Investigating IT Use and Satisfaction among Jordanian Commercial Banks: A Management Challenge

Loay M. Salhieh and Jamal D. Abu-Doleh *

ABSTRACT

This study focuses on the psychometric stability of the IT use instrument by Doll's and Torkzadeh's (1998), and the psychometric stability of the IT satisfaction instrument by Palivia's and Palivia's (1999) when applied to Jordanian end-users. Furthermore, the study uses canonical analysis to investigate a causal link proposed by the success model of Delone and McLean (1992). The results of the study give evidence that the two instruments are valid and reliable measure; which contributes to the generalizability of the two instruments. The results of the canonical analysis give evidence of the causal link between IT use and IT satisfaction, and identify useful and not useful variables in the two instruments.

KEYWORDS: IT Use, IT Satisfaction, IT Success, Canonical Analysis.

1. INTRODUCTION

The availability of Information Technology (IT) within organizations, over the last two decades, has increased tremendously. The rapid growth of the personal computer industry, substantial decreases in computer unit costs, and simultaneous increases in computer power and speed have made vast amounts of information readily available to individuals in organizations. This proliferation of IT products (hardware, software and communication technology) and applications has been experienced by most organizations and has been increasingly researched in the past. The availability and use of information systems and technologies has grown almost to the point of being commodity like in nature, becoming nearly as ubiquitous as labor, and U.S. companies spent more on information technology than on any other form of investment (Dewett and Jones, 2001). Given the increasing complexity and uncertainty in the financial industry, banks are presently investing more and more in Information Technology (IT), hoping to obtain more and more productivity and greater effectiveness by this mean (Osei and Ko, 2004), and IT is seen as a vehicle to gain a competitive advantage (Earl, 1993).

However, it is important to note that the mere introduction of IT, in and of itself, does not create a competitive advantage (Huff and Beattie, 1985), but the use of the right type of IT applications and consequently the satisfaction of the introduced IT for a given organization may lend a competitive edge (Kathuria et al., 1999). Also, investments in Information Systems (IS) does not automatically lead to success as implied by some earlier studies, but the benefits of IS come from the varying ways of its use and satisfaction with the investment (Byrd et al., 2005). So, in order to measure the success of the IT investments or the information system, usage and satisfaction has been proposed as a management information science (MIS) success in several frameworks for research (Doll and Torkzadeh, 1998). IT usage and satisfaction are a central concept in taxonomies of IT success (Doll and Torkzadeh, 1998,

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Palvia and Palvia, 1999, Vlahos et. al., 2004). Much of the research of IT use and satisfaction has been of an academic nature, and its intent is to provide a valid and reliable surrogate for measuring the level of IT use and satisfaction with an organization's IT (McHaney et al., 2002). Although a comprehensive instrument for measuring IT use and satisfaction does not yet exist, accepted surrogate measures are presently in use, such as: Doll and Torkzadeh (1998) of measuring IT use and Palivia and Palivia (1999) of measuring IT satisfaction. Although managerial use and satisfaction of IT has been studied in several countries (Vlahos et al., 2004; McHaney et al., 2002) in order to add evidence to the generalizability of the instruments used. Unfortunality, available literature lacks such studies in Jordanian's settings.

The purpose of this present study is three folds. The first is to determine whether the Doll's and Torkzadeh's (1998) instrument (IT Use) maintains psychometric stability in Jordanian settings. The second is to determine whether Palivia's and Palivia's (1999) instrument (IT satisfaction) maintains psychometric stability in Jordanian's settings. In order to investigate the validity of these two instruments, this investigation focuses on establishing content validity, construct validity and reliability. Both developers of the two instruments used a multi-step process to validate their instrument and found it to be generalizable across several contexts. However, Jordanian's context was not among them. Therefore, it is important to ensure that the psychometric properties of the two instruments remain constant. The third is to investigate the causal link between the IT Use and IT Satisfaction identified by Delone and McLean (1992). But due to the complexity of the two constructs (IT Use and IT Satisfaction); the researchers believe that it is beneficial and appropriate to study this relationship by using canonical analysis.

This study is organized as follows: The following section describes related literature. The third section discusses the method used to validate the two instruments. The fourth section discusses the results that will support the three aspects of this study. The final section discusses conclusions and limitations.

2. LITERATURE REVIEW

This study represents a fusion of two research streams: the strategic use of information technology and the user satisfaction of the utilized information technology. The former has been studied by Doll's and Torkzadeh's (1998), while the latter has been investigated by Palivia's and Palivia's (1999) primarily through the Technology Acceptance Model (TAM) (Davis, 1989).

2.1. Information Technology Success

Some of the introduced information technology or information systems are successful and others are not. While it is convenient to categorize outcomes in this manner, it is not that simple. Success cannot always be characterized as a 'yes' or 'no' proposition or in a binomial fashion (McHaney et al., 2002). A particular system may be viewed as a success by some stakeholders and as a failure by others because of different requirements and needs within an organization. In the absence of clear objective measures, researchers and practitioners have turned to perceptual surrogates. In order to identify the determinants of success, a researcher must first be able to operationalize a measure. Many empirical studies in the area of information systems have been concerned with this task (McHaney et al., 2002). Evaluating the success of information systems has proved to be elusive from the earliest applications. The need to evaluate effectiveness and the difficulty of operationalizing an economics based construct, accelerated the search for constructs which could be identified and more easily measured including success, satisfaction and usage (Powers and Dickson, 1973; Nolan,1974). The principal approach has regarded these constructs as surrogates for each other (Melone, 1990). While the evaluation of systems implementations remains important in the literature, few studies have sought to examine or establish linkages between the measures (Gatain, 1994). An important step in consolidating prior research was undertaken by Delone and McLean (1992).

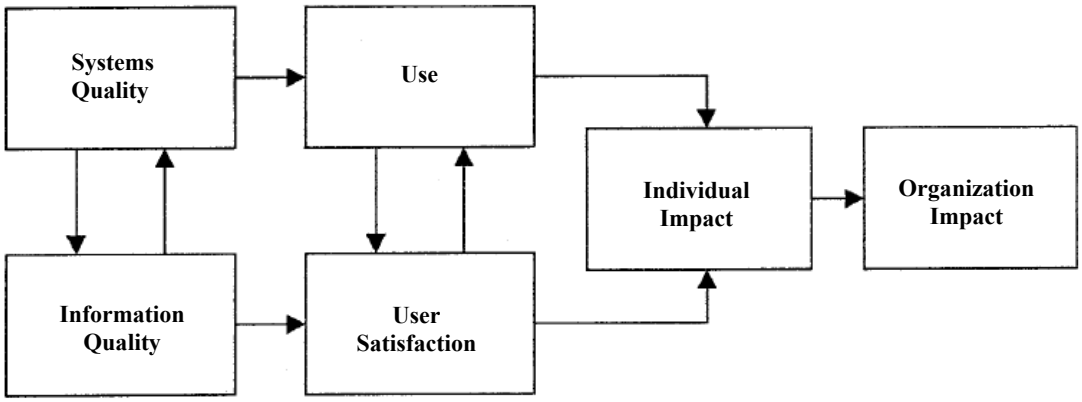

Figure 1: IS/IT Success Model (Delone and McLean, 1992).

IT Functions	Components	Definition
Decision Support	Problem Solving	The extend that information technology is used to analyze cause and effect relationships (i.e., to make sense out of data).
	Decision Rationalization	The extent that information technology is used to improve the decision making processes or explain/justify the reasons for decisions.
Work Integration	Horizontal Integration	The extend that information technology is used to coordinate work activities with others in one's work group.
	Vertical Integration	The extend that information technology is used to plan one's own work, monitor performance, and communicate vertically to coordinate one's work with superiors and subordinates.
Customer Service	Customer Service	The extend that information technology is used to service people. The people serviced by the application may be internal to the organization (i.e., internal customers) or external customers.

Figure 2: Functions and components of the IT use construct (Doll and Torkzadeh, 1998).

In this regard, DeLone and McLean (1992) offered a relational model that interrelates six variable categories as dependent variables of IS or IT success: system quality, information quality, use, user satisfaction, individual impact and organizational impact as shown in Figure (1). In their construction of the model, these authors did not claim that their model is definitive and indeed validation is invited and their review of the literature reveals that these dimensions have evolved over time. The success model clearly needs further development and validation before it could serve as a basis for the selection of appropriate IS measures (Drury and Farhoomand, 1998). This study is concerned with IT use and IT satisfaction, as a measure of IT success, and examining the nature of the relationship between these two dimensions.

2.2. IT Use Construct

Many organizations are today experiencing a large growth in their use of information technology. During the 90s, local and global computer networks have grown rapidly. The establishment of this infrastructure can be expected to lead to increased contacts between people. This in turn means that we can foresee further increases in IT use. The literature has long recognized the importance of IT use as a measure of technology's acceptance (Ives and Olson, 1984), and usage has been proposed as an MIS success measure in several frameworks for research (Doll and Torkzadeh, 1998). Also, managers' use of information and information technology is a recurring theme in the literature (Larsen and Wetherbe, 1999), and usage has been studied as a phenomenon of interest in its own right (Taylor and Todd, 1995). Understanding the determinants of information technology usage should help to ensure effective deployment of IT resources in an organization. Such usage is a necessary condition for ensuring productivity payoffs from IT investments (Davis, 1989, Mathieson, 1991). Based on previous researchers on IT usage and the social and economic impact of IT, Doll and Torkzadeh (1998) developed a multidimensional measure of how IT is used in the work context. Their instrument consisted of five components of IT use as defined in Figure (2). Their instrument evaluated how extensively IT systems are used (that is, a taxonomy of performance-related behaviors) by individuals to perform certain organizationally relevant functions for which IT is utilized in the post-implementation context. Doll's and Torkzadeh's (1998) measure of IT use in terms of decision support, work integration and customer service functions has several advantages. First, it enables researchers to investigate the patterns and extent of IT use along organizationally relevant dimensions. Thus, it sheds light on how fully or effectively organizations are using IT. Second, it is meaningful and relevant whether usage is voluntary or required. Third, it enables us to measure IT use at the application or individual level. Fourth, it is appropriate for studies where the unit of analysis is the application, the individual, or the work group. So, when evaluating how individuals are using the technology, we are evaluating a complex socio-technical phenomenon defined by the interaction of people and technology in an organization context.

The first part of this study is to validate the IT use construct developed by Doll's and Torkzadeh's (1998) in Jordanian's settings. The most overriding and important reason for validating the IT use construct is that IT use is an important driver of IT success within organizations (Mahmood et al., 2001). By developing a better understanding of the factors affecting IT use, strategic managers should be able to shape policies within their organizations, to maximize the effectiveness of their efforts to stimulate IT usage and in the process increase organizational performance and productivity.

2.3. IT Satisfaction Construct

Cyert and March (1963) proposed the concept of user satisfaction with IT as a surrogate of IT success. Since then, IT satisfaction has become a pervasive measure of the success or effectiveness of information systems for both practitioners and researchers (Doll et al., 2004). DeLone and McLean's (2003) updated model of information system success continues to consider IT satisfaction as one of the key measures of system success. IT satisfaction instruments have been developed for: a traditional data processing environment, an end-user computing environment, a mainframe-based corporate database environment, decision support applications and an end-user development context (Doll et al., 2004). An understanding of user's satisfaction with Information Technology (IT) is needed in order to continue to design better IT. Also, organizations rather have their employees satisfied than unsatisfied with the IT they use. Thus, much work has been performed on the construct over the past several decades, and probably it has been one of the most studied constructs in IS research (Woodroof and Burg, 2003). However, the IT satisfaction construct cannot be directly observed, and a further operationalization is required. Palvia and Palvia (1999) developed a twenty three items for their instrument which included: software adequacy, software maintenance,

information content, information accuracy, information format, ease of use, timeliness, security and integrity, documentation, vendor support and training and education. This study adopted Palvia and Palvia (1999) instrument to be validated in the Jordanian context, and to satisfy our second fold of this study. If evidence supports psychometric stability of the studied instrument, managers and software product developers can confidently apply the instrument in the investigation of competing tools, features and technologies. Also, the use of the instrument can be confidently extended to use in the Jordanian's applications.

2.4. Causal Link

Even though IT use and IT satisfaction are one of the most researched dimensions of IT success (Doll and Torkzadeh, 1998; Palvia and Palvia, 1999; Vlahos et al., 2004), the effort to explore the nature of the relationship between them has been less clear. Support for the causal link between IT use and IT satisfaction has been recognized and addressed by many researchers as to exist (Hunton and Flowers, 1997, Seddon and Kiew, 1994). Support for the causal link between IT use and IT satisfaction comes from the Theory of Planned Behavior (TPB) (Grandon and Perason, 2004). The theory of planned behavior is a well established intention model that has been successful in predicting and explaining behavior across a wide variety of domains, including the use of information technology (Agarwal, 2000). In the DeLone and McLean's (1992) model, as shown in Figure 1, both IT use and IT satisfaction are both affecting each other. Elements of DeLone and McLean's (1992) model have been tested previously. For instance, Hunton and Flowers (1997), and Seddon and Kiew (1994) have tested the relationships between categories of DeLone and McLean's (1992) taxonomy. In general, Hunton and Flowers (1997) and Seddon and Kiew (1994) found support for the relationships of the DeLone and McLean's (1992) model. Hunton and Flowers (1997) found support for seven of the nine relationships as shown in Figure (1). The two categories with insignificant relationships were from IS use to user satisfaction and from user satisfaction to individual impact. In contrast with Hunton and Flowers (1997), Seddon and Kiew (1994) found a significant path from usefulness (alternative for Use) to user satisfaction. This disparity in findings may be due to differences in the constructs used to represent DeLone and McLean's taxonomic categories. The third fold of this study is to examine the relationship between the IT use and IT satisfaction as depicted by DeLone and McLean (1992) model. A canonical analysis will be utilized in order to investigate whether there is a relationship between IT use and IT satisfaction as multioperationalized in the variable sets. The Canonical correlation analysis is often used to investigate the relationship between two sets of variables (Hotelling, 1935). This analysis is primarily descriptive, although it can be used for predictive purposes (Grandon and Perason, 2004). This study, therefore, use this method to identify the relationship between IT use variables and IT satisfaction variables.

3. METHODS

3.1 Subjects

The target population for this study was knowledge workers-specifically, individuals whose primary work related activities were information-based and required the use of IT to complete these activities. The targeted population was employees located at banks' headquarter. Currently 19 banks are reported in the Jordanian Stock Market Exchange (2005). They vary between commercial, investment, industrial development and Islamic banks. Banks offer almost the same type of services with minor variations except for industrial development and Islamic banks. This study targeted Jordanian's commercial and investment banks (8 banks) while excluded industrial development, Islamic banks and foreign banks operating in Jordan because of major differences in services offered, operation structure and environment. Investment banks carry on the same activities as commercial banks with the exclusion of short-term commercial lending (overdraft). Representatives from 8 banks were identified and asked

to participate in this study. Each representative was asked to distribute 25 questionnaires (5 to each department located at headquarter: Human resources, Treasury, Credit, Operations and Risk Management).

3.2 The Instrument of Study

The survey package contained a letter from the researchers explaining the purpose of the study, and the questionnaire. All respondents were guaranteed confidentiality of individual responses, and only summary statistics were returned to participating organizations.

The questionnaire consisted of three parts as shown in appendix A. The first part involved 5 demographic questions designed to solicit information about the respondents. The second part of the questionnaire was Doll's and Torkzadeh's (1998) instrument for measuring IT use. This consisted of 35 questions designed to measure the respondent's IT usage. This instrument was designed to provide a composite measure of IT usage, as well as to provide measures on the dimensions of using IT in the following areas: problem solving, decision rationalization, horizontal integration, vertical integration and customer service. Five Likert-type scales were used to score the responses. The third part of the questionnaire was Palivia's and Palivia's (1999) instrument for measuring IT satisfaction. This consisted of 23 questions designed to measure the respondent's satisfaction with the IT they utilize. This instrument was designed to provide a composite measure of user satisfaction, as well as to provide measures on the dimensions of software adequacy, software maintenance, information content, information accuracy, information format, ease of use, timeliness, security and integrity, productivity, documentation, vendor support, training and education, and overall evaluation. Five Likert-type scales were used to score the responses.

3.3. Demographics Profile

The response rate was 78% (156 usable responses out of 200 questionnaires distributed). This high return rate can most likely be attributed to the use of the bank representative in the dissemination, and collection of the survey instrument. The sample was divided between males (66.67 %) and females (33.33 %); 84% of the respondents were between 20 and 40 years of age; and 56% had a bachelor degree. Table (1) shows a detailed descriptive statistics of the respondents demographics (gender, age and education), and the distribution of the respondents departments.

Table 1: Demographics Profile of Study (n = 156).

Gender		
	Male	66.67 %
	Female	33.33 %
Age		
	20 - 30	43.59 %
	31 - 40	40.38 %
	41 - 50	15.38 %
	> 50	0.65 %
Education		
	High school	3.85 %
	2- Year college	17.95 %
	4- Year college	56.41 %
	Master degree or higher	21.79 %
Department		
	Credit	10.90 %
	Human Resources	21.15 %
	Operation	30.13 %
	Risk Management	12.82 %
	Treasury	25. %

4. ANALYSIS AND RESULTS

Using the non-parametric Kruskal-Wallis tests and Levene's Test on the two instruments items found no significant differences between the banks used in this study as shown in the p-value in Table (2). Thus, it was

Table 2: Kruskal-Wallis and Levene's Tests (p-value Results).

Bank Name	Construct	Levene's Test (ά = 0.01)	Kruskal-Wallis Test (ά = 0.01)
Bank 1	IT Satisfaction	0.507	0.033
	IT Use	0.156	0.756
Bank 2	IT Satisfaction	0.913	0.143
	IT Use	0.234	0.605
Bank 3	IT Satisfaction	0.947	0.141
	IT Use	0.612	0.227
Bank 4	IT Satisfaction	0.439	0.411
	IT Use	0.505	0.594
Bank 5	IT Satisfaction	0.113	0.021
	IT Use	0.659	0.039
Bank 6	IT Satisfaction	0.338	0.040
	IT Use	0.348	0.027
Bank 7	IT Satisfaction	0.719	0.97
	IT Use	0.559	0.040
Bank 8	IT Satisfaction	0.562	0.295
	IT Use	0.437	0.393

Table 3: Cronbach's α Reliability Coefficients for the Two Instrument Items (Number of Items for Each Variable Shown in Parentheses).

Variables	**Cronbach's α**
IT Satisfaction (23)	**0.953**
Software Adequacy (1)	-----
Software Maintenance (1)	-----
Information Content (2)	0.825
Information Accuracy (1)	-----
Information Format (2)	0.889
Ease of Use (3)	0.752
Timeliness (2)	0.765
Security and Integrity (2)	0.515
Productivity (2)	0.867
Documentation (2)	0.825
Vendor Support (1)	-----
Training and Education (1)	-----
Overall Evaluation (3)	0.886
IT Use (35)	**0.970**
Problem Solving (9)	0.811
Decision Rationalization (7)	0.936
Horizontal Integration (5)	0.911
Vertical Integration (7)	0.930
Customer Service (7)	0.918

Table 4: Content and Construct Validity of IT Satisfaction Instrument (See Appendix A for Abbrev.)

Correlation with	***r***	***(p)***	***r***	***(p)***
Scale	*Software Adequacy*		*IT Satisfaction*	
Sa1	1	*	0.632	(0.000)
	Software Maintenance			
Sm2	1	*	0.652	(0.000)
	Information Content			
Ic3	0.916	(0.000)	0.651	(0.000)
Ic4	0.929	(0.000)	0.691	(0.000)
	Information Accuracy			
Ia5	1	*	0.734	(0.000)
	Information Format			
If6	0.950	(0.000)	0.778	(0.000)
If7	0.947	(0.000)	0.755	(0.000)
	Easy of Use			
Eu8	0.803	(0.000)	0.677	(0.000)
Eu9	0.851	(0.000)	0.644	(0.000)
Eu10	0.827	(0.000)	0.576	(0.000)
	Timeliness			
Tm11	0.894	(0.000)	0.693	(0.000)
Tm12	0.906	(0.000)	0.674	(0.000)
	Security and Integrity			
Si13	0.837	(0.000)	0.587	(0.000)
Si14	0.804	(0.000)	0.608	(0.000)
	Productivity			
Pr15	0.937	(0.000)	0.772	(0.000)
Pr16	0.942	(0.000)	0.765	(0.000)
	Documentation			
Dc17	0.935	(0.000)	0.763	(0.000)
Dc18	0.913	(0.000)	0.775	(0.000)
	Vendor Support			
Vs19	1	*	0.699	(0.000)
	Training and Education			
Te20	1	*	0.713	(0.000)
	Overall Evaluation			
Oe21	0.858	(0.000)	0.771	(0.000)
Oe22	0.946	(0.000)	0.825	(0.000)
Oe23	0.901	(0.000)	0.771	(0.000)

concluded that the banks could be treated as one sample for further analysis. Table (3) reports simple statistics for each dimension of IT use and IT satisfaction. Also, an initial reliability test was performed on the two instruments (IT Satisfaction and IT Use). The internal consistency method was used to verify the two instruments reliability. Cronbach's α was computed for each entire instrument as well as for each of the multi-item variables as shown in Table (3). The reliability coefficient for IT Satisfaction and IT Use was 0.953 and 0.970 respectively. The individual variables range between 0.515 and 0.936. These scores are high enough to warrant further validity investigation (Nunnally, 1978; Palvia, 1996).

Table 5: Content and Construct Validity of IT Use Instrument.

Correlation with	***R***	***(p)***	***R***	***(p)***
Scale	*Problem Solving*		*IT Use*	
Ps1	0.706	(0.000)	0.665	(0.000)
Ps2	0.159	(0.048)	-0.119	(0.139)
Ps3	0.252	(0.001)	-0.034	(0.672)
Ps4	0.710	(0.000)	0.611	(0.000)
Ps5	0.782	(0.000)	0.735	(0.000)
Ps6	0.779	(0.000)	0.788	(0.000)
Ps7	0.784	(0.000)	0.767	(0.000)
Ps8	0.807	(0.000)	0.772	(0.000)
Ps9	0.716	(0.000)	0.720	(0.000)
	Decision Rationalization			
Dr10	0.867	(0.000)	0.827	(0.000)
Dr11	0.825	(0.000)	0.697	(0.000)
Dr12	0.877	(0.000)	0.807	(0.000)
Dr13	0.855	(0.000)	0.774	(0.000)
Dr14	0.888	(0.000)	0.763	(0.000)
Dr15	0.835	(0.000)	0.752	(0.000)
Dr16	0.807	(0.000)	0.727	(0.000)
	Horizontal Integration			
Hi17	0.786	(0.000)	0.650	(0.000)
Hi18	0.871	(0.000)	0.770	(0.000)
Hi19	0.893	(0.000)	0.754	(0.000)
Hi20	0.909	(0.000)	0.776	(0.000)
Hi21	0.836	(0.000)	0.801	(0.000)
	Vertical Integration			
Vi22	0.762	(0.000)	0.718	(0.000)
Vi23	0.850	(0.000)	0.766	(0.000)
Vi24	0.833	(0.000)	0.742	(0.000)
Vi25	0.860	(0.000)	0.784	(0.000)
Vi26	0.878	(0.000)	0.769	(0.000)
Vi27	0.862	(0.000)	0.766	(0.000)
Vi28	0.826	(0.000)	0.797	(0.000)
	Customer Service			
Cs29	0.773	(0.000)	0.769	(0.000)
Cs30	0.837	(0.000)	0.753	(0.000)
Cs31	0.801	(0.000)	0.744	(0.000)
Cs32	0.832	(0.000)	0.713	(0.000)
Cs33	0.825	(0.000)	0.727	(0.000)
Cs34	0.834	(0.000)	0.740	(0.000)
Cs35	0.828	(0.000)	0.782	(0.000)

Table 6: Simple Statistics and Cronbach's α Reliability Coefficients for the Two Instrument Items (Number of Items for Each Variable Shown in Parentheses).

Variables	Cronbach's α	Mean	Median	St. Deviation	Minimum	Maximum
IT Satisfaction (23)	**0.953**	**3.87**	**3.83**	**0.59**	**2.57**	**5.00**
Software Adequacy (1)	-----	4.05	4.00	0.75	2.00	5.00
Software Maintenance (1)	-----	3.88	4.00	0.78	2.00	5.00
Information Content (2)	0.825	3.81	4.00	0.69	2.00	5.00
Information Accuracy (1)	-----	3.95	4.00	0.75	2.00	5.00
Information Format (2)	0.889	3.82	4.00	0.74	2.00	5.00
Ease of Use (3)	0.752	3.96	4.00	0.67	2.00	5.00
Timeliness (2)	0.765	3.89	4.00	0.73	2.00	5.00
Security and Integrity (2)	0.515	4.07	4.00	0.65	1.50	5.00
Productivity (2)	0.867	3.94	4.00	0.75	2.00	5.00
Documentation (2)	0.825	3.58	3.50	0.97	1.00	5.00
Vendor Support (1)	-----	3.95	4.00	0.87	1.00	5.00
Training and Education (1)	-----	3.81	4.00	1.08	1.00	5.00
Overall Evaluation (3)	0.886	3.77	4.00	0.84	1.00	5.00
IT Use (35)	**0.976**	**3.67**	**3.73**	**0.66**	**2.20**	**4.89**
Problem Solving (7)	0.901	3.66	3.67	0.73	1.57	5.00
Decision Rationalization (7)	0.936	3.72	3.71	0.77	1.43	5.00
Horizontal Integration (5)	0.911	3.73	3.80	0.82	1.80	9.00
Vertical Integration (7)	0.930	3.69	3.71	0.81	2.00	5.00
Customer Service (7)	0.918	3.74	3.86	0.78	1.43	5.00

Table 7: Canonical Statistical Significance Tests (α <= 0.01).

Test Name	Approx. Stat.	Value	Hypothesis D.F.	Error D.F.	p-value
Pillais's	F-Test	3.0136	65	710	0.000
Hotelling's	F-Test	5.6621	65	582	0.000
Wilks's λ (λ = 0.197)	Chi-Squared	236.400	65	-------	0.000
Roy's	F-Test	25.2267	13	147	0.000

Table 8: Canonical Correlation Statistics.

Function No.	Canonical Correlation Coefficient (R_c)	Squared Canonical Correlation (R^2_c)	Wilks λ	Chi-Sqr.	D.F.	p-value
1	0.828	0.685774	0.197	236.400	65.000	0.000
2	0.462	0.213535	0.627	67.963	48.000	0.030
3	0.348	0.121034	0.797	33.013	33.000	0.467
4	0.245	0.060028	0.907	14.242	20.000	0.818
5	0.188	0.035339	0.965	5.235	9.000	0.813

4.1 Validity Tests

Content and construct validity tests were utilized in order to validate the two adopted instruments (IT Satisfaction and IT use). Content validity was tested by computing an item correlation with the item total of the group. The purpose is to retain only the highest correlated items within each group, but items would be removed if the correlation is less than 0.4 (p-value > 0.01) (Palivia,

1996). Table (4) reports the results of the content test of the IT Satisfaction instrument which shows a significant correlation between an item and its item total of the group. The results are consistent with Palvia and Palvia (1999). Table (5) reports the results of the content test of the IT Use instrument which shows a significant correlation between an item and its item total of the group except for the second and third items (Ps2, Ps3) in the problem solving construct. The decision to remove the questioned items needs to be made on; whether the items represent a new sub-domain of the construct and its relationship to the overall construct (IT Use) (Raymond and Pare, 1992, Palvia, 1996). A re-examination of the items indicates that they did not represent a new sub-domain, and the two items correlations with overall construct are not significant which consequently are dropped from the IT use instrument. The correlation coefficients of the remaining items are quite high and the results are consistent with Doll's and Torkzadeh's (1998). A construct validity test was conducted by computing an item correlation to the overall construct in order to find out if the item does represent a new sub-domain (Palvia, 1996). Tables (4) and (5) reports the results of the construct validity test of IT Satisfaction and IT Use respectively. The result indicates a significant correlation between an item and its overall construct except the above discussed two items (Ps2 and Ps3).

4.2 Final Reliability and Sample Statistics

Table (6) reports simple statistics for each dimension of IT use and IT satisfaction, as well as the final reliability of the 33 items of the IT Use instrument after dropping the two items (Ps2 and Ps3) because they are not correlated to the items group or the overall construct (IT Use) as shown in Table (5). The reliability results of the IT Satisfaction shown in Table (2) are kept as they are because all items in the IT Satisfaction instrument are significantly correlated to the group items as well as to the overall construct (IT Satisfaction) as shown in Table 4. Table (6) shows medium to high IT Satisfaction and IT Use among the Jordanian banks.

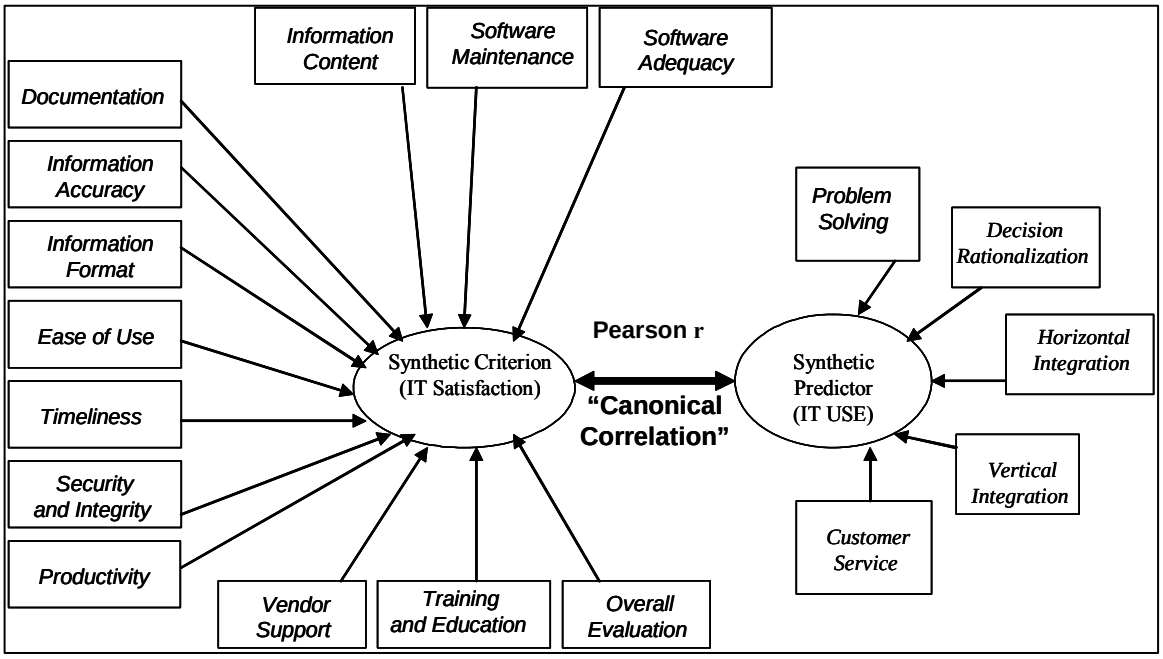

Figure 3: Proposed first function in a canonical correlation analysis.

Table 9: Canonical Solution for IT Use Predicting IT Satisfaction for Functions 1 and 2.

	Function 1			Function 2			
Variable	**Coef. Weights**	**r_s**	**r^2_s (%)**	**Coef. Weights**	**r_s**	**r^2_s (%)**	**h^2 (%)**
Software Adequacy	0.132	0.652	42.51	-0.154	-0.061	0.37	42.88
Software Maintenance	-0.030	0.561	31.47	-0.340	0.065	0.42	31.89
Information Accuracy	0.096	0.727	52.85	-0.647	-0.116	1.35	54.20
Vendor Support	0.109	0.759	57.61	-0.900	-0.342	11.70	69.30
Training and Education	0.058	0.736	54.17	-0.008	-0.091	0.83	55.00
Information Content	-0.029	0.590	34.81	0.159	0.257	6.60	41.41
Information Format	0.145	0.733	53.73	-0.285	0.223	4.97	58.70
Ease of Use	0.038	0.620	38.44	0.635	0.428	18.32	56.76
Timeliness	0.081	0.629	39.56	0.302	0.226	5.11	44.67
Security and Integrity	0.158	0.748	55.95	-0.318	-0.135	1.82	57.77
Productivity	-0.096	0.684	46.79	-0.105	0.057	0.32	47.11
Documentation	0.287	0.880	77.44	0.020	-.052	0.27	77.71
Overall Evaluation	0.287	0.890	79.21	0.963	0.154	2.37	81.58
R^2_c			***68.57***			***21.35***	
Decision Rationalization	0.240	0.914	83.54	0.181	0.054	0.29	83.83
Horizontal Integration	-0.080	0.706	49.84	-0.069	0.205	4.20	54.05
Vertical Integration	0.180	0.836	69.89	1.420	0.516	26.63	96.52
Customer Service	0.051	0.824	67.90	0.142	0.289	8.35	76.25
Problem Solving	0.657	0.980	96.04	-1.449	-0.159	2.53	98.57

Thus, the validity tests analysis (content, construct and reliability tests) as a whole supported the validity and generalizability of the two instruments (IT Use and IT Satisfaction), and consequently the first two folds of this study has been met.

4.3 Canonical Analysis

Canonical analysis is a multivariate statistical model that studies the interrelationships among sets of multiple dependent variables and multiple independent variables (Diamantopoulos and Schlegelmilch, 1997). Additionally, it can handle both variable types; the quantitative and the qualitative (Cheng, 1995; Cliff, 1987). Apparently, the objective of Canonical analysis is to decide whether the two variable sets are related or not and the magnitude of their relationship (Lotayif, 2004). But this study also wants to what IT Use and IT Satisfaction variables are more or less useful in the two instruments and whether they relate to each other in expected directions. In canonical analysis, there are criterion variables (dependent variables) and predictor variables (independent variables) based on a researcher's expectations about predictive causality. But, the nature of the Canonical Correlation Analysis (CCA) as a correlation method makes such a declaration ultimately arbitrary (Lotayif, 2004). The CCA can be conceptualized as a simple bivariate correlation (Pearson r) between the two synthetic variables. The maximum number of canonical correlations (functions) between these two sets of variables is the number of variables in the smaller set (Grandon and Pearson, 2004). In our study, the number of variables for the IT Use construct is five while the number of variables in the IT Satisfaction construct is thirteen as shown in Figure (3). Thus, the number of canonical functions extracted from the analysis is five; i.e., the smallest set. Hair et al., (1995) suggested three different measures to interpret the canonical functions:

(a) the significance of the F-value given by Wilk's lambda, Pillai's criterion, Hotteling's trace and Roy's gcr;

(b) the measures of overall model fit given by the size of the canonical correlations;
(c) the redundancy measure of shared variance (ability of a set of independent variables, to explain the variation in the dependent variables taken one at a time.

This study will use a hierarchal strategy which consists of three steps in order to report interpretation and findings.

Step 1: The purpose of the first step is to evaluate the full canonical model. There are four ways to evaluate the full model for statistical significance as shown in Table (7). These test statistics evaluate the shared variance between the predictor (IT Use) and criterion (IT Satisfaction) variables across all of the canonical functions (five functions). Nevertheless, by far the most common method used is Wilks's lambda (λ) (Sherry and Henson, 2005), as it tends to have the most general applicability. The results in Table 7 shows that the full model was statistically significant as reported by Wilks's lambda (λ) test. Accordingly, we can reject the null hypothesis that there was no relationship between the variable sets and conclude that there probably was a relationship. Also, by taking 1- λ, we can find an overall effect of 1 - 0.197 = 0.803 = R^2_c for the full model .This effect statistic can be interpreted as the proportion of variance share between the variable sets across all functions. Thus far, step (1) has concluded that the full model was both statistically significant and had a large effect size.

Step 2: The purpose of the second step is to evaluate each canonical function's extend of explaining the relationship between the variable sets in order to warrant interpretation. Table (8) lists each function separately along with its canonical correlation statistics. The first function is created to maximize the canonical correlation between the two synthetic variables (IT Use and IT Satisfaction variables). Then, using the remaining variance in the observed variables, the second function is created in order to maximize another canonical correlation. For this study, this continues until five orthogonal (uncorrelated) functions are created. The squared canonical correlation (R^2_c) represents the proportion of variance (variance-accounted-for effect size) shared by the two synthetic variables. So, the R^2_c indicates the amount of shared variance between the variable sets. So, the CCA researcher should only interpret those functions that explain a reasonable amount of variance between the variable sets or risk interpreting an effect that may not be noteworthy or replicable in future studies (Sherry and Henson, 2005). Consequently, this study chooses to interpret the first two functions, as they explain 68.57% and 21.35% of the variance within their functions, respectively. In other words, the sum squared canonical correlation of function 1 and 2 explains 89.92 % of the variance between the variable sets. So, the second step concluded that the relationships between the two variable sets are largely captured by the first two functions in the canonical model.

Step 3: The aim of step 3 is to determine what variables are contributing to the canonical correlation relationship between the variables sets across the two functions. This study wants to know (in terms of magnitude and directionality) what IT Use variables are related to what IT Satisfaction variables in this multivariate analysis. So the standardized weights and structure coefficients are examined, in order to interpret the first two functions, and determine the magnitude and directionality of the variables. Table (9) presents the standardized canonical function coefficient (the weights) and structure coefficients (r_s) for all variables across both functions. Also, the squared structure coefficients (r^2_s) are given, which explains the percentage of shared variance between the observed variable and the synthetic variable created from the observed variable's set. The last column in Table (9) lists the communality coefficients (h^2). This represents the amount of variance in the observed variable that was reproducible across both functions, and can be viewed as an indication of how useful the variable was for the solution. Structure coefficients and communalities above 0.50 are underlined (Grandon and Pearson, 2004) in Table (9) to show the variables with the highest level of usefulness in the two instruments.

Looking at function (1) coefficients (r_s), we see that

the relevant criterion variables (IT Satisfaction variables) were overall evaluation and documentation, with vendor support, security and integrity, training and education, information format and information accuracy made secondary contributions, but the rest of the criterion variables came last in contributions to the synthetic variable (IT Satisfaction). This conclusion is supported mainly by the squared structure coefficients (r^2_s), which indicates the amount of variance, the observed variable can contribute to the synthetic criterion variable. By looking at the canonical function coefficients (weights), the results show that the first primarily contribution set had a larger coefficients compared to the second and last set except training and education which had a lower function coefficient (weight) compared to timelines in the last set. This result is due to the multicollinearity that training and education variable had with other criterion variables. Also, all of the structure coefficients (r_s) in function (1) had the same sign, which indicates that they were all positively related to each other.

The other side of the equation in function (1) involves the predictor set (IT Use). Table (9) results inform us that the problem solving and decision rationalization variables were the primary contributors to the predictor synthetic variable (IT Use), followed by vertical integration and customer service. The last contributor to the predictor synthetic variable was horizontal integration. Because the structure coefficients (r_s) for the IT Use variable were all positive, then all the variables were positively related to all IT Satisfaction variables.

Moving to function (2) in Table (9), the structure coefficients (r_s) suggests that none of the criterion variables (IT Satisfaction) were relevant. As for IT Use variables, vertical integration was the dominant predictor, which was of a secondary contribution in function (1). Consequently, this finding indicates that vertical integration is something of a different nature than the other IT Use variables, and additional work is needed to identify this nature.

Looking at the last column h^2 in Table (9), we can identify the variables that are not useful in the two instruments or the suggested canonical model. For example, software adequacy, software maintenance, information content, timeliness and productivity did not appear to be related to IT Use variables. Also, these variables were identified as having the least contribution to the IT Satisfaction variable (see column r^2_s in Table 9) in function (1). This section has informed us that there exists a causal link between IT Satisfaction and IT Use variables, and identified the most contributing and useful variables in the two instrument by magnitude and directionality. Therefore, the third fold of this study has been met.

5. CONCLUSION AND LIMITATION

This study attempted to validate two instruments that measure IT Use and IT Satisfaction in Jordan context, and add to the generalizability of the two instruments as it was evident from the results of the validity test section. The replication of the two instruments in Jordan yields some rich managerial insights as well as practical implications. First, IT Use and IT Satisfaction variables should be the focus of IT managers in determining what variables are most important in increasing the utilization and satisfaction of IT in their firms. Second, Problem solving and decision rationalization are the most important drivers for increasing IT utilization in firms. So, at minimum IT managers should focus on ensuring that their IT is capable of providing such functions to users. Finally, banks in Jordan must first test the generalizability of supposedly universal recommendations before applying them to Jordan.

Also, this study attempted to investigate a causal link that was suggested by the success model (Delone and McLean, 1992) between IT Use and IT Satisfaction by building a proposed canonical correlation relationship model that explains how IT Use variables are related to IT Satisfaction, and what variables are useful in contributing to this relationship. Also, the canonical analysis revealed what variables are useful in each instrument. Overall, the findings of the canonical analysis should help researchers' understanding of the relationship between IT Use and IT Satisfaction variables. But

researchers must be very caution especially with the canonical findings, because some of the variables that were identified as not useful, may be context-invariant. Consequently, researchers are welcome to further investigate these canonical findings in different context.

APPENDIX A

Measures of IT-Satisfaction Instrument

Scale: 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree. Indicate your level of agreement with the following statements:

I. Software Adequacy

Sa1. The software is adequate to handle and meets your processing needs.

II. Software Maintenance

Sm2. The software can be easily modified, corrected or improved.

III. Information Content

Ic3. The information from the computer system meets your needs.

Ic4. The system provides reports that are just about what you need.

IV. Information Accuracy.

Ia5. You are satisfied with the system's accuracy.

V. Information Format

If6. The output is presented in a useful format.

If7. The presented information is clear.

VI. Ease of Use

Eu8. The system is easy to use.

Eu9. The system is easy to learn.

Eu10. The system is easy to access.

VII. Timeliness

Tm11. You get the needed information in time.

Tm12. The system provides up-to-date information.

VIII. Security and Integrity

Si13. The system provides for the security of data.

Si14. The system includes features for preventing and reducing user errors.

IX. Productivity

Pr15. The system has improved your productivity.

Pr16. The system lets you do more work than was previously possible.

X. Documentation

Dc17. Good manuals/procedures exist to aid in running and using the system.

Dc18. Good manuals/procedures exist to fix the system if it breaks down.

XI. Vendor Support

Vs19. There is help available from vendors in case of software errors.

XII. Training and Education

Te20. The organization provides you with a quality training and education to help in utilizing the system.

XIII. Overall Evaluation

Oe21. The system is successful.

Oe22. You are satisfied with the system

Oe23. The system has met your expectations.

Measures of IT-Use Instrument

Scale: 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree. Indicate your level of agreement with the following statements:

A.1. Problem solving

Ps1. I use this application to make decisions.

Ps2. When I use this application to analyze a situation, I bring extensive prior knowledge to bear upon my interpretation.

Ps3. When I use this application to analyze a problem, I spend a great deal of time interpreting data to make sure I understand exactly what it means.

Ps4. I use this application to solve job problems.

Ps5. I use this application to decide how to best approach a problem.

Ps6. I use this application to help me think through problems.

Ps7. I use this application to make sure the data matches my analysis of problems.

Ps8. I use this application to help me make inferences about the causes of problems in an innovative way.

Ps9. I use this application to get information from other work groups.

A.2. Decision rationalization

Dr10. I use this application to help me explain my decisions.

Dr11. I use this application to improve management control.

Dr12. I use this application to make my decision making more explicit.

Dr13. I use this application to rationalize my decisions.

Dr14. I use this application to make the decision making process quicker.

Dr15. I use this application to improve the effectiveness and efficiency of the decision process.

Dr16. I use this application to make the decision process more rational.

A.3. Horizontal integration

Hi17. I use this application to communicate with other people in my work group.

Hi18. I use this application with others in my work group to solve job problems.

Hi19. I use this application to coordinate activities with others in my work group.

Hi20. I use this application to exchange information with people in my work group, and other groups.

Hi21. When I work with others, I use this application to interpret information, and solve problems.

A.4. Vertical integration

Vi22. I use this application to help me manage and plan my work.

Vi23. I use this application to monitor my own performance.

Vi24. I use this application to communicate with people who report to me or I report to.

Vi25. I use this application to monitor the performance of my work group.

Vi26. I use this application to exchange information with people who report to me or I report to.

Vi27. I use this application to manage the complexity of my job.

Vi28. I use this application to get feedback on job performance.

A.5. Customer service

Cs29. I use this application to deal more strategically with internal and/or external customers.

Cs30. I use this application to keep track of how well internal and/or external customers are being served.

Cs31. I use this application to analyze data generated from contacts with existing and potential customers.

Cs32. I use this application to improve the quality of customer service.

Cs33. I use this application to keep track of customer needs.

Cs34. I use this application to exchange information with internal and/or external customers.

Cs35. I use this application to create value for customers in an innovative ways.

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واقع استخدام تكنولوجيا المعلومات ومستوى الرضا عنها كتحدٍ إداري في البنوك التجارية الأردنية

لؤي محمد صالحية وجمال داود أبو دولة*

ملخص

تركز هذه الدراسة على تحري مدى الاتزان السيكومتري (Psychometric) لكل من أداة "استخدام تكنولوجيا المعلومات" Doll's and Torkzadeh's (1998) وأداة "الرضا عن تكنولوجيا المعلومات" Palivia's and Palivia's (1999) عند تطبيقهما على المستخدم الأردني. كما تستخدم هذه الدراسة التحليل الكانوني لتحري علاقة سببية مقترحة في أنموذج النجاح لـDelone and McLean (1992). أظهرت نتائج الدراسة مدى صحة وموثوقية القياس المتأتي من الأداتين مما يعزز عموميتهما، أما نتائج التحليل الكانوني فقد أظهرت وجود علاقة سببية بين استخدام تكنولوجيا المعلومات ومستوى الرضا عن تكنولوجيا المعلومات، كما فرقت النتائج بين المتغيرات المفيدة وغير المفيدة في كل من الأداتين.

Loay M. Salhieh and Jamal D. Abu-Doleh

Department of Business Administration, Faculty of Economics and Administrative Sciences, Yarmouk University, Irbid, Jordan.

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