AUTOMATION IN BANKING SERVICES, MANAGERS' PERCEPTIONS AND BANK PERFORMANCE: THE UAE EXPERIENCE

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A survey of thirty-eight UAE bank managers was conducted for the purpose of investigating their perceptions toward automation. Analysis of the survey data combined with collected financial performance data yielded several important findings. First, the UAE banks are adopting automated banking technologies in the expectation of improving their equity multiplying effect. Second, managers perceived improved service quality and the realization of a distinct competitive advantage to be the most important benefits arising from banking automation. The system security, training personnel on the use of the system, and increased system development cost were perceived as the most important problems in operating the automated system. Third, analysis of the interrelationships among bank managers' beliefs, experience, and participation on one hand, and their attitudes toward automation on the other, were successful in identifying the significant influencing beliefs on their perceived benefits and problems of automated systems.

United Arab Emirates' (UAE) local banks have been under growing pressure from their foreign counterparts to become more competitive and advanced in order to capture a reasonable share of the fast-growing total demand on banking services. While anxiously searching for solutions, these banks have learned that one of the most important competitive weapons is an efficient and effective operations system, a system that is capable of increasing their business while decreasing average operations costs.

Information Technology (IT) possesses the capability to facilitate the daily business operations, to reduce the costs of these operations, and to attract new business. In recent years,

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radical changes have been taking place in the banking sector as various automated banking systems and technologies have been introduced to many banking functions in the UAE.

Many researchers have investigated various issues related to choosing and planning for the use of advanced information technologies in manufacturing (Steele, 1983; Bullinger, 1986; Meredith, 1986). Others have studied the role of management perceptions in the automation process (Meredith & Hill, 1987; Tambak & De Meyer, 1988; Farhoomand, 1990). Alpar (1992) has investigated the managerial implications of automating bank functions; and Apcar (1987) has reported the effect of automation in banking. Despite growing interest in the area, little attention has been paid to the role of management perceptions toward automation in the automation process in general (Meredith & Hill, 1987) and in banking in particular (Alpar, 1992). These and other controversial results concerning the impact of automating services on banks' performance make further empirical inquiries necessary.

Theoretically speaking, managers' perceptions are important factors that affect the system's acceptance and hence its use (Fishbein & Ajzen, 1975; Davis, 1986; Davis, Bagozzi & Warshaw, 1989). Empirical investigation of these perceptions and the factors that influence them should be useful in understanding their role in adopting, accepting, and using an automated banking system.

The current study is an attempt to investigate bank managers' perceptions towards automating their bank systems. In order to achieve this goal, the study seeks to find answers to such basic questions as: How do UAE banks justify their huge IT investment? What kind of benefits can IT realize? What potential problems might a bank encounter in the process of using an automated information system? What are the important factors that affect the perceptions of bank managers towards automating their bank operations?

BACKGROUND

A considerable amount of literature investigates the strategic and operational impacts of automated systems on firm performance. However, much of this literature consists of empirical studies based on the economic or technical expectations of experts and concerned parties (Humprey, 1987; Tambak & De Meyer, 1988; Alpar, 1992; Alpar & Kim, 1992; Jones, 1993; Palmer, 1994). In their analysis of the effect of automation on firm efficiency, most of these studies have only considered the cost factor. They have not equally considered the revenue factor. Experts tend to disagree on the effects of such systems on short-term cost reduction objectives (Lawrence & Shey, 1986; Roach, 1989; Alpar, 1992; Alpar & Kim, 1992). Nevertheless, they all agree that the real advantages of implementing these systems normally materialize in the long-run (Apcar, 1987; Humphrey, 1987; Alpar, 1992).

Strategic Impact of Banking Automation

The importance of information for effective management, as a fundamental concept of survival and prosperity, hardly needs to be argued. However, it is necessary for developing countries, such as the Arabian Gulf States, to go beyond this concept. The huge spending on computers and computerized systems reflects the interest of these countries in IT as a means of handling managerial problems.

The strategic application of IT in the banking sector may be the sole and most important factor in determining winners and losers (Sinkey, 1992). However, research reveals much doubt that banks have succeeded so in reaping satisfactory benefits from IT investments (Palmer, 1994). Roach (1989), for example, claims that despite the large investments in IT, productivity in the service sector did not increase much in the period from 1962 to 1988. He, therefore, concludes that IT investments did not pay off. On the other hand, Alpar & Kim (1992) conclude that IT did help to decrease the average costs of American commercial banks. Notably, they have performed their analysis at the bank function level and adjusted costs to total funds in the function.

In the competitive environment of the 1990s, technological innovation presents banks, through the Electronic Funds Transfer System (EFTS), with an opportunity for gaining a competitive advantage by controlling costs, generating revenues, or both (Sinkey, 1992). EFTS is a generic term referring to various computer-based technologies for delivering banking services. The basic EFT components are Automated Teller Machines (ATMs), Automated Checks Clearinghouses (ACHs), and Point-of-Sale systems (POSs). In addition, other services such as cash management, telephone bill payment, automatic transfers, checks verification, checks truncation, and home banking are part of the total EFT picture.

Perceptions of Managers Towards Automation

In order to determine the full range of managers' potential perceptions toward banking automation, the literature within the field of IT adoption was consulted. Farley et al. purchasing model (1987) suggested that the perceptions about automation are influenced by the current state of automation in the firm. The perceived benefits and problems of automation will in turn affect the attitudes toward automation. On this basis, it is contended that managers are concerned with technical and economic uncertainties surrounding new technology adoptions (Tambak & De Meyer, 1988). Using this model as a starting point, the study predicated two streams of research: the theory of reasoned action (Fishbein & Ajzen, 1975), and the model of innovation decision process (Rogers, 1983). Both models will be presented in the next section on the study methodology.

Published results on managers' perceptions towards automation are diverse. For example, Meredith and Green (1986) have emphasized the importance of employees' involvement in various stages of technology introduction. However, Farhoomand et al. (1990) have found that managers perceived this aspect of automation to be the least serious problem that arises from an increase in the firm's automation. Their study also indicated that managers perceive "cost reduction" to be a less important benefit arising from an increase in the firm's automation system than "improved flexibility" and "product quality." This is what the present analysis will attempt to examine.

METHODS

Study Model

As aforementioned, the literature suggests two models that can help in deciding on adopting an automated management information system:

1. the theory of reasoned action (Fishbein &Ajzen, 1975) which maintains that the intention to adopt a certain automated information system is influenced - among other things - by the managers' beliefs about the potential outcomes of actually adopting an innovation; and

2. the model of innovation decision process (Rogers, 1983) which states that, based on the perceptual characteristics of an innovation, an adopter forms a certain attitude toward that innovation during two stages of the adoption process - the persuasion stage and the confirmation stage. First, a favorable attitude would lead to a behavioral intention during the persuasion stage of the decision process. Second, attitude formation takes place in the confirmation stage of the adoption decision process when the adopters reevaluate their attitudes toward the innovation depending upon the correspondence between their prior expectations and the actual outcomes of the innovation.

The aforementioned two models will be used as a theoretical basis to the empirical investigation in this study.

Sources of Data

Published financial information on 44 local and foreign banks in the UAE was retrieved from The Gulf News Agency Banking and Insurance annual reports. For this research, the banks' financial data from 1985 through 1993 were available.

A specifically designed questionnaire was used (see Appendix). Examining all questionnaires used in related empirical literature, consulting with several faculty members of

the department of business administration, and discussing alternative questions with bank managers constituted the initial steps to develop this study's questionnaire.

The questionnaire contained five questions. Only four of them are related to this study. The first question, which consisted of ten items, elicited data pertaining to the perceived benefits of automation in such areas as cost reduction, revenue increase, service quality, and control. The second question included another ten items to gather information on perceived problems related to: inadequate financial justification of the system, resistance to change, and system implementation and maintenance. Each item in the first two questions had a five-point Likert scale ranging from "very important" to "not important at all." The third question included four sections to measure four different personal beliefs and attitudes: (1) beliefs about computers, (2) beliefs about new technology, (3) attitudes toward banking automation, and (4) personal participation in developing or acquiring the bank's current system. The last question investigated the different features of a current automated system and collected demographic data on the bank.

The study utilized a set of ten semantic differential items to measure each manager's beliefs or attitudes. Each scale had a five-point scale ranging from "one" to "five." The average of all ten scales for each belief or attitude constituted its index.

A panel of seven industry experts and university academics have subjectively assessed every participant bank's level of automation. A score between (zero) and (five) was assigned to each bank based on the availability of electronic facilities. These facilities include data processing equipment to manage customer accounts, an electronic credit management facility, ATMs and the functions they perform, an electronic network communication arrangement among the bank headquarters and branches, a worldwide interbank telecommunication network such as SWIFT, electronic payment services, and POS machines and telephone/home banking systems.

A sample of ten banks has participated in testing the validity of the questionnaire. The responses and comments of these bank managers were subsequently used to modify the instrument. Testing the internal structure stability of the questionnaire, it appeared that Cronbach Alpha for the first two questions was always higher than 0.82. It could not be increased if any item was dropped from any of these questions. Alpha was at least 0.75 for the items in question three and four. The conclusion was that the instrument was highly stable.

Between January and July of 1994, 42 local and foreign banks that operate in the UAE were visited. During those bank visits, the bank managers in charge of making system automation decisions using the above-mentioned questionnaire were interviewed. The choice of increasing the managers sample through interviewing a number of managers in each bank was available. However, to avoid intraclass correlation, only a single manager for each bank

answered the questionnaire. Since the information systems in question were centrally managed, only central information managers were viable candidates for the study. Acknowledging the likely high correlation between central information managers' responses, it seemed more reasonable to restrict the interviews to the banks'Central Information Officer or equivalent.

Based on available financial data, the possible sample size ranged from 39 to 44 banks. However, this study concentrated its analysis on 38 banks that had complete financial time-series data on record, had an automated system, and agreed to participate in the study in order to test the long term effects of banking automation. This sample accounted for 88.5% of all banks in the UAE. Although the sample is not large, it is enough for an exploratory study of its nature.

ESTIMATION AND RESULTS

The study analysis proceeds in two steps. The first step attempts to examine the sample banks' economic justification of their investment in automation according to the theory of reasoned action. The second step endeavors to analyze the sample bank managers' perceptions toward automation according to the model of innovation decision process. Data on the most recent financial records, 1993, is utilized in estimating these models.

Justification of Investment in Automation

The well-known return-on-equity (ROE) model is utilized in this study to analyze a bank management's efficiency performance. It states that (Sinkey, 1992):

$$\frac{\text{ROE}}{\text{Net Income}} = \frac{\text{PM}}{\text{Net Income}} * \frac{\text{AU}}{\text{Operating Income}} * \frac{\text{EM}}{\text{Average Assets}}$$

$$\frac{\text{Net Income}}{\text{Average Equity}} = \frac{\text{Net Income}}{\text{Operating Income}} * \frac{\text{Operating Income}}{\text{Average Assets}} * \frac{\text{Average Assets}}{\text{Average Equity}}$$

The ROE model implies those electronic banking needs to support the bank's profit margin (PM) by holding costs down and needs to pump up the bank's asset utilization (AU) by generating additional service revenues. To the extent that a bank can use electronic banking as an aggressive tool to expand its asset base safely, it can increase its equity multiplier (EM), given a fixed capital base. With a constant return on assets (ROA = PM * AU), this greater leverage will mean a higher return on equity (ROE). If this higher ROE can be achieved without changing the market's perception of the bank's risk exposure, the bank's market value should rise. (Sinkey, 1992).

In order to answer the question of how the UAE banks justify their huge investment in IT, multivariate regression analysis is performed. The following regression model is employed.

$$\begin{Bmatrix} PM \\ AU \\ EM \end{Bmatrix} = \beta 0 + \beta 1(BankAutomationLevel) + \beta 2(LogofBankTotalLoansAmount) + \epsilon$$

It tests the significance of the relationship between PM, AU, and EM as dependent variables, and the bank automation level controlled for the bank total loans amount as independent variables. Total loans amount is used as proxy for the bank size. Total assets amount was not used because of its high structural correlation with both AU and EM. The dependent variables in the model, by definition, are assumed to reflect changes in a bank's revenues and expenses that result from changes in its profitability, assets utilization, and efficient equity deployment.

In 1993, the profit margin has ranged from a minimum of -.20 to a maximum of 1.13 with an average of .38. As for the assets utilization, it has ranged from .02 to .30 with an average of .05. But, the sample equity multiplier has ranged from 1.19 to 22.06 with an average of 9.18. In addition, the loans amount has ranged from 43.58 million Dirhams (1 Dirham = $0.27) to 10,036.20 million Dirhams with an average of 1,575.10 million Dirhams. Table 1 shows the distribution of participating banks among the different automation levels.

Table 1
Automation Levels of Participating Banks

Automation Level	Number of Banks	Percent
1. (lowest level of automation)	2	5.3
2. (low automation)	8	21.1
3. (Average automation)	12	31.6
4. (high automation)	11	28.9
5. (highest level of automation)	5	13.2

Of course, when multivariate analyses are undertaken, it is not sufficient just to look at the characteristics of the variables individually. Information about their joint distribution must also be obtained. Similarly, identification of outliers must be based on the joint distribution of variables (Norusis, 1990). Investigation of information on the multivariate distribution of the above variables indicates its normality and equality of variance-covariance matrices. In addition, unreported Pillai's, Hotelling's, and Wilk's statistics and their approximate F-values show that the null hypothesis that the population means do not differ from zero is rejected.

Table 2 shows Univariate F-tests for the proposed regression model. The relationship between EM and both automation level, AUTOLVL, and the logarithm of total loans, log (LOANS), is significant at .01. Further investigation of this relationship seems necessary to identify which independent variable is responsible for changes in EM.

Table 2
Regression of Profit Margin, Assets Utilization and Equity Multiplier on Automation Level and Log (Loans): Univariate F and t-tests with (2,35) d. f.

Regression				Covariate			
Variable	Adjusted R^2	F	Prob > F	Term	Beta	t	Prob > t
PM	.0151	1.283	.290	AUTOLVL Log (LOANS)	-.2956 .0739	-1.499 0.375	.143 .710
AU	.0212	1.401	.260	AUTOLVL Log (LOANS)	.3291 -.1905	1.674 -0.969	.103 .339
EM	.1859	5.224	.010	AUTOLVL Log (LOANS)	.3976 .2636	2.301 1.470	.032 .150

As can be seen from Table 2, bank size, that is, log (loans), does not significantly affect its performance. In other words, returns to scale do not overshadow the effect of banking automation on performance. In fact, although increasing the level of automation seems to hurt a bank's profit margin in the short-run, it enhances the bank equity multiplier. This equity multiplier is the result of accumulated long term effects of expanding bank assets base given a fixed capital base. This later effect should lead to an increase in the market value of a bank and add to its stockholders' wealth. However, Table 3 should be viewed with some caution. Still, the data suggest that automated banking systems have become the norm, not the exception, in today's UAE banks. The only difference between them is in the degree of automation adopted by each bank.

This finding seems to disagree with some previously reported results that average costs of commercial banks do actually decrease due to the introduction of information technology to banking functions (Alpar & Kim, 1992). It also contradicts other reported findings that average banking costs first fall and then rise with bank size (Humphrey, 1987). Bank size did not appear to have a significant effect on the relationship between automation and economic performance. These two studies (Humphrey, 1987; Alpar & Kim, 1992) have modeled the overall bank production setup with a cost function including major input factors and outputs. This made it possible to measure the impact of IT on total costs while controlling for other input factors. The above-mentioned studies (Humphrey, 1987; Alpar & Kim, 1992) suggest that in order to achieve the given output volumes while minimizing costs, it was better for banks to

demand additional IT rather than labor. This is compatible with our finding that performance improved with higher levels of automation, although our sample, data, and analysis approach were different from theirs. This study considers the costs and revenue dimensions of bank performance whereas both of these studies focused on the cost aspect. At the same time the study findings agree with other studies, e.g., (Davis, 1986; Apcar, 1987; Humphrey, 1987; Alpar, 1992) in that most of banking automation's advantages appear in the long run .

Perceived Benefits of Banking Automation

Table 3 presents the survey results of perceived banking automation benefits. It shows that the mean scores of the responses for all the perceived benefits were at least "relatively important." It also indicates that "improved service quality" is apparently the biggest achievement of banking automation; with a standardized score of 4.365, it ranks number one among all perceived benefits. "Improved accuracy" and "reduced customer complaints" follow in the second and third positions, respectively. Notice that both aspects are related to improved service quality. This proves that banking automation is perceived as a successful strategy to increase these banks' service quality and consequently increase their ability to compete in the industry. The reported improvement in service quality is obviously going to evoke more interest among UAE banks for further automation endeavors. This result agrees with Hughes (Hughes, 1990) and Beyer's (1994) findings that the use of advanced IT in an industry leads to an increase in the overall levels of information technology in use in this industry.

Table 3
Means, Standard Deviations, Standardized Sores and Ranks of Perceived Benefits

Variable	Mean	Standard Deviation	Standardized Score[a]	Rank
Increased Volume	4.16	.68	1.706	5
Business Flexibility	4.08	.75	1.440	7
Reduced Cash	3.63	.94	0.670	9
Reduced Labor Cost	3.61	1.15	0.530	10
Improved Service Quality	4.79	.41	4.365	1
Competitive Advantage	4.42	.86	1.651	6
Improved Accuracy	4.58	.55	2.873	2
Reduced Complaints	4.55	.69	2.246	3
Improved Morale	4.08	.78	1.385	8
Improved Productivity	4.42	.76	1.868	4

(a) standardized score = (mean -3)/standard deviation.

"Increased volume" and "improvement in employees' productivity" are also clearly recognized benefits among the banks surveyed. With standardized scores of 1.706 and 1.651, they rank fourth and fifth, respectively. As a service provider, a bank has no means of storing its service. Increasing its operations efficiency is one major aspect of successful bank management. Operations efficiency is another factor that reflects the cost reduction and increasing revenue objective in managing a bank. Identifying this variable as an important aspect in banking automation is in agreement with Alpar (1992) and Apcar (1987).

"Realized competitive advantage" ranks as the sixth most important contribution of banking automation. Although advanced use of IT technologies in automating the banking systems leads to increasing competition, it helps the IT bank leaders to achieve higher revenues and reduce their operating costs. Further steps in automating their systems are expected to allow them to enjoy further lower costs (Boston Consulting Group, 1968). This is in agreement with Sinkey's (1992) aforementioned argument.

Perceived Problems of Banking Automation

Again, the mean scores of the responses for all the perceived benefits, as depicted in Table 4, were at least "relatively important." "System security" appears as the major problem; with a standardized score of 2.710, it ranks first among perceived problems of banking automation. However, this obstacle has not slowed or prohibited UAE banks from pursuing automation. In fact, most banking automation equipment is the product of current advanced technology, and technical expertise is needed in order to operate it safely and securely. This result is in contrast to Farhoomand et al. (1990) who have found that managers perceived this aspect to be a less important problem in deciding to increase a firm's level of automation. This difference can be related to the fact that Farhoomand et al. study was not concerned directly with banking automation per se. In addition, a recent study by Culpan (1995) reported that end users in the manufacturing industry manifest attitudes and intentions toward IS that may differ from those of users in the service industry.

"Training personnel on the use of the system" ranks second as an important problem of automating bank services. Employees' involvement in developing the system is a crucial factor that affects its future success (Meredith and Green, 1986). Moreover, employees' training to operate and maintain such sophisticated systems are critical to the successful operation of these systems. This result is consistent with the recent findings of Tombak and De Meyer (1988).

"Time required to develop adequate software," "cost of developing the system," and "cost of operating the system" rank third, fourth and fifth, respectively. The finding of the cost of developing the system problem is at a variance with Farhoomand et al. (1990) who found that this problem is one little concern to managers when deciding on increasing the level of automation. However, the same finding is in agreement with the recent findings of Tombak and

De Meyer (1988), who contended that managers are concerned with economic uncertainties surrounding operations automation.

Table 4
Means, Standard Deviations, Standardized Scores and Ranks of Perceived Problems

Variable	Mean	Standard Deviation	Standardized Score[a]	Rank
Software Development Time	3.92	.82	1.122	3
Software Development Cost	3.79	.87	0.918	7
IS Developing Cost	3.87	.78	1.120	4
IS Operating Cost	3.89	.80	1.115	5
Employee Training	4.16	.64	1.813	2
System Security	4.68	.62	2.710	1
Customer Awareness	3.66	.71	0.930	6
Financing the System	3.74	.92	0.804	8
Increased Maintenance Cost	3.58	.89	0.652	9
Employee Resistance	3.16	.97	0.167	10

(a) standardized score = (mean -3)/standard deviation.

" Inadequate customer awareness" ranks sixth. As in, most third world countries, illiteracy and customer awareness constitute major problems in offering customers advanced technology equipment to use in accomplishing his banking needs. It takes a great deal of information dissemination and persuading to promote the new banking automation uses and limitations.

"Resistance to change" is the least important problem; with a standardized score of 0.167 it ranks tenth. Bank managers do not seem to worry about introducing the new automated systems to their staff. Our data do not support employees' resistance to change as an important area to worry about when considering banking automation.

Perceived Benefits, Problems and Managers' Beliefs

It should be interesting to examine the interrelationships among managers' perceptions (perceived benefits and problems) and their individual characteristics "(see below)" based on the model of innovation decision process (Rogers, 1983). The model implies that, based on the perceptual characteristics of a system, managers form a certain attitude toward it. A favorable attitude would lead to a behavioral intention during the persuasion stage of the decision process.

First, managers' related beliefs and previous experiences affect their perceptions toward the system. Second, managers reevaluate their attitudes toward the system depending upon the

feedback information that they receive on the system. Their active participation in adopting the system may help them in evaluating correspondence between their prior expectations and the actual outcomes of the system.

The current section intends to evaluate the relationships between these four groups of variables that interact with each other during the persuasion stage of the adoption decision process. For this purpose, a model will be proposed that will relate managers' perceptions, beliefs, experience, and active participation. Estimating this model will be used to understand the functional relationships among these four sets of variables.

Examining related literature, it was possible to identify five related characteristics that may influence managers' perceptions. They are: beliefs about new technology (Millman and Hartwick, 1987), beliefs about computers (Dutta, Cerveny, Ghorab and Kasper, 1982), beliefs about banking automation systems (Sinkey, 1992), experience (Dutta et al., 1982), and active participation in developing or acquiring the system (Millman and Hartwick, 1987).

Before embarking on an analysis of the relationship between managers' perceptions and their individual characteristics, it is important to explain the steps that led to using a nonlinear model in examining these relationships. Due to the lack of a concrete theory that can predict the relationships among the independent variables in the model, we relied on examining the correlation matrix for these variables. Our purpose in examining this correlation matrix was to assess any multicolinearity problems among them.

Table 5
The Correlation Matrix For The Independent Variables In The Model

Variables	X1	X2	X3	X4	X5
X1	1.000	-.0773	.5084	-.0262	.4063
		p=.421	p=.101	p=.438	p=.006
X2		1.000	.0280	.1317	.0344
			p=.034	p=.0001	p=.419
X3			1.000	-.1218	.2811
				p=.233	p=.044
X4				1.000	-.0655
					p=.348
X5					1.000

(b) X_1 is belief about new technology, X_2 is belief about computers, X_3 is belief about banking automation, X_4 is active participation in adopting the system, and X_5 is manager's experience.

As can be seen in Table 5, the correlation coefficients were not considerably alarming; they range between -.077 and .508. Five correlation coefficients were significant at the level .10 or

less. Only the correlation coefficient of the relationship between " belief about new technology" and " belief about banking automation" reached .508 and was significant at .10 level; all other nine correlation coefficients had the value .4 or less. The interrelation between " belief about new technology" and "experience" reached .4 and was significant at .05 level. The other three significant correlation coefficients were less than .4 in value and either significant at .05 or .0001 levels.

Next, using the variance inflation factor method (VIF) to assess the relationship between every independent variable and all possible subsets of remaining independent variables, it appeared that there was no serious relationship of this kind. Further, we postulated that the relationship between everyone of the managers' perceptions and all their five individual characteristics was curvilinear. All twenty dimensions of managers' perceived benefits and problems were subjected to a polynomial regression analysis of the following form:

$$Y = B_0 + B_1 X_1 + B_2 X_2 + B_3 X_3 + B_4 X_4 + B_5 X_5 + B_6 X_1 X_2 + B_7 X_1 X_3 + B_8 X_1 X_4 + B_9 X_1 X_5 + B_{10} X_2 X_3 + B_{11} X_2 X_4 + B_{12} X_2 X_5 + B_{13} X_3 X_4 + B_{14} X_3 X_5 + B_{15} X_4 X_5 + B_{16} X_1^2 + B_{17} X_2^2 + B_{18} X_3^2 + B_{19} X_4^2 + B_{20} X_5^2 + \epsilon,$$

Where Y is one of the managers' perceived benefits or problems of automating bank services, X_i is every of managers' five individual characteristics. We do not claim a specific theoretical justification of this curvilinear equation.

The method used to estimate the model consisted of performing stepwise regression analysis. The partial F-test to let a curvature coefficient enter the equation was conducted at .10 level of significance.

The results of the stepwise regression analyses, with system perceived benefits as dependent variables are presented in Table 6. In addition to regression coefficients, the figures show the model R^2 value. The variables in the regression equations cumulatively explain between 10 (for improving employees' morale) and 41 percent (for helping to gain competitive advantage) of the variance in perceived benefits of banking automation.

"Managers' beliefs about computers" and "managers' beliefs about banking systems" appeared in most of the cases as significant predictors of perceived benefits of banking automation. This finding is in agreement with Huang and Sakurai (1990) and Alper (1992). In addition,"realized competitive advantage" is significantly affected by "bank managers' beliefs about computers." This is in agreement with Hughes (1990). Unexpectedly, "Managers' beliefs about new technology" appear to be unrelated to perceived benefits of the system. However, "managers' experience," and "active participation in adopting the current system" showed in few cases as significant predictors of perceived benefits of banking automation. This is in agreement with Dutta et al. (1982).

Table 6
Estimated Perceived Benefits Stepwise Regression Models [a]

Dependent Variable	Regression Model [b]	R^2	F
Increased Volume	Y = 3.107 + .061 X2 t = 7.29 t = 2.54 (.0001) (.016)	.15	6.44 (.016)
Business Flexibility	Y = 2.320 + .408 X_2 t = 3.622 t = 2.789 (.0009) (.0084)	.18	7.78 (.0084)
Reduced Cash	Y = 3.404 + .0729 X3 - .0872 $X_3$2 t = 6.02 t = 3.525 t = 1.950 (.00001) (.0012) (.0593)	.26	6.217 (.0049)
Reduced Labor Cost	Y = 2.282 + .078 X_3 t = 4.772 t = 2.959 (.00001) (.0054)	.196	8.76 (.0054)
Improved Service Quality	Y = 4.193 + .0343 X_3 t = 18.98 t = 2.811 (.00001) (.0079)	.18	7.91 (.0079)
Competitive Advantage	Y = -3.773 + 3.867 X_2 - .442 X_2^2 t = -2.052 t = 3.983 t = -3.515 (.047) (.0003) (.0012)	.41	12.02 (.0001)
Improved Accuracy	Y = 3.293 + .0587 $X_5$2 t = 8.751 t = 3.134 (.00001) (.0034)	.22	9.82 (.0034)
Reduced Complaints	Y = 5.5307 - .2429 X_3 t = 10.54 t = -1.904 (.00001) (.0600)	.09	3.63 (.0600)
Improved Morale	Y = 2.708 + .3175 X2 t = 3.857 t = 1.982 (.0005) (.0500)	.10	3.93 (.0500)
Improved Productivity	Y = 3.293 + .0587 X_4^2 t = 8.748 t = 3.134 (.00001) (.0030)	.21	9.82 (.0030)

a) The number in parentheses indicate the level at which a statistic is significant.
b) X_1 is belief about new technology, X_2 is belief about computers, X_3 is belief about banking automation, X_4 is active participation in adopting the system, and X_5 is manager's experience.

The results of stepwise regression analysis, with system perceived problems as dependent variables and managers' characteristics as independent variables are presented in Table 7. The variables in the significant regression equations cumulatively explain between 22 (for employees' resistance to change) and 47 percent (for increased cost of developing adequate software) of the variance in perceived problems of banking automation.

The estimated models of system perceived problems have considerably higher R^2 than the estimated models of perceived benefits. The association of managers' characteristics with system perceived problems appear more complex than with perceived benefits of automated systems.

"Managers' beliefs about new technology," "managers' beliefs about computers," and "managers' beliefs about banking automation" appeared in most of the cases as significant predictors of perceived problems of automated systems. This finding agrees with Dutta et al. (1982) and with Millman & Hartwick (1987).

CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

This study is an attempt to analyze the automation decision of the UAE banks in terms of two models of adopting innovations: (1) the theory of reasoned action to examine the impact of increasing levels of automation on bank performance, and (2) the model of innovation decision process to examine managers' perceptions toward automation. Many of the relationships proposed through these models were supported empirically. Further, the results were discussed and contrasted with related literature.

Although previous studies have mainly concentrated on the cost aspects of a bank's economic performance, the results of the current study are based on examining both the cost and revenue sides of that performance. Results reveal that the UAE banks are adopting automated banking technologies and even increasing their level of automation on the expectation of improving their equity multiplying effect. UAE banks realize the short term negative impact of this automation on their profit margins and the long term positive effect of this automation on their business volumes and assets bases.

Examining management perceptions towards banking automation reveals that managers perceive "improved service quality," "enhanced accuracy," and "reduced customer complaints" as the most important benefits arising from banking automation. However, "reduced labor cost" shows as the least important perceived benefit of this process.

Bank managers perceive "the system security " as the most important problem in operating a bank automated system. However, "training personnel on the use of the system" and "increased system development costs" rank second and third, respectably, in importance. Interestingly enough, "resistance to change" is the least important problem in the process.

An important and immediate aim of this study is to examine managers' beliefs, experiences, and active participation in adopting the system as determinants of the system's perceived benefits and problems. According to the study model, managers' perceptions towards

automated systems play a major role in forming these managers' attitudes towards these systems. In turn, these attitudes influence the managers' intentions to adopt higher levels of automated systems in the future. We have used multiple regression analysis based on the stepwise technique to examine the association between managers' perceptions towards banking automation, on one hand, and their characteristics, on the other.

Table 7
Estimated Perceived Problems Stepwise Regression Models [a]

Dependent Variable	Regression Model [b]	R^2	F
Software Development Time	$Y = 1.2240 + .2360\ X_1 + 1.404\ X_4 - 2389\ X5$ t = 1.098 t = 1.371 t = 2.370 t = -2.610 (.2800) (.1795) (.0230) (.0130)	.23	3.38 (.0234)
Software Development Cost	$Y = 3.3308 + .0840\ X_1$ t = 7.486 t = 4.460 (.00001) (.0001)	.47	15.38 (.0001)
IS Development Cost	$Y = 1.8439 + .8902\ X_1 - .35757\ X3$ t = 3.06 t = 4.29 t = -2.16 (.0042) (.0001) (.0376)	.36	9.99 (.0004)
IS Operating Cost	$Y = 1.7061 + .5071\ X2$ t = 2.60 t = 3.39 (.0133) (.0017)	.24	11.51 (.0017)
Employee Training	$Y = 5.1720 - .0859\ X_5^2$ t = 9.01 t = -1.794 (.00001) (.0812)	.082	3.22 (.0812)
System Security	$Y = 2.1574 + .5471\ X_2 + .1077\ X_5 - .0212\ X_2X_5$ t = 2.575 t = 2.748 t = 2.258 t = -1.836 (.0146) (.0095) (.0305) (.0751)	.26	3.926 (.0165)
Customer Awareness	$Y = 2.9900 + .0384\ X2$ t = 7.443 t = 1.731 (.00001) (.0920)	.077	2.99 (.0920)
Financing the System	$Y = 1.8126 + .1123\ X4$ t = 3.394 t = 3.712 (.0017) (.0007)	.28	13.78 (.0007)
Increased Maintenance Cost	$Y = 2.2277 + .4111\ X_1 - .0084\ X_4$ t = 2.734 t = 1.889 t = -1.327 (.0098) (.0673) (.1930)	.10	1.97 (.154)
Employee Resistance	$Y = 2.0406 + .0865\ X_3$ t = 5.408 t = 3.193 (.00001) (.0029)	.22	10.20 (.0029)

(a) The number in parentheses indicate the level at which a statistic is significant.
(b) X_1 is belief about new technology, X_2 is belief about computers, X_3 is belief about banking automation, X_4 is active participation in adopting the system, and X_5 is manager's experience.

Analysis reveals that "managers' beliefs about computers" and "banking automation systems" are critical predictors of "system-perceived " benefits and problems. "Managers' beliefs about new technology" and "active participation in adopting the system" are additional worthy predictors of system perceived problems only. While "managers' belief about new technology" is unrelated to system perceived benefits, "managers' experience," is not associated with system perceived problems. This implies that new as well as experienced managers, in our sample, do not perceive banking automated systems differently. Experience is not a statistically significant factor in shaping these managers' perceptions. This is a positive result. It means that although one would expect more aggressive attitudes among young managers towards new technology means, such as automated banking systems, than among experienced managers, this is not validated by our data. Both young and experienced managers show positive attitudes towards the use of IT in banking.

The results of estimating the proposed models of system perceived benefits and problems are encouraging in terms of these models predictability. They are also encouraging in terms of their explanatory power in the case of perceived problems of automated systems, and not so enlightening in the case of system perceived benefits. The association of managers' characteristics with perceived problems of the system appears more complex than with perceived benefits of automated systems. More importantly, since only very few nonlinear terms of the independent variables have entered the estimated model, this would suggest using a linear model as a reasonable approximation in future studies.

The current study provides empirical estimation of its model proposed relationships that can be of reasonable value to the process of adopting automated systems. Note that the literature on information systems success asserts the significant relationship between user satisfaction and system usage. User satisfaction is dependent on the system perceived usefulness, benefits, and ease of use. This study has focused on examining some of the factors that are thought of as important determinants of the user perceptions about the system. Identifying these factors is important to rationalize the process of adopting new automated systems in general.

The above findings can be of reasonable practical significance when planning managerial development activities in banks. These activities should target, in part, enhancing bank managers' beliefs about advanced technologies, including computers, and banking automation. In addition, the findings can help in predicting bank managers' perceptions towards the automated system. The perceptions, in turn, influence managers' attitudes towards the system and intentions to adopt higher level banking automated systems in the future. On the other hand, the findings add to our academic understanding of the functional relationships among the variables that affect the innovation adoption decision. Finally, the study is limited by the models used in the analysis and interpretation of results, the variables included in these models, the database utilized in estimating the models, and by its sample.

Further research using different instruments and alternative research designs will be needed to substantiate the findings of this project and earlier studies. Another equally interesting research idea is to study the perceptions and reactions of customers toward the banking automated systems.

APPENDIX
The Questionnaire

Question # 1: Managers differ in their evaluation of various benefits that may result from automating bank functions. The following is a list of bank automation possible benefits. For each item, please specify your opinion as to the degree of importance of each item.

(VI=Very Important, I=Important, RI=Relatively Important, NI=Not Important, NIA=Not Important at All)

	Automating our bank functions:	**NIA**	**NI**	**RI**	**I**	**VI**
1	Helps the handling of high volumes of business	1	2	3	4	5
2	Helps providing flexible service	1	2	3	4	5
3	Enables better cash management	1	2	3	4	5
4	Reduces labor cost	1	2	3	4	5
5	Enables providing customers with improved service quality	1	2	3	4	5
6	Helps to gain competitive advantage	1	2	3	4	5
7	Enhances operations accuracy	1	2	3	4	5
8	Reduces customer complaints	1	2	3	4	5
9	Improves employees morale	1	2	3	4	5
10	Results in improved productivity	1	2	3	4	5

Question # 2: Managers differ in their evaluation of the importance of the problems that may result from automating bank functions. The following is a list of possible problems of adopting an automated banking system. Based on your bank experience, will you please indicate your own opinion as to the degree of importance of each item.

(VI=Very Important, I=Important, RI=Relatively Important, NI=Not Important, NIA=Not Important at All)

	Automating our bank functions has resulted in:	**NIA**	**NI**	**RI**	**I**	**VI**
1	Long time to develop the required software	1	2	3	4	5
2	High Cost of software development	1	2	3	4	5
3	High cost of developing the system	1	2	3	4	5
4	High operating costs	1	2	3	4	5
5	A great deal of Employee training	1	2	3	4	5
6	Troubles from the system security	1	2	3	4	5
7	Inadequate Customer awareness	1	2	3	4	5
8	High initial investment	1	2	3	4	5
9	Increased system maintenance costs	1	2	3	4	5
10	Resistance from bank employees	1	2	3	4	5

Question # 3: On each section in the following, you will find a different object to be judged and beneath it a set of scales. Will you kindly rate the object on each of these scales in order. Given the two extremes on the sides, please circle the digit that best describes your banking automated system.

A. Computers

worthless	1	2	3	4	5	valuable
regressive	1	2	3	4	5	progressive
threatening	1	2	3	4	5	reassuring
erratic	1	2	3	4	5	flawless
unreliable	1	2	3	4	5	reliable
unnecessary	1	2	3	4	5	essential
hindering	1	2	3	4	5	helpful
unfriendly	1	2	3	4	5	friendly
passive	1	2	3	4	5	active
boring	1	2	3	4	5	interesting

B. New Technology

worthless	1	2	3	4	5	valuable
regressive	1	2	3	4	5	progressive
threatening	1	2	3	4	5	reassuring
erratic	1	2	3	4	5	flawless
unreliable	1	2	3	4	5	reliable
unnecessary	1	2	3	4	5	essential
hindering	1	2	3	4	5	helpful
unfriendly	1	2	3	4	5	friendly
passive	1	2	3	4	5	active
boring	1	2	3	4	5	interesting

C. Banking Automation Systems

worthless	1	2	3	4	5	valuable
regressive	1	2	3	4	5	progressive
threatening	1	2	3	4	5	reassuring
erratic	1	2	3	4	5	flawless
unreliable	1	2	3	4	5	reliable
unnecessary	1	2	3	4	5	essential
hindering	1	2	3	4	5	helpful
unfriendly	1	2	3	4	5	friendly
passive	1	2	3	4	5	active
boring	1	2	3	4	5	interesting

D. Experience with Your Bank Automated System

I did not have actively participated in developing nor acquiring our bank's automated system	1	2	3	4	5	I have actively participated in developing or acquiring our bank's automated system

Question # 4: Please indicate which features of banking automation your bank has. Place an "X" in front each of the features you already have.

System Features	Included Services	"X" if your system already has the feature or service
Computer to Manage Customer Accounts		
Electronic Credit Management Facility		
Automatic Teller Machines	process withdrawals in local money	
	process withdrawals in foreign money	
	process deposits in local money	
	process deposits in foreign money	
	process account balance inquiries	
	process transfers between accounts	
	handle credit card operations	
	handle telephone bill payments	
Automatic Checks Clearinghouse		
Point of Sale System		
Cash Management System		
Check Verification System		
Check Truncation System		
Home Banking System		
Automatic Transfers System		

1. How many ATMs do you operate?

Less than 10	Between 10 and 25	More than 25

2. Where are your ATMs located?

Outside your branches	Inside some shopping areas	Within the local airports	Other areas

3. Which size of computers do you have?

Mainframe	Minicomputers	Microcomputers

4. Are you participating in a worldwide interbank telecommunication network such as SWIFT or alike?

Yes
No

5. Do you have an electronic network communication arrangement among the headquarters and branches?

Yes
No

6. If yes, which kind of network do you have?

_____

_____

7. Bank Name:

_____

8. Your Name:

_____

9. Position:

_____

10. How Long is Your Total Seniority:

_____

(with the bank and with any other firm)

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