

An Integrated Success Model for Evaluating Information System in Public Sectors

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ABSTRACT

This study modified the dimensions of the TAM and D&M IS Success Models and added additional two success dimensions (Management support and Training). An integrated model for evaluating IS success was generated; the proposed model has been validated by an empirical study based on a questionnaire. The results indicated that information quality has a strong significant influence on IS success (81.9%) followed by Behavioral intention (80.2%); Perceived usefulness (78.8%); whereas the least one is user involvement (70%). The overall results show that the proposed model can be beneficial for decision makers in organizations on evaluating the implementation of information systems.

Key words: *DeLone & McLean IS success model, Technology Acceptance Model, Integrated IS Success Model*

1. INTRODUCTION

The role of information systems (IS) in providing business a competitive edge has recently been the subject of much debate. However, it has been argued that not the IS solution but their utilization is what provides the competitive advantages. However, because these systems are always advancing, they are very costly. Therefore, to reduce their costs, organizations must recognize the factors that affect the success of their information system.

In this research work, we seek for the possibility of creating a new model for evaluating information systems success (ISS) by applying the concepts of both Technology Acceptance Model (TAM) and DeLone & McLean update IS success model (D&M). An integrated model for evaluating IS success was generated using the fundamental theories of both the TAM and the D&M update IS Success Model. The proposed model was adopted the assessment of the critical success factors affecting information systems in public sector in Egypt to demonstrate how the proposed model can be applied and supporting the decision makers in evaluating and developing the information systems. A sample of 320 participants expressed their opinions about the proposed dimensions. The results show that more than 75% of the participants (50.20 % strongly agreed; 26.14 % agreed; 13.32 % average; 6.72 % disagreed and 3.62 % strongly disagreed) believe that model dimensions have high impact on IS success. The results also show that the most important dimension is information quality and the least one is user involvement. The remainder of this paper is organized as follows. Section 2 presents information system success models, whereas, section 3 describes the proposed integrated success model. In section 4 we apply this proposed model and in section 5 we discuss the results. Finally, we conclude with summaries of this work.

2. INFORMATION SYSTEM SUCCESS MODELS

The IS literature provides several definitions and measures of IS success. As DeLone and McLean state, there are nearly as many measures as there are studies; obviously, there is no ultimate definition of IS success [1]. In particular this work considered two main research streams: Technology Acceptance and IS Success. As for the first research stream, the reference theory is the so called technology acceptance model (TAM), proposed by Fred Davis [2] and widely developed in the following years. The second research stream is about information systems success and based on the D&M model [1 &3] or Information System Success Model (ISS).

2.1 Technology Acceptance Model (TAM)

Davis [2] and Davis et al. [4] introduced Technology Acceptance Model (TAM), for modeling user acceptance of information systems. TAM starts by proposing external variables as the basis for tracing the impact of external factors on two main internal beliefs, which are perceived usefulness and perceived ease of use, while perceived ease of use also affects perceived usefulness over and above external variables. These two beliefs both influence users' attitude toward using IS. Attitude toward using IS, sequentially has influence on behavior intention to use, which is the key factor for determining actual conditions of system use as shown in Figure (1).

a. Technology Acceptance Model Applications

The technology acceptance model (TAM) proposed that ease of use and usefulness predict applications usage.

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Researchers had conducted several studies to examine the relationship between perceived ease of use, perceived usefulness, attitudes, and the usage of other information technologies in recent years [5, 6, 7, 8 & 9].

2.2 DeLone and McLean Information System Success Model (D&M)

DeLone and McLean [1] in 1992 conducted a comprehensive review of IS success literature and proposed a model of IS success. This model provided a robust

indicator of the success of information systems by identifying six interrelated dimensions of IS success: 'System Quality', 'Information Quality', 'Use', 'User Satisfaction', 'Individual Impact' and 'Organizational Impact'. Later, DeLone and McLean [3] in 2003 revisited their own model and made minor modifications to it. They defined their updated model dimension as: Systems quality, Information quality, Service quality, Use, User satisfaction, and Net benefits as shown in Figure (2).

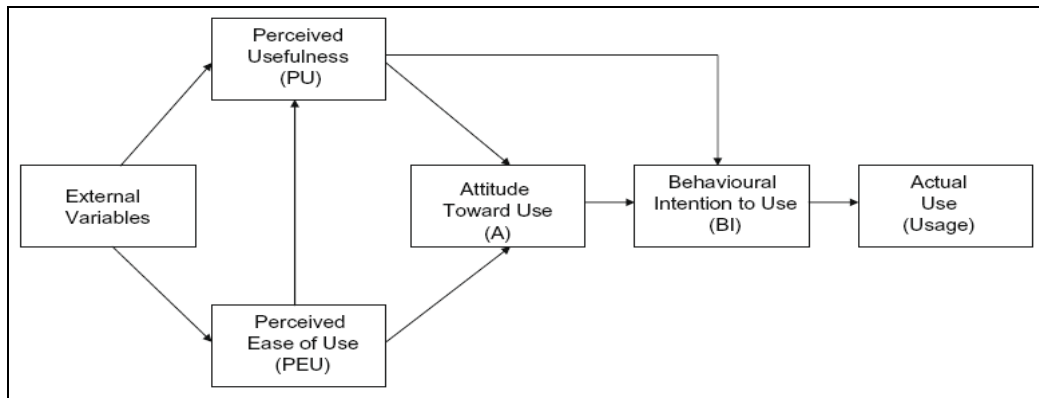


Fig 1: Original Technology Acceptance Model (TAM)

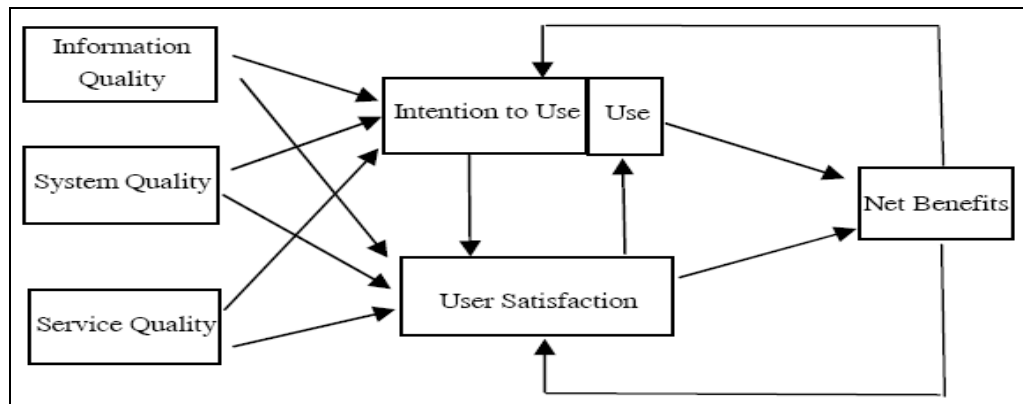


Fig 2: The updated DeLone and McLean's 2003 Model

a. DeLone and McLean Model Applications

Many empirical studies supported the updated DeLone and McLean (D&M) model. The findings of these studies provided several important implications for using (D&M) model in research and practice. Also, it encouraged Governmental and Private Authorities to include measures for information quality, system quality, service quality, system use, user satisfaction, and perceived net benefit in their valuation techniques of information system success [10, 11, 12, 13, 14, 15, 16 & 17].

3. PROPOSED INTEGRATED SUCCESS MODEL (ISM)

In accordance with (TAM) and D&M updated model, this study proposes an integrated model for evaluating IS success. Consequently, ten dimensions were proposed for measuring information system success: Behavior intention; Information quality; Management support; Perceived ease of use; Perceived usefulness; Service quality; System quality; Training; User satisfaction; and User involvement. The model assumes that information

quality, system quality and service quality are linked to management support, training and user involvement, and these in turn; influence perceived usefulness and perceived

ease of use which affect on behavior intention and user satisfaction as shown in Figure (3).

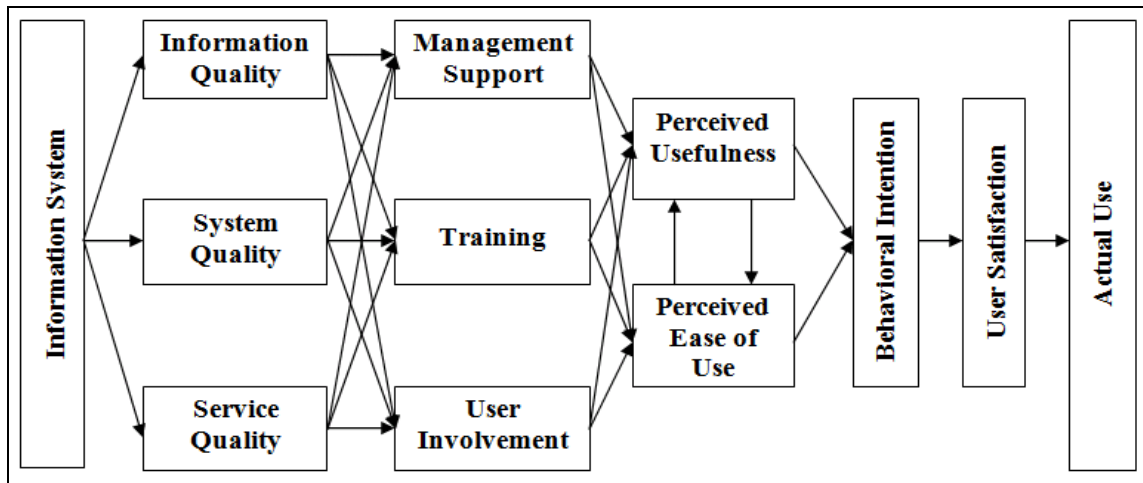


Fig 3: Proposed integrated success model (ISM)

Five items were selected to measure each dimension; these elements were adapted primarily from previous researches as follows:

3.1 Elements for Measuring System Quality

Measures of System Quality typically focus on performance characteristics of the system under study. Some researchers had looked at resource utilization and investment utilization, reliability, response time, aggregation of details, human factors, and system trust and accuracy. In this work, the selected system quality elements are: Reliability; Usability; Adaptability; Trust; and Maintainability [11, 18, 19, 20, 21, 22, 23 & 24].

3.2 Elements for Measuring Information Quality

Information quality (IQ) is an important factor for the adoption of services. In real every study has interpreted and classified IQ criteria conform to its context. The selected information quality elements are: Completeness; Understandability; Security; Availability; and Accuracy [10, 17, 25, 26 & 27].

3.3 Elements for Measuring Service Quality

Service quality is a measure of how well the service level delivered matches customer expectations. The selected service quality elements are: Availability; Reliability; Integrity; Functionality; and Efficiency [28, 29, 30, 31, 32, 33 & 34].

3.4 Elements for Measuring Management Support

Management support refers to management approval and continuous support not only during the IS project implementation but also throughout the operational phase of the system. The selected management support measures are: management's encouragement; providing all necessary resources; discussing problems associated with the system; appreciating the optimal use of the system; and having sufficient knowledge of the system [35, 36, 37 & 38].

3.5 Elements for Measuring Training

The level of training an organization's employees undergo with respect to information systems will have a positive relationship with implementation success. The selected training measures are: including training programs on the application; the clearance of training programs; users' role; availability of training material; and support [9, 35, 36 & 39].

3.6 Elements for Measuring User Involvement

User involvement defined as a matter of importance and personal relevance that users attach to a given system. The selected user involvement measures are: user's involvement in input design; user's involvement in output design; perceptions of service evaluations; perceived value; and customer attitude [35, 40 & 41].

3.7 Elements for Measuring Perceived Usefulness

Perceived usefulness can be defined as an individual's perception that use of technology will improve performance. The selected elements were adapted from previous studies [5, 6, 7, 8, 9, 42, 43, 44 & 45]. The selected perceived usefulness elements are: Performance; Effectiveness; Productivity; Risk perception; and trust.

3.8 Elements for Measuring Perceived Ease of Use

Perceived ease of use can be defined as the degree to which an individual believes that learning to adopt a technology requires little effort. The selected perceived ease of use elements are: Easy to learn; Easy to manage; Self efficiency; Simplicity; and Compatibility [6, 42, 44, 45 & 46].

3.9 Elements for Measuring Behavioral Intention

The selected elements were adapted from previous [6, 7, 8, 9, 38, 42 & 47]. These items are: Personalization; Interactivity; Response time; Uncertainty avoidance; and Number of transactions executed.

3.10 Elements of Measuring User Satisfaction

Satisfaction is an overall affective response to a perceived discrepancy between prior expectations and perceived performance after consumption. The elements selected to measure customer satisfaction were adapted from previous studies [18, 19, 21, 28, 48, 49, 50 & 51]. These elements are: Self-efficacy; Repeat visits; Personalization; Perceived Risk; and Enjoyment.

4. RESEARCH METHODOLOGY

The proposed model has been validated by an empirical study based on a questionnaire and interview. Structured questionnaire was used for data collection. The questionnaire was designed based on the proposed integrated success model. The questionnaire consists of thirty four elements with 68 statements as shown in Appendix (I). Several professors and IS professionals were interviewed to modify the statements and the construction of the questionnaire. Then, a sample of 500 participants belonging to ten large organizations in Egypt was selected randomly based on their experiences in information system usages.

Questionnaire distribution and returns were by Email. We excluded both IS professionals and managers from the sample set because they are not real end-users by definition. The participants were asked to indicate the extent

of their agreement with each element on a five-point Likert-type scale with anchors from "Strongly agree" to "Strongly disagree".

A total of 320 questionnaires were returned for a response rate of 64%. Table (1) shows the distribution of the received sample according to gender (Men 57.5% and Women 42.5%) and educational level. The university degrees (undergraduate and postgraduate) represent 80% from the sample.

Table 1: Sample distribution

Educational level	Total		Men		Women	
	No.	%	No.	%	No.	%
High school or less	25	8.0	15	4.7	10	3.1
Professional diploma	38	12.0	21	6.6	17	5.3
University degree	228	71.0	130	40.6	98	30.6
Graduate education	29	9.0	18	5.6	11	3.4
Total	320	100	184	57.5	136	42.5

More than 75% of the participants strongly agree and agree that the proposed ten dimensions have high impact on information system success, whereas only about 10% disagree and strongly disagree as shown in Figure (4).

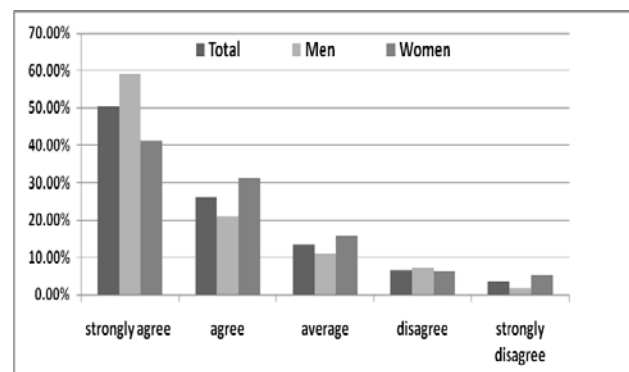


Fig 4: Participants' Agreements

5. RESULTS AND DISCUSSION

The accumulated results are shown in Appendix (II). Pearson correlation was used to examine is there any correlation between the proposed model dimensions? The results show that the correlation coefficients are more than 0.7; it means that there is a strong positive correlation between model dimensions as shown in table (2).

Table 2: Correlation Coefficients

Dimension	Information quality	System quality	Service quality
Behavioral intention	0.998	0.998	0.991
Perceived usefulness	0.999	0.997	0.995
Perceived ease of use	0.998	0.991	0.999
User satisfaction	0.997	0.999	0.991
Management support	0.994	0.997	0.990
Training	0.965	0.946	0.983
User Involvement	0.936	0.901	0.961

The greatest correlations are between information quality & perceived usefulness; System quality & User satisfaction and between Service quality & Perceived ease of use. The correlation test shows that management support will lead to increase system quality which improves user satisfaction. Training also may lead to increase service quality which in turns improves perceived ease of use.

The results indicated that information quality has a strong significant influence on IS success (81.9%) followed

by behavioral intention (80.2%) and perceived usefulness (78.2%) as shown in table (3) and Figure (5). These findings match with results from reviewed IS success models [3, 6 & 8]. While user involvement and training are important factors of user behavior and user satisfaction, the results show that user involvement is the least important one (only 70%) followed by Training (71%). These findings differ from those shown in the IS success models reviewed earlier [9, 35, 36, 40 & 41], these unexpected results because of most participants have no chance to participate in system design phase and most systems have user manuals and help menus. Also, perceived usefulness (78.8%) is slightly more important than perceived ease of use (77.6%), this is because perceived usefulness has direct relation with information quality.

The results show also that behavioral intention exhibited a stronger effect on IS success (80.2%), because it translates user's perceptions and attitudes towards system usages. The most important element that affect IS success from participants' point of view are Security (4.38); Availability (4.37); Compatibility (4.34); Privacy (4.32); and Maintainability (4.32), whereas the least important elements are User Involvement (3.81); Simplicity (3.90); Training (3.96); Functionality (4.03); Repeat visits (4.03) as shown in Figure (6).

Table 3: Participants' Agreements

Dimensions	Participants' Agreements						Rank
	strongly agree	agree	average	disagree	Strongly disagree	strongly agree + agree %	
Information quality	55.60%	26.30%	10.00%	5.30%	2.80%	81.90%	1
Behavioral intention	56.80%	23.40%	11.20%	6.20%	2.40%	80.20%	2
Perceived usefulness	54.00%	24.80%	12.00%	6.40%	2.80%	78.80%	3
Service quality	49.60%	28.60%	12.40%	6.40%	3.00%	78.20%	4
Perceived ease of use	50.60%	27.00%	12.40%	7.80%	2.20%	77.60%	5
User satisfaction	54.20%	22.80%	13.60%	6.40%	3.00%	77.00%	6
System quality	55.20%	21.00%	13.80%	7.00%	3.00%	76.20%	7
Management support	50.00%	22.50%	16.80%	6.70%	4.00%	72.50%	8
Training	40.00%	31.00%	18.00%	6.00%	5.00%	71.00%	9
User Involvement	36.00%	34.00%	13.00%	9.00%	8.00%	70.00%	10

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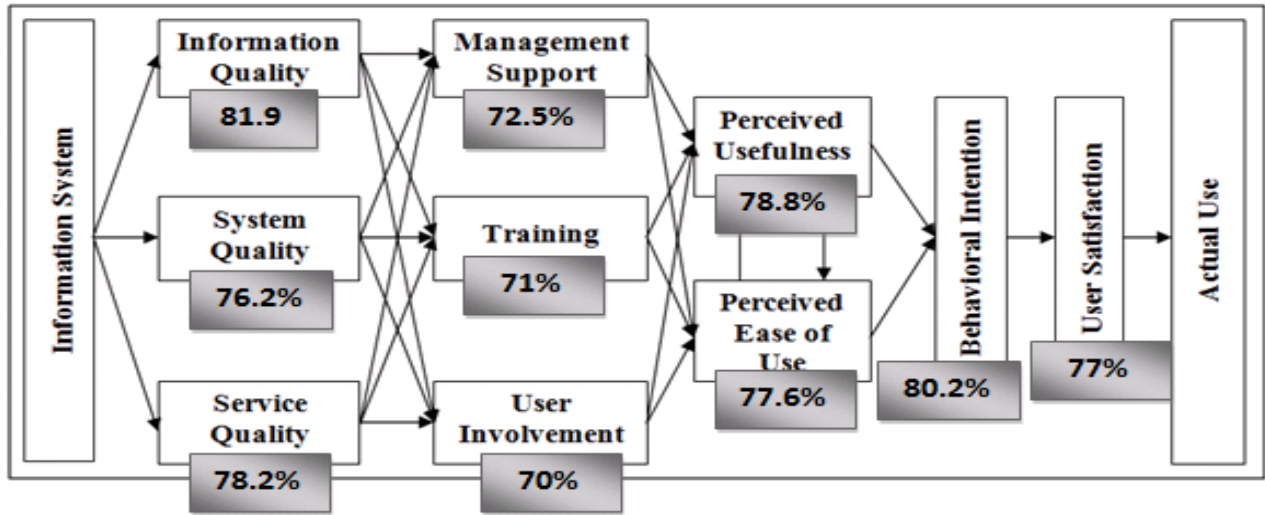


Fig 5: Participants' Agreements

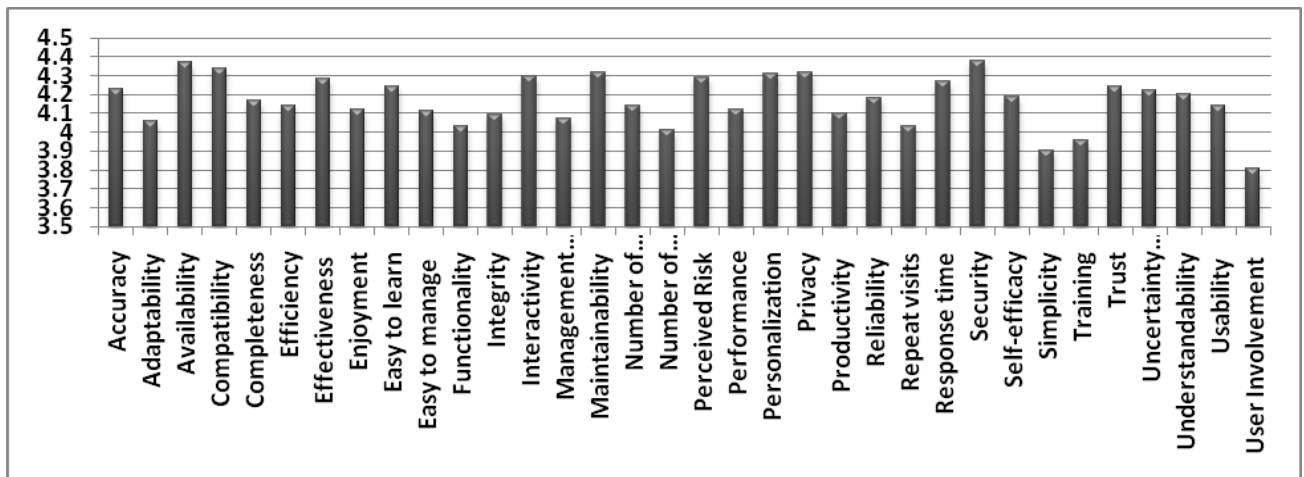


Fig 6: Elements' importance

6. CONCLUSIONS

Based on empirical findings, this study reached several conclusions. First, results of the empirical analysis indicated that information quality has a strong significant influence on IS success. Thus, system designers should make full use of the completeness; understandability; security; availability; and accuracy of information to increase behavioral intention and user satisfaction to use IS. Second, system designers should actively seek methods of improving system security; system availability; system compatibility; system privacy; and system maintainability since these elements significantly affect IS success. Third, the results also indicated that services quality has positive influence on IS success, moreover, it can assist and enhance system usage and in turns IS success. Fourth, the improvement of information system through enhancing information quality; perceived usefulness; service quality and perceived ease of use will foster user involvement;

behavioral intention and user satisfaction. Finally, the proposed model and its elements proved that it can be used as a beneficial tool for decision makers in organizations on evaluating the implementation of information systems.

7. STUDY LIMITATIONS

While our study provided a useful starting point for investigating IS success dimensions, it has limitations. First, in describing the relationship between the dimensions and IS success, participants were asked to assess the IS success dimensions based on proposed statements, those participants who had good rapport with the information system might judge them positively and vice versa. Second, the findings may be susceptible to the influence of culture difference, thus generalizing findings to other cultures should be made cautiously. Finally, our study focused on the users'

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perspective in assessing the impact of proposed dimensions on IS success; the relationships were analyzed at the individual level instead of the organizational level. However, it seems more sensible if IS success is conceptualized to reflect the impact of IS on the organization.

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AUTHOR'S INTRODUCTION

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APPENDIX I: QUESTIONNAIRE

(5): Strongly agree - (4) Agree – (3) Average – (2) Disagree – (1) Strongly disagree

Element	Statement	Agreements				
		5	4	3	2	1
Accuracy	The information provided by the information system is accurate and is free from errors.					
	The information system provides the precise information I need.					
Adaptability	It is easy for me to become skilful at using the information system.					
	I find the information system is easy to use.					
Availability	It was easy to find what you were looking for.					
	The information system allows information to be readily accessible to me.					
Compatibility	Information system contains necessary topics to complete related task.					
	The information system provides sufficient information.					
Completeness	The output information of the information system is complete.					
	The information system provides information precisely according to my need.					
Efficiency	Using information system in my job would enable me to accomplish tasks more quickly.					
	By using the functions of the information system, I can upgrade the efficiency of my work.					
Effectiveness	Using information system will enhance my effectiveness on the job.					
	I can easily use the functions of the information system to do my work.					
Enjoyment	I am pleased with the experience of using information system.					

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	I am very satisfied with the information I receive from the information system.					
Easy to learn	Learning to operate the information system is easy for me.					
	Learning to interact with the information system is easy for me.					
Easy to manage	I find it is easy to get the information system to do what I want it to do.					
	I feel that the information system constitutes an integral part of my daily work.					
Functionality	The information system in use is always up to date.					
	The information system provides customized operations.					
Integrity	The information received from the information system is adequate.					
	It is easy for me to find out and get the desired information.					
Interactivity	I find information system to be flexible to interact with.					
	I can interact with the information system and receive the required information.					
Management support	The management encourages using the system and appreciates the optimal use of the system to meet its goal.					
	The management discusses problems regarding the system and provides all necessary resources to improve it.					
Maintainability	The information system is up-to-date.					
	The information system is easy to maintain.					
Number of transactions executed	If I could, I would like to continue using the information system as much as possible.					
	I recommend using the information system to others.					
Number of system visits	I intend to use the information system frequently.					
	I believe it is worthwhile for me to use the information system routinely.					
Perceived Risk	I think that the information system is concerned with the present and future interests of its users.					
	I think that the information system takes into account the repercussions that their actions could have on the users.					
Performance	Using information system would improve my job performance.					
	Using information system would make it easier to do my job.					
Personalization	I think that the information system knows its users well enough to offer them products and services adapted to their needs.					
	I think that the design of the information system take into account the desires and needs of its users.					
Privacy	I think that the information offered by the information system is sincere and honest.					
	I think I can have confidence in the promises that the information system makes.					
Productivity	I believe that using the information system will further increase my productivity.					
	I have fully accepted the information system in my daily work.					
Reliability	The information system performs the order right the first time.					
	Relevant order confirmation details are sent to the user.					
Repeat visits	The frequency of use with the eServices website system is high.					
	I am satisfied with my previous online shopping experience.					
Response time	Scrolling through system's menus is kept to minimum.					
	The system provides fast information access.					
Security	The output information of the information system is secure.					
	Overall, I trust the information system's security measures.					
Self-efficacy	The information system is characterized by the frankness and clarity of the services that it offers to the user.					
	It is easy for me to become skilful at using the information system.					
Simplicity	Interacting with the system is a clear and understandable process.					
	The system is simple to use.					
Training	Organization offers training programs regarding information system application					
	Training material is available during training					
Trust	The information system usually fulfils the commitments it assumes.					

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	Security privacy policies are accessible					
Uncertainty avoidance	The information system design makes finding information easy without mistakes.					
	The information system does not make false statements.					
Understandability	The output information of the information system is easy to understand					
	It is easy to find what you're looking for when using the information system.					
Usability	I always do my job using the information system.					
	I find the information system is available and flexible to be used.					
User Involvement	I m involve in input design					
	I m Involve in output design					

APPENDIX II: OVERALL RESULTS

Elements	strongly agree		agree		average		disagree		strongly disagree		Agreement mean (out of 5)
	N	%	N	%	N	%	N	%	N	%	
Accuracy	167	52	89	28	40	13	17	5	7	2	4.23
Adaptability	155	48	68	21	66	21	22	7	9	3	4.06
Availability	190	59	92	29	11	3	19	6	8	3	4.37
Compatibility	187	58	88	28	14	4	30	9	1	0	4.34
Completeness	157	49	100	31	31	10	23	7	9	3	4.17
Efficiency	149	47	104	33	39	12	19	6	9	3	4.14
Effectiveness	182	57	90	28	13	4	27	8	8	3	4.28
Enjoyment	161	50	84	26	41	13	21	7	13	4	4.12
Easy to learn	178	56	79	25	31	10	25	8	7	2	4.24
Easy to manage	156	49	91	28	33	10	31	10	9	3	4.11
Functionality	139	43	95	30	50	16	28	9	8	3	4.03
Integrity	145	45	98	31	48	15	19	6	10	3	4.09
Interactivity	189	59	85	27	10	3	25	8	11	3	4.30
Management support	159	50	73	23	53	17	22	7	13	4	4.07
Maintainability	199	62	61	19	30	9	23	7	7	2	4.32
Number of transactions	168	53	69	22	53	17	21	7	9	3	4.14
Number of system visits	156	49	55	17	75	23	25	8	9	3	4.01
Perceived Risk	187	58	75	23	29	9	22	7	7	2	4.29
Performance	159	50	79	25	53	17	19	6	10	3	4.12
Personalization	188	59	80	25	25	8	18	6	9	3	4.31
Privacy	199	62	68	21	20	6	22	7	11	3	4.32
Productivity	148	46	89	28	62	19	10	3	11	3	4.10
Reliability	173	54	68	21	51	16	19	6	9	3	4.18
Repeat visits	155	48	59	18	77	24	19	6	10	3	4.03
Response time	182	57	66	21	55	17	10	3	7	2	4.27
Security	198	62	70	22	36	11	9	3	7	2	4.38
Self-efficacy	175	55	70	22	46	14	18	6	11	3	4.19
Simplicity	113	35	101	32	76	24	21	7	9	3	3.90
Training	128	40	99	31	59	18	19	6	15	5	3.96
Trust	188	59	63	20	35	11	26	8	8	3	4.24

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Uncertainty avoidance	178	56	73	23	38	12	22	7	9	3	4.22
Understandability	179	56	69	22	41	13	19	6	12	4	4.20
Usability	169	53	77	24	38	12	23	7	13	4	4.14
User Involvement	116	36	108	34	41	13	30	9	25	8	3.81