zaatreh, PhD**
Email: **drzatreh@netscape.net**
Dr. Zaatreh is an assistant professor of Information Systems at the University of Yarmouk, Jordan since academic year 2004.

Abstract

Banks and other financial institutions in Jordan are one of the largest investors in the fields of information systems (IS), and there are many indications that these trends to continue in the future. However, there is a concern among CEOs and top managers that the IS investments are not yielding the anticipated outcomes. This paper investigates the investment of information systems at Jordan banks and reports the results of an empirical study that evaluates the contribution of IS in the effectiveness of banks operations. The paper measures the factors which determine information systems effectiveness at Jordan main banks. These variables are presumably system decision performance, system usage and user satisfaction among others that are considered the

most effective variables in banks performance.

Keywords: **Decision performance, Effectiveness, Information system, Jordan banks, System evaluation, User satisfaction.**

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INTRODUCTION

IT applications would never have existed without a long and expensive gestation period in which computer power and telecommunication applications were devoted to help gain the initiative in science and technology (Strassmann, 2006, Locke, 1999, and Leslie 2000). The primary objective of implementing information systems (IS) in the financial institutions is to help the organization achieve its goals (Watson, 1993). Gory and Scot Morton (1971) suggest that the primary objective of an information system in an organization is to support decisions.

In essence, the impact of information technology on value creation in any organization happen either through increasing revenues at marginal cost, or through reducing costs at marginal changes in revenue, and thus enhancing operating profits. The issue of measuring the return on investment in information systems is being hotly debated in the IS literature. The debate is growing also in the business community about the importance of measuring the return of investment in IS, since most of the benefits are derived from intangible and long terms investments. Information systems evaluation was the topic of a conference of the International of Federation of Information Processing (Smithson & Hirschman, 1998); in addition many information systems authors stress the importance of this topic (Strassmann, 2004, and Morrison & Brendit, 1990, Schumann, 2003). Evaluation of IS investment therefore, is an important issue in organizations which is often overlooked. There is emerging widespread and growing concern in organizations that IS investment does not deliver value and that many objects do not meet business objectives (Fitzgerald, 1998).

AN OVERVIEW OF INFORMATION SYSTEMS IN BANKING

Although IS expenditure is regarded costly and risky financial institutions are one of the largest investors in IS (Robson, 1997). The past 25 years have witnessed vast reductions in the cost of information technology. Between 1995 and 2005, the computing power of the average PC increased tremendously, while the price declined. The introduction of telecommunications into bank markets dates to 1846 when the telegraph reduced stock price differentials between New York and regional stock markets (Garbade and Silber, 1978). At the same time, a revolution in telecommunications reduced the cost of transmitting data by a high margin since 1990. Such cost reductions have made it less expensive to acquire, store, transmit, and transform data into information. They have also created enormous changes in the services of the financial institution. The characteristic provision of financial services in retail markets was to change with the commercial use of computer power. For commercial banking worldwide,

these advances in IT have resulted in dramatic productivity gains. One early example was the introduction of the automatic teller machine (ATM), which first appeared in the United States in 1968. The introduction of ATMs made the distribution of some banking services more efficient.

IT has developed the competition between financial institutions. Many new banking innovative strategies emerged from a new or enhanced banking information systems, which include e-banking, smartcard system or enhancement of other payment card system. ATMs, for instance, has many application such as withdrawing funds, account inquiries, and transferring funds between accounts. All require face-to-face interaction between the customer and a bank teller. The bank's costs for these transactions included wages of tellers and back-office personnel, the cost of maintaining the premises, and other related expenses. ATMs automated this process and, to the extent that they were simply substituting a machine for a bank teller, costs per transaction fell significantly. So, in this complex environment, how can information technology investments create value for the financial services organizations? According to Read et al (2001, page 97) "At its simplest level, value is created by generating revenues from the delivery of products and services to customers that exceed the cost of the delivery process". In essence, the impact of information technology on value creation in any organization can happen either through increasing revenues at marginal cost, or through reducing costs at marginal changes in revenue, and thus enhancing operating profits.

An interesting finding of Morton (1991) supported by Hitt & Brynjolfsson (1996) and by Hayward et al (2002), is that benefits from IT do in fact exist, but are not captured by the organization. Several frameworks have been proposed to guide the choice among IS evaluation methodologies (Stone, 90). These frames include defining objectives and measures, considering qualitative effects from IS, and considering and integrating differing evaluative viewpoints (Hamilton and Chervany, 1981). Akoka (1981) uses the Gorry and Scott-Morton (1972) framework for MIS as a contingency model for choosing among evaluation methodologies. He proposed that structured operational control problems should be evaluated using cost-benefit analysis, while unstructured strategic planning problems should be evaluated using an ecdotal reports and managerial assessment of system value.

Allen et al (2006) pointed out that efficiency is measured in three ways: performance ratio, economy of scale, and cost efficiency, and according to Pehlivan & Kirkpatrick (1990), functional (operational) efficiency in financial institutions is measured by the cost and profit margins.

According to Gupta and Collins (1997), there are four popular efficiency measures used to assess IS return, which are as follows:
  - reduced operating expenses,
  - increased profitability,
  - increased fee income as percentage of total revenues,
  - Increased net-interest margin to average earning assets.

In spite of the disagreement among researchers on the assumptions and evaluation factors of IS, the following factors represent the common factors to evaluate of financial information systems performance.

(a) IT integrated in IS: information technology is important to understand the relationship between information technology investment and firm productivity. Mitra and Chaya (1996) found that IT investments reduce average production costs, and increase average overhead costs in firms. Alpar and Kim (1990) reported that investments in information technology decrease total costs in the banking industry. Harris and Katz (1991) found that higher information technology spending is associated with lower growth in operating cost of insurance companies. Morison and Brendt (1990), found, from government data, that technology provides only marginal returns and concluded that there was over-investment in IT.

 (b) Software quality: Software quality can be utilized by meeting user needs, reusability of code and ease of expandability, and number of programming errors. Quality software products are essential in a highly competitive technology arena. ISO 9001 have been established by ISACA (information Systems Auditing & Control Association) organization as general guidelines for software quality. In measuring software quality specific characteristics of a system are typically addressed. These characteristics seem to focus on software engineering aspects of software development which ultimately affect customer satisfaction...

(c) Investment in training: Arthur (1993) defines three types of quality costs: failure or fault cost, appraisal costs (cost of inspecting and testing software prior to the release of software) and prevention costs (cost of training, and continuous quality improvement). According to a survey conducted by (Gupta and Collins, 1997) banks are reluctant to invest in training; they reported that Florida banks showed less than $50 per thousand investments in information systems training in 5 years time, which is considered very low amount of investment.

(d) Aligning corporate goals with technological investments: Companies should ensure that investment in technology is aligned with achieving strategic, tactical and operational goals. According to (Gupta and Collins, 1997), banks strongly agreed that information systems plays a valuable role in helping them achieve overall organizational goals.

(e) Customer services: Common monitoring service measurements include:
-   The throughput - number of jobs completed in a given period.
- Response time - the time requirement for completion of a job.
- Reliability - the percentage of time the application is available.

(f) Productivity: information systems managers and consultants consider evaluating and understanding information systems productivity a key management issue. Many surveys were presented to assess and improve information systems productivity. Information systems productivity was ranked one of the most important issues among others (Dickson et al., 1983) and (Brancheau and Wetherbe, 1987).

 (g) User satisfaction: The dominant Research focus on information systems evaluation over the passed two decades has been the development of survey instruments for the measurements of user satisfaction by proposing perceptual and quantitative measures of user satisfaction which is administered through retrospective survey instruments... Among the more popular instruments are those developed by Bailey and Pearson (1988), Ives ad Feeny (1990), Ivis and Olson (1983), and Baroudi (1983), and Davis (1989).

 (h) Cost-benefit analysis: Cost-Benefit analysis (information systems return) by reducing operating expenses and increased profitability. A variety of models have been proposed to quantify the cost and benefits of information systems (Alpar and Kim, 1989), and (Emery, 1982). Some expands the use of quantitative variables to include nonmonetary measures such as timesaving due to improved workflow (Kauffman and Krieblel, 1990).
In Jordan, IS are taking greater role in bank operations and decision performance, and have the potential to change the business process. These roles and/or services are summarized in the bank model (relationship of bank IS to environmental elements) shown in figure (1).

HYPOTHESIS
The deployment of IS has been heralded as the solution to many organizational and business problems. Proponents of IS often claim that the implementation of IS can resolve many complex business problems and can deliver real competitive advantage and organizational improvements (Hammer and Champy 1990 and Robson 1997).
Thus, any investment in IS should be examined for its business value and benefit to the organization (Galliers and Baker, 1997).

> H01:   Information systems provide a competitive Advantage to the banking industry.
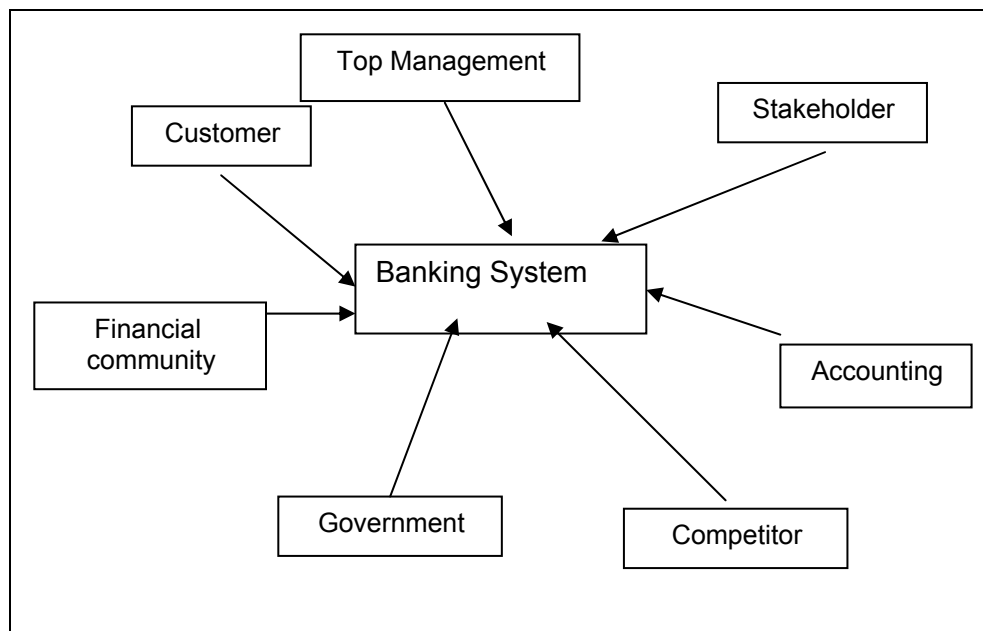

Figure 1 : Bank System Model

Delone and McLean (1992) review at least 180 empirical studies that use IS effectiveness as the dependent variable. They identified six categories in which IS measures can be grouped, namely, system quality, information quality (which are inputs to decision making), system usage, user satisfaction, individual impact, and

organizational impact. Decision performance is the degree to which a system support or improve decision making. Decision performance generally includes a productivity dimension that focus on the efficiency with which tasks are accomplished, and a quality dimension that focus on the efficacy of the decision. Yuthas and Eining (1995) found that IS effectiveness is determined by decision performance, system usage and user satisfaction.

H02: The effectiveness of information systems has a positive impact on Jordan banks

Customer satisfaction is the degree to which the customers are satisfied with the deployment of IS and the support provided by the IS department; it is an outcome measure.

H03: The use of information systems by Jordan banks is positively associated
With customer satisfaction.

METHODOLOGY

To bring an understanding of the complex issue of evaluating the effectiveness of information systems at Jordan banks, and to extend experience and add strength to what is already known through previous research, a descriptive approach is conducted. High ranking managers at major banks were interviewed and information regarding banks general IT investments for conducting a Cost – Benefit Analysis (see table 1 for the items that were investigated). Another set of data was collected by designing a survey, and distributing it nationwide. The goal of surveying is to investigate the investment of information systems at Jordan banks and to evaluate the contribution of IS in the effectiveness of banks operations. To achieve this goal, the research focuses on two tested instruments that were developed by Moore and Benbasat (1991) and Idowu, Alu, & Adagunodo (2002) (see table 2 and table 3).

Table 1: Variables Used In the Cost – Benefit Analysis

Description
total cost (divided by the price of labor)
short-term loans
long-term loans
Services weighted commission income.
IT capital price (divided by the labor price)
branches price (divided by the labor price)
Capital divided by total assets
Net services value revenue divided by gross income
Number of employees divided by number of branches
Number of redundant employees divided by total staff
real hardware capital per employee (billion lire)
real software capital per employee (billion lire)
Wages paid to IT personnel divided by total wages
ATM divided by number of branches.

Table 2 Instrument Items

Item	Instrument
IT/Computer is really helping this bank	dowu et al (2002)
I don't think IT has effect on the bank's operation	dowu et al (2002)
IT/computer has a great positive impact on the growth of this bank	dowu et al (2002)
IT/Computer encourages customers to patronize this bank	Idowu et al (2002)
There is a need to improve the services rendered by this bank	Idowu et al (2002)
IT does not increase prompt and efficient service delivery	Idowu et al (2002)
Computer really speed up cashiers' work	Idowu et al (2002)
IT makes enquiry about the state of my account faster	Idowu et al (2002)
IT improves transactions	Idowu et al (2002)
I enjoy prompt and efficient service delivery	Idowu et al (2002)
IT/Computer has reduced the interaction of the Cashiers with customers	Idowu et al (2002)
To save or withdraw money is time consuming	Idowu et al (2002)
I was once delayed in the bank because the computer was down	Idowu et al (2002)
IT/Computer enables me to accomplish tasks more quickly.	Moore & Benbasat (1991)
IT/Computer improves the quality of work I do.	Moore & Benbasat (1991)
IT/Computer makes it easier to do my job.	Moore & Benbasat (1991)
IT/Computer improves my job performance.	Moore & Benbasat (1991)
Overall, I find IT to be advantageous in my job.	Moore & Benbasat (1991)
IT/Computer enhances my effectiveness on the job.	Moore & Benbasat (1991)
IT/Computer gives me greater control over my work.	Moore & Benbasat (1991)
IT increases the banks productivity.	Moore & Benbasat (1991)

Table 3: Grouped Variables

IT Impact on Banks 　　　　Q1: IT/Computer is really helping this bank 　　　　Q2: I don't think IT has effect on the bank's operation 　　　　Q3: IT/computer has a great positive impact on the growth of this bank 　　　　Q4: IT/Computer encourages customers to patronize this bank

IT Impact on Services	Q5:There is a need to improve the services rendered by this bank
	Q6: IT does not increase prompt and efficient service delivery
	Q7: Computer really speed up cashiers' work
	Q8: IT makes enquiry about the state of my account faster
	Q9: IT improves transactions
	Q10: I enjoy prompt and efficient service delivery
	Q11: IT/Computer has reduced the interaction of the Cashiers with customers
	Q12: To save or withdraw money is time consuming
	Q13: I was once delayed in the bank because the computer was down
IT Relative Advantage	Q14: IT/Computer enables me to accomplish tasks more quickly.
	Q15: IT/Computer improves the quality of work I do.
	Q16: IT/Computer makes it easier to do my job.
	Q17: IT/Computer improves my job performance.
	Q18: Overall, I find IT to be advantageous in my job.
	Q19: IT/Computer enhances my effectiveness on the job.
	Q20: IT/Computer gives me greater control over my work.
	Q21: IT increases the banks productivity.

RESULTS AND DISCUSSION

Using information systems in Jordanian banks seems to be vital to the success of today's banking systems in Jordan. Understanding how IS operates to improve banks competitive advantage and results in more efficiency and better customer satisfactions. SPSS version 11 is used in the analysis of the questionnaire. The research reveals the following:

a)   17% of users declared that their information systems were not returning the investment.
b)   IT overhead costs are consistently larger than anticipated
c)   73% of participants report that the introduction of IT has been very successful
d)   84% of participants claim an above average return on capital investment
e)   20% of IS spending is wasted and 30% claim that no net benefits whatsoever have been measured.

Three hypotheses were the focus of this research. The results are illustrated in table 4 and table 5.

Table 4: Variables Used in the Cost – Benefit Analysis

Description	Mean	Min	Max	St.dev
total cost (divided by the price of labor)	4.062	1.341	8.557	1.605

short-term loans	3.473	-4.221	8.722	1.546
long-term loans	3.200	-1.152	8.762	1.395
Services weighted commission income.	4.134	-2.099	8.629	1.289
IT capital price (divided by the labor price)	1.655	0.202	2.995	0.496
branches price (divided by the labor price)	-0.110	-1.013	1.466	0.424
Capital divided by total assets	0.074	0.014	0.317	0.027
Net services value revenue divided by gross income	0.048	-0.786	0.445	0.048
Number of employees divided by number of branches	8.960	1.600	193.600	8.046
Number of redundant employees divided by total staff	0.001	0.000	0.415	0.010
real hardware capital per employee (billion lire)	0.041	0.000	0.374	0.034
real software capital per employee (billion lire)	0.003	0.000	0.048	0.003
Wages paid to IT personnel divided by total wages	0.044	0.000	0.800	0.056
ATM divided by number of branches.	0.421	0.000	16.000	0.600

All financial variables are measured in JD million and are adjusted for inflation.

Table 5: Descriptive Statistics of Respondents Surveyed

Variable	Min	Max	Std dev	Mean	Construct Group Mean
Q1	5	7	0.66	6.4	
Q2	4	7	0.76	6.3	5.6
Q3	1	7	1.4	5.5	
Q4	1	7	2.3	4.3	
Q5	3	7	0.8	5.9	
Q6	3	7	0.83	6	
Q7	2	7	1.1	4.8	
Q8	1	7	1.5	3.9	
Q9	1	7	1.7	3.5	5.4
Q10	3	7	0.91	5.7	
Q11	1	7	1.2	3.6	
Q12	2	7	1.2	5.4	
Q13	3	7	1	5.4	
Q14	1	7	1.4	4.2	
Q15	1	7	1.3	4.9	
Q16	1	7	1.8	3.3	
Q17	1	7	1.9	3.3	
Q18	1	7	1.8	2.7	4.1
Q19	1	7	1.5	4.3	
Q20	1	7	1.7	2.6	
Q21	1	7	1.6	4.6	

The first hypothesis H01: Information systems provide a competitive Advantage to the banking industry.

The effect of using information systems on banks competitiveness was measured using the average score of the relating questions (Q1-Q5) so that "1" stands for "extremely agree" and "7" stands for "extremely disagree". In this way a higher score in these questions indicates that information systems provide a competitive advantage for banks. The descriptive statistics indicates that the mean score for effectiveness of information systems on Jordan banks is 5.68 with a standard deviation of 1.184, in a scale of 1 to 7. Based on the testing result, the study concludes that information systems has a positive impact on Jordan banks, and does so at a very high degree of confidence (at least 99.9%).

The second hypothesis H02: The effectiveness of information systems has a positive impact on Jordan banks

The effectiveness of information systems was measured using the average score of the relating questions (Q8-Q13) with a higher score in these questions represents higher level of effectiveness of information systems on banking. The descriptive statistics indicates that the mean score for effectiveness of information systems on Jordan banks is 4.78 with a standard deviation of 1.18, in a scale of 1 to 7. Based on the testing result, the study concludes that information systems have a positive impact on Jordan banks.

The third hypothesis H03: The use of information systems by Jordan banks is positively associated with customer satisfaction

The Pearson correlation coefficient between the use of information systems in banking and customer satisfaction was found to be 0.17 and the corresponding P-value will be 0.39 or 4%. This means the positive correlation between the two measurements is statistically significant (at 5% significant level). So the hypothesis is accepted.

Information systems can be assessed using assessment matrices such as detailed benefit measurement formulae, evaluation concepts or cost – benefit technique. Critical assessment of the implementation of certain IS have demonstrated that it is possible to solve problems and yield competitive advantage and organizational improvements (Ives and Feeny, 1990). There are many well documented examples including (American airlines reservation system (Copeland and McKenny, 1988).

Banks should introduce a justification and evaluation criteria. In the rest of this section we will present a matrix design for the purpose of assessment of cost / benefit factors analysis of a bank information system. Information system value is determined by the change in the dollar payoff from decision making without IS versus using the proposed IS (Schell, 2003). Further more accuracy of IS affects the economic value of an IS. A mean accuracy of 90% yield an economic benefit more than 30% grater than the expected payoff of decision making with IS. There are a number of articles that focus on establishing the economic benefits of an IS based on results after implementation (Schumann, 1989, Due, 1996, Chandler, 1982, and Mukkhopadhyay, et al, 1996). Table 3 depicts suggested cost – benefit factors of a bank information system and their percentage effect on the operations of a bank.

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