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Evaluating the Factors Affecting DSS Usage in Strategic Decisions in Local Authorities in Egypt Using a Structural Equation Modelling Approach

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ABSTRACT

This article draws on a survey among CEO and IT mangers in local authorities in Egypt to explain the key factors affecting using DSS in making strategic decisions. A structural equation model that extends the generally accepted Technology Acceptance Model (TAM) is proposed and tested to assess the relationships among the following constructs: task characteristics, cultural characteristics, DSS characteristics, environmental characteristics, organisational characteristics, internal support characteristics, external support characteristics, decision-maker characteristics and top management characteristics and its relation with DSS usage via Perceived Ease of Use (PEU) and Perceived Usefulness (PU).

INTRODUCTION

The astronomical global growth of Information Technology (IT) has inspired IT practitioners, researchers, developers, and innovators to seek new, more sophisticated, and more effective acceptance and usage methods (Agarwal & Prasad, 1998a, Moor & Benbasat, 1991, Taylor & Todd, 1995). This interest in the subject has been manifested in the abundant research and studied carried out to identify the factors that lead to successful adoption and use of IT in general and Decision Support Systems in particular (DSS) (Agarwal & Prasad, 1998b, Agarwal & Prasad, 1998a, Davis, 1989, Rose & Straub, 1998, Thompson & Rose, 1994). In fact, the last two decades have generated a multi-disciplinary research body that expands over the field of technology, Human Computer Interaction (HCI), and social psychology to shed light on user acceptance of technology (Agarwal & Prasad, 1998b, Agarwal & Prasad, 1998a, Davis, 1989, Rogers, 1995). As a result of the reach research findings, many models have been developed to predict the relationship between user perception and technology acceptance and use. The TAM, initially developed in 1986 by Fred Davis, is the best known and respected in the industry(Davis, 1989, Moor & Benbasat, 1991, Taylor & Todd, 1995, Thompson, Higgins, & Howell, 1991).

Computing technology and information systems represent substantial investments for organisations; investments on which they hope to realise a return in areas such as making effective Strategic Decision Making (SDM) and improving efficiency. Simply acquiring the technology, however, is often not sufficient; in order to obtain the anticipated benefits, it must be used appropriately by its intended users. The biggest and most expensive shortcoming a DSS can have is that it is not used in making effective strategic decisions. On the other hand if all the different variables that could affect this usage considered, CEO and other users are more likely to apply it in all different stages of SDM. There are many factors affecting the utilisation of IT in supporting effective SDM. These factors ranging from the systems themselves, the organisations that use the systems, the decision-makers and even the environment. Yet , the recent vogue to study technology acceptance and usage has only been concentrated in the technologically developed world. Certainly, of the large number of IT acceptance and usage studies covered in recent literature review, few, if any, took place in the developing world (Rose & Straub, 1998, Thompson & Rose, 1994). Of course the developing countries have their own unique characteristics, therefore conducting research in developing countries is indeed required to enhance our understanding of DSS acceptance and usage.

In 1985, the Cabinet of Egypt established the Information and Decision Support Centre (IDSC) whose mission was and is to provide information and decision support services to the Cabinet and the governorates for socio-economic development. The objectives of IDSC include (El Sherif, 1990 #733; El Sherif, 1988 #91):

- to develop information and decision support systems for the Cabinet and top policy makers in different governorates in Egypt;
- to support the establishment of decision support systems/centres in different ministries and governorates making more efficient and effective use of available information resources;
- to initiate, encourage and support informatics projects that could accelerate managerial and technological development of Egyptian ministries, sectors and governorates; and
- to participate in international co-operation activities in the areas of information and decision support.

In late 1987, the Cabinet IDSC launched the Governorates project, which represent a significant administrative and technological innovation for Egypt from the perspective of the central government. The project sought to implement 27 IDSCs, one for each governorate (including the city of Luxor). See Table 1 for the current situation of number of DSS units, number of employees and number of computer in each unit.

These centres were expected to enhance the administrative effectiveness of each governorate by providing information and decision support to the governors and their administrative staff (Kamel, 1995).

PURPOSE OF RESEARCH

The purposes of this research is to examine and define the factors that influence DSS usage in making strategic decisions in local governments in Egypt.

By understanding the factors that affect CEO DSS usage in making strategic decisions mangers can develop strategies to increase the utilisation of the DSS. In particular, the research in user acceptance is of value to local authorities for four reasons:

- Understanding the factors affecting user acceptance of DSS: knowledge of the factors affecting user acceptance of DSS, how they can be measured, and how they relate to each other is crucial in the development, implementation, and managing successfully DSS. Knowing

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Table 1: Profile of DSS units in local Governorates

No.	Governorate	DSS Unit	Employee	Computers
1	Ministry of village development	3	17	21
2	Trustee of Local Management.	1	10	10
3	Cairo	41	386	146
4	Giza	44	352	167
5	Kalubya	60	363	94
6	Alexandria	25	208	124
7	Beheira	96	624	191
8	Matrough	18	86	39
9	Menouffia	35	300	77
10	Gharbeya	79	512	45
11	Kafr El Sheik	59	373	98
12	Damietta	24	197	68
13	Dakhlia	76	616	146
14	North Sinai	33	142	92
15	South Sinai	20	84	57
16	Port Said	20	82	67
17	Ismailia	40	163	116
18	Suez	18	80	65
19	Sharkia	73	371	155
20	Bani Suef	31	192	45
21	Fayoum	29	186	79
22	Menia	39	232	114
23	Assiut	97	477	169
24	New Valley	22	137	49
25	Red Sea	13	62	55
26	Souhag	76	411	199
27	Kena	67	344	101
28	Aswan	48	232	120
29	Luxor	15	61	38
Total		1202	7300	2668

Source: IDSC in 1/11/1998

theses factors, interventions during implementation (such as training or involving user in development) can be used to increase user acceptance and usage.

- Prediction of user acceptance of DSS: before investing a large amount of money in a technology, an organization must be able to predict whither or not the investment will be accepted and used.
- Selection of alternatives: relative measures of user acceptance can be used to chose between alternative technologies.
- Guiding development: measurement of specific aspects or elements of a technology which affect user acceptance can be used to provide guidance to system/software developers as to which of these aspects or elements are important to the decision maker or need to be improved to utilise the system effectively. This knowledge can also be used in the early stages of software development to prevent potential problems before they occur or when it happened it can be sorted easily.

INFORMATION TECHNOLOGY ADOPTION AND USAGE FOR DSS

Research into information technology adoption and use has been motivated by the desire to predict the factors which lead to IT use (Thompson & Rose, 1994). Under a general assumption of a positive relationship between IS/IT utilisation and performance, numerous individual, organisational, and technological variables have been investigated in efforts to identify key factors affecting IS/IT behaviour. (Saga & Zmud, 1994) identified twenty empirical studies aimed at investigating the nature and determining factors of IT acceptance. Also a literature review by Prescott and Conger (1995), for instance, include 70 IT adoption and use articles based on the diffusion of innovation paradigm alone.

The overwhelming majority of information technology adoption and use research has been carried out in the technologically developed world. In fact, of the one hundred IT adoption and use studies covered in two recent literature reviews (Prescott & Conger, 1995, Thompson & Rose, 1994), non of the studies took place in developing countries or conducted on DSS usage on SDM. Perhaps this is understandable in that the majority of academic institutions and IT users are located in the industrialised world. The consequence, however, is that study of these phenomenon in developing world, where IT has thus failed to transfer effectively (Goodman & Press, 1995, Knight, 1993) (Mahmood, Gemoets, & Gosler, 1995, Odedra, Lawrie, Bennett, & Goodman, 1993), has been Severely limited. Mutual understanding between decision-makers from different parts of the world and cultural backgrounds is essential to ensure smooth interaction between these two parties and mutually beneficial relationships. Currently the developing countries invest a lot of money in the IT relating enterprises but the return on these investment still in the lower level of the expectations from these investment. The need for understanding how and why DSS has or has not been used by the decision makers in both developing and developed countries important to fully get a return on the investment. Many students from developing countries attend western universities and go back to their home countries. Students from developing countries who study abroad do so not only to apply technical and business knowledge but also to bring back some understanding western culture they experienced while they were living abroad. A transfer of cultural knowledge in the opposite direction is not necessarily happening (Rose & Straub, 1998).

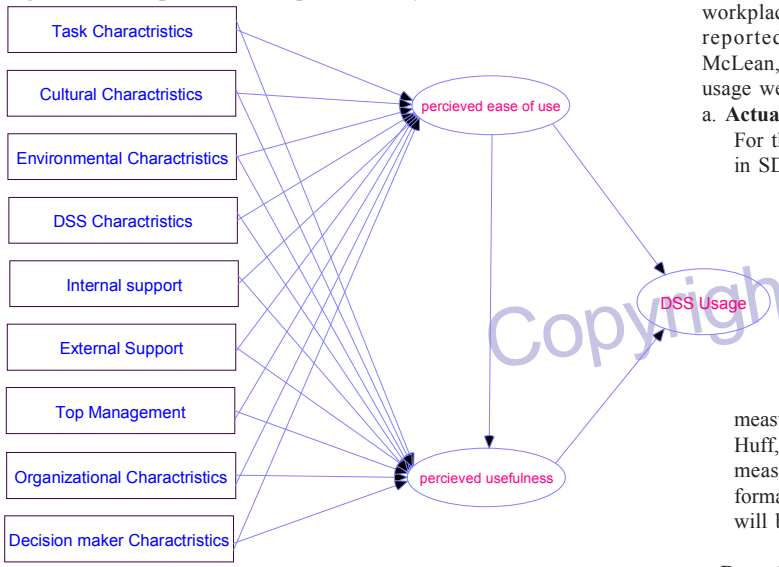
While information technology –specific adoption and use has not been evaluated across cultures of varying technological development levels, diffusion of non-IT innovations has been tested successfully(Rogers, 1995). Although these studies do suggest that information technology adoption and use models tested in developed nations may be applicable to less developed countries, no hard evidence presently exists. Of the 70 IT- based studies which either confirmed or extended the Roger's diffusion of innovation (DOI) model evaluated by Prescott and Conger (1995), non were conducted within developing nations (Rose & Straub, 1998).

A suitable first model for testing in developing world would be one which has shown robustness across the spectrum of IT application. This robust model should have the highest probability of success in future transfers across economic and cultural boundaries (Rose & Straub, 1998). Davis' Technology Acceptance Model (TAM) is a model closely related to Rogers' DOI model which has demonstrated this robustness. For this reason, TAM was selected as an appropriate model for studying DSS usage in making strategic decisions in local authorities in Egypt.

AN ADAPTED CONCEPTUAL BASED TAM

Figure 1 depicts the research model employed in the study. It is a reduced TAM model, excluding attitude and intention to use, because this research targeted only the local authorities that adopted already DSS systems in their organisations. The basic idea for the model is DSS usage in making strategic decisions as a dependent variable, can be predicted by both perceived ease of use and perceived usefulness with the different contextual variables. In this context the model hypothesises that DSS usage can be explained, accurately predicted, by means of a host of relevant contextual factors and the degree to which DSS usage in making strategic decisions is easy and useful as perceived by decision makers.

Figure 1: Conceptual DSS adoption model for SDM



RESEARCH HYPOTHESES

The following hypotheses provide the basis for the system evaluation of the DSS in SDM selected for this study.

Hypothesis 1: Perceived ease of use and perceived usefulness of DSS fully mediate the influence of task characteristics variables on usage of DSS in SDM.

Hypothesis 2: Perceived ease of use and perceived usefulness of DSS fully mediate the influence of cultural characteristics variables on usage of DSS in SDM.

Hypothesis 3: Perceived ease of use and perceived usefulness of DSS systems fully mediate the influence of DSS characteristics variables on usage of DSS in SDM.

Hypothesis 4: Perceived ease of use and perceived usefulness of DSS fully mediate the influence of environmental characteristics variables on usage of DSS in SDM.

Hypothesis 5: Perceived ease of use and perceived usefulness of DSS fully mediate the influence of organisational characteristics variables on usage of DSS in SDM.

Hypothesis 6: Perceived ease of use and perceived usefulness of DSS fully mediate the influence of internal support characteristics variables on usage of DSS in SDM.

Hypothesis 7: Perceived ease of use and perceived usefulness of DSS fully mediate the influence of external support characteristics variables on usage of DSS in SDM.

Hypothesis 8: Perceived ease of use and perceived usefulness of DSS fully mediate the influence of decision maker characteristics variables on usage of DSS in SDM.

Hypothesis 9: Perceived ease of use and perceived usefulness of DSS fully mediate the influence of top management characteristics variables on usage of DSS in SDM.

OPERATINALIZATION OF CONSTRUCTS

The constructs composing the research model were operationalized using a combination of items extracted from previous relevant research and newly composed items.

System Usage

It is now self-evident that computer technology is being increasingly utilised in the workplace. The extent to which decision makers use information systems or engage in other computer-related activities is most economically determined by asking them directly and this method is frequently used (Deane, Podd, & D. Henderson, 1998). Based on previous research which examines the usage of IT in the workplace which relied very heavily on defining usage based on self-reported estimates(Birdi, Pennington, & Zapf, 1997, DeLone & McLean, 1992, Igbaria, Pavri, & Huff, 1989) three dimensions of DSS usage were included in this study:

a. **Actual usage of DSS**: This dimension is widely used in MIS studies. For the purpose of this study, self reported percentage of use of DSS in SDM to the whole SD made during a period of time.

b. **Frequency of use**: This measure suggested by many researcher for example (DeLone, 1988, Raymond, 1985, Sirnivasan, 1985). Frequency of use was measured on a five point scale ranging from "several times a month" to "once a year".

c. *Level of use*: This serves to measure proficiency of use of the DSS. The respondents were asked to indicate their level of expertise of DSS usage in SDM on a five point scale ranging from " no use" to "extensive use". This measure was used by many researchers for example (Igbaria, Pavri, & Huff, 1989, Maish, 1979). The ranges of use has been changed in this measures from days to months and from months to year this transformation because of the nature of SDM making the frequency of use will be more sporadic.

Perceived Ease of Use (PEU) and Perceived Usefulness (PU)

This is the two constructs that originally proposed by Davis which he defined the PU as the degree to which a person believes that using a particular system would enhance his or her job performance and PEU as the degree to which a person believes that using a particular system would be free of effort (Davis, 1989). The validity of these two constructs (i.e., PEU and PU) in Davis's model was re-examined in a number of other studies. Adams, et al., 1992 replicated Davis's study with a focus on evaluating the psychometric properties of the two scales, while they examined the relationship among ease of use, usefulness, and system usage. The results showed that the reliability and validity of the two scales were very high. Another test of the reliability of PEU and PU scales by using two software packages, showed that the instrument exhibited a high degree of test-re-test reliability (Hendrickson, 1993). As Davis (1989) pointed out, psychometricians emphasis that the validity of measurement scale is built from the outset. To ensure the content validity of the scales, the items selected must represent the concept about which generalisations are to be made(Bohmstedt, 1970). Statements used in this research to operationalise the PEU and PU were basically adapted from Davis's study (1989) with minor changes in wording and adding one item to PU which is "lower cost" to fit the environment, specially developing countries, where cost is an important factor in using DSS.

Task Characteristics

Several studies have attempted to develop conceptual models of the strategic decision-making process based on studies of multiple decision situations (Fahey, 1981, Mazzolini, 1981, Mintzberg, 1976). They have broadly view the process in three steps of problem formulation and objective setting, identification and generation of alternative solutions, and the analysis and choice of a feasible alternative. Theses models appear to be variations or extensions of the intelligence-design-choice phases discussed by Simon (Simon, 1965). Most strategic decisions are characterised by uncertainty and complexity (Kivijarvi & Zmud, 1992). Complexity means existence of multiple and conflicting interpretations of the problem definition, which is particularly troublesome for the decision maker in using DSS. With highly complex decision situations, ...'the answers are obtained through subjective opinions rather than from objective data'(Daft & Lengel, 1986). Thus, characteristics of the task (i.e. strategic decision) in general is seen to be an important element likely to affect using DSS in making effective strategic decisions. To operationalize the concept of task characteristics the researcher combined both the complexity of the task as one of the most important characteristics of strategic

decisions and the different stages of this process. The respondents requested to indicate, on a five-point scale, their degree of agreement or disagreement with each item (5 being strongly agree and 1 strongly disagree). Although researchers expected that information technology would increase the amount of information available for strategic decision making, the soft, personal information often used by management (El Sawy, 1985, Mintzberg, 1975) is not easily captured by a computer based system (Karten, 1987). To measure what the CEO in local authorities think about the possibility of computerising SDM, the respondents requested to indicate, on a five-point scale, their degree of agreement or disagreement with each item (5 being strongly agree and 1 strongly disagree) about the following two items "strategic decision process is too complex to be computerised" and "strategic decision making tasks are too person centred to be computerised".

Cultural Characteristics

This construct investigate how the psychological context on both the individual and organisational level affects the perception and use of DSS in SDM. Hofstede's dimensions of cultures, power distance, individualism and uncertainty avoidance were adopted in general to measure this construct. Power Distance (PD) is the extent to which the less powerful members of organisations within a country expect and accept that power is distributed unequally. in large PD situations, superiors and subordinates consider themselves unequal; hierarchy is important. Centralisation and structure are important. Subordinates expect to be told, directed. In small power distance countries there is limited dependence of subordinates on their bosses. Malaysia, Guatemala, Panama, the Philippines and Mexico are, according to Hofstede's work, the strongest in PD, while the Scandinavian nations, New Zealand, Israel and Austria are the weakest. The Arab countries rank 7th.

Individualism (IDV) pertains to societies in which the ties between individuals are loose; everyone is expected to look after himself or herself and his or her immediate family. Collectivism as its opposite pertains to societies in which people from birth onwards are integrated into strong, cohesive in groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty. In high individualistic cultures, speaking one's mind is a virtue. The collectivist or low IDV culture, on the other hand, harmony is more important. High IDV nations include the USA, Australia, UK, Canada and Netherlands. The lowest IDV nations are the nations of the Pacific Rim and several central American countries. The Arab countries rank 27th.

Nation high in Masculinity (MAS) index attach the most importance to earnings, recognition for doing a job well, the opportunity for advancement, and challenge work A low MAS index reflects the importance of a good working relationship with the direct supervisor, co-operation with fellow employees, an acceptable family space, and employment security. High MAS countries include Japan, Austria, Venezuela and Italy. Low MAS nations are Denmark, Netherlands, Norway and Sweden. The Arab countries rank 23rd.

Uncertainty Avoidance (UA) is defined as the extent to which the members of a culture feel threatened by uncertain or unknown situations. A need for predictability and a predisposition for written and unwritten rules express this dimension. UA leads to a reduction of ambiguity. According to Hofstede, the emotional need for rules in strong UA nations can result in a talent for precision and punctuality, especially where the PD is relatively small. Strategic planning demands a greater tolerance for ambiguity. Weak UA cultures are more likely to stimulate innovation and tolerate deviant ideas. Greece, Portugal, Guatemala, Uruguay and Belgium are the strongest in UA, while Hong Kong, Sweden, Denmark, Jamaica and Singapore scored lowest. The Arab countries rank 27th .

The researcher , as mentioned in the literature that the gap between DSS professional and CEO may play important role in DSS usage in SDM (Hatten & Hatten, 1997), add this to the chosen cultural dimensions of Hofestede. Although other dimensions may also be important, these were chosen as most obvious to the CEO in both the two countries. The respondents were asked to indicate , on a five-point scale, their degree of agreement or disagreement with each item 1 being "strongly disagree" and 5 being "strongly agree" on the effect of these item on DSS usage in SDM.

DSS Characteristics

Previous studies have found that certain DSS characteristics seem to have an important influence on the effectiveness of the systems: user-friendliness; ease of use; size (cost)of DSS; range of alternatives; timeliness, accuracy and relevancy of output (Igbaria, Pavri, & Huff, 1989, Udo & DAVIS, 1992a, Udo & Davis, 1992b). Executives access to computerised information systems arisen as an issue in the strategic use of these systems (Hasan, 1995). Also some researchers attempting to measure IS success proposed items related to DSS characteristics like system quality, information quality, information use and user satisfaction with the information (DeLone & McLean, 1992, Li, 1997). Based on the literature, the instrument asked the respondents to indicate their agreement or disagreement with 12 statements reflecting the different DSS characteristics that might affect DSS usage in SDM. The response option are anchored on a five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree.

Environmental Characteristics

The government play a major role in local authorities in both developed and developing countries. It can play two roles, first as a regulator, and second as investor(Blanning, 1997). The government policies could be extended to the development of human resources which includes developing technical skills as well as building a society that is computer literate which in turn will be reflected on creating a favourable market conditions for using DSS strategically (Blanning, 1997). Also both "favourable government policies" and "uncertainty in environment" were mention as one of the key facilitators of the strategic use of IT (King & Teo, 1996). In addition to the previous items pressure from competition was mention in many studies as on of the factors for using IT strategically (Blanning, 1997). for example (Benjamin, Rockart, Scott Morton, & Wyman, 1984, Johnson & Carrico, 1988, Neo, 1988). Based on previous literature, the instrument asked the respondents to indicate their agreement or disagreement with 4 statements reflecting the different environmental characteristics that might affect DSS usage in SDM. The response option are anchored on a five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree.

Organisational Characteristics

Many studies have investigated the influence of organisational attributes on the effectiveness of information systems in general (Cheney, Mann, & Amorso, 1986, Lind, Zmud, & Fischer, 1989) and DSS in particular(Guimaraes, 1992, Sanders & Courtney, 1985). Based on previous literature, the instrument asked the respondents to indicate their agreement or disagreement with 7 statements reflecting the different organisational characteristics that might affect DSS usage in SDM. The response option are anchored on a five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree.

Internal Support Characteristics

Internal support that the decision makers get within the organisation either through training within the organisation or other sources of support is critical specially in developing countries where there is lack of resources. As a result, some decision makers rely on help from unspecialised persons (i.e. their colleagues), manuals, purchased books, and help screens. Based on previous literature, the instrument asked the respondents to indicate their agreement or disagreement with 5 statements reflecting the different internal support characteristics that might affect DSS usage in SDM. The response option are anchored on a five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree.

External Support Characteristics

because of insufficient internal technical expertise, specially in developing countries, the availability and quality of external support could be considered as an important determinant of DSS effectiveness in SDM. Recommendations from outside consultants were found to be an important variable in using IT strategically strategically(Neo, 1988). Also the support that the decision maker get from the government agencies is important and vary from a country to another. For example, some governments may wish to maintain tighter control over their information infrastructure, as it is the case in most of developing countries, while others may prefer to take the market approach (Blanning, 1997). Also good relationships with external vendors was one of the facilitators of success of end user computing (Shayo, Guthrie, & Igbaria, 1999). Based on previous literature, the instrument asked the respondents to indicate their agreement or disagreement with 3 statements reflecting the different external support characteristics that might affect DSS usage in SDM. The response option are anchored on a five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree.

Decision Maker Characteristics

The importance of decision maker characteristics as determinants of information systems success has been emphasised by several authors (Guimaraes, Igbaria, & Lu, 1992, Igbaria, Pavri, & Huff, 1989, Sanders & Courtney, 1985). Computer experience and user training have been found to have strong effects on micro-computer usage (Cheney, Mann, & Amorso, 1986). The importance of user training has long been proposed as a critical component of MIS success, in general, and for micro-computer usage in particular (Igbaria, 1992). Also cognitive style as one of decision maker characteristics, has probably received the most attention Huber (1983) reviews these studies and concludes that cognitive style is not a sufficient basis for driving DSS design guidelines because cognitive style is only one of many individual differences (Huber & Robey, 1983). Computer anxiety was found to have an effect on IS usage (Igbaria, Pavri, & Huff, 1989). In addition to that, some studies regard motivation as the key to MIS success (DeSanctis, 1982). Others find a positive relationship between user attitude and the successful use of information systems (Toubkin & Simis, 1980). Also some Managers will have a more positive attitude toward change and a greater willingness to implement new ways of doing things. Innovative decision-makers are more eager to try new ideas, have more favourable attitudes toward change, are less dogmatic, and are more able to cope with uncertainty and ambiguity (Brancheau & Wetherbe, 1990, Rogers, 1983). Decision makers characteristics measured by asking mangers to indicate their agreement or disagreement with 12 statements reflecting the previously mentioned different dimensions of decision makers characteristics in DSS usage in SDM. The response option are anchored on a five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree.

Top Management Support Characteristics

it is important that top management participation be active, and not merely symbolic. Simply giving the go ahead for the DSS implementation in the organisation is not sufficient (Ang & Teo, 1997). Some of the ways that top management can demonstrate its support could be by providing the necessary resources, leadership by setting goals and polices for DSS and showing interest by participating in DSS design and development (Ang & Teo, 1997, King & Teo, 1996). Based on previous studies question using 6 statements on a five point scale format ranging from (1) strongly disagree to (5) strongly agree were used to determine top management support.

SAMPLING

The unit of Analysis for this research is the chief executive officer or his/her delegate in the local governments in Egypt. The sampling frame including the directory of DSS units in the local governments in Egypt issued by Information and Decision Support Centre (IDSC).

A package that was mailed to senior executive officers contains two items: a covering letter explaining the importance of the study, the questionnaire with stamped return address on the back. The covering letter requested the respondent to return the completed questionnaire within two weeks. The respondents were assured of the confidentiality of their responses.

Of the 309 questionnaires that were returned from Egypt sample, 294 (about 73.5%) were valid, 12 incomplete and 3 returned by post-office due to incorrect addresses. To ensure that the valid responses were representatives of the larger population, a non-response bias test was used to compare the early and late respondents. χ^2 tests show no significant difference between the two groups of respondents at the 5% significance level, implying that non-response bias is not a concern.

ANALYSIS AND RESULTS

Cronbah's coefficient α was used to asses the reliability of all multi-item scales. All scales showed reasonable reliability (Ramaprasad, 1987) as indicated in the following table.

Table 2: Cronbah's coefficient α for constructs

Factors	α
DSS usage (3 items)	0.70
PEU (6 items)	0.69
PU (7 items)	0.72
Task characteristics (5items)	0.65
Cultural characteristics (4 items)	0.78
DSS characteristics (12 items)	0.68
Environmental characteristics (4 items)	0.71
Organisational characteristics (7 items)	0.78
Internal support characteristics (5 items)	0.74
External support characteristics (3 items)	0.81
Decision maker characteristics (12 items)	0.68
Top management support (6 items)	0.79

Following (Taylor & Todd, 1995), because of sample size limitations, multi-item constructs for the external variables were measured using a summated scale derived as the average value of all items pertaining to these constructs.

Structural Equation Analysis

Structural Equation Modelling (SEM) techniques are a second-generation multivariate technique and have gained increasing popularity in management sciences, notably marketing and organisational behavior, in the last decade (Chau, 1997).

The researcher used AMOS 4.0 (Arbuckle & Wothke, 1999) program to test the hypothesised linear effect of each group of variables on PEU, PU and DSS usage. There are a number of measures generated by AMOS to evaluate the goodness of fit of the model, like other commercial statistical software packages that adopt the structural equation modelling approach.

The most popular index is perhaps the chi-square statistic. This statistic tests the proposed model against the general alternative in which all observed variables are correlated. It measures the distance (difference, discrepancy, deviance) between the sample covariance or correlation matrix and the fitted covariance or correlation matrix (Joreskog, 1993). With this index, significant values indicate poor model fit while insignificant values indicate good fit. This is why it is also called a "badness-of-fit" measure Hartwick and Barki (1994) pointed out a major shortcoming of this index. They noted that "in large samples, the chi-square statistic will almost be significant, since chi-square is a direct function of a sample size…, in small samples, the statistic may not be chi-square distributed, leading to inaccurate prob-

ability values". In their study, Hartwick and Barki used four other measures of overall model goodness of fit: chi-square/degree of freedom, Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Average Absolute Standardised Residual (AASR). In another study Segars Grover (1993) included several other measures of model fit: Goodness of fit index (GFI), Adjusted Goodness-of-fit Index (AGFI), fit criterion, and Root Mean Square Residual. Table (2) lists the recommended values of various measures of model fit as suggested by these authors. Many researchers recommend that multiple fit criteria be use (Bollen & Long, 1993; Breckler, 1990; Tanaka, 1993) in order to attenuate any measuring biases inherent in different measures.

The hypothesised research model shown in Figure (2). The goodness of fit measures for this model are summarised in table (3) indicated a significant χ^2 = 246.58, df = 225, p = .154. This result indicated a good fit, as the probability level was above the generally accepted critical value p = .05. which supported the research hypotheses.

The parameter estimates and their t-values are shown in Table 5.

DISCUSSION OF RESEARCH RESULTS

This study integrated the theoretical approaches and empirical findings of research on DSS usage in local authorities in Egypt and tested a structural equation model examining TAM and other organisational and human factors that supposedly increase DSS usage by CEO in local authorities in particular and other organisations in general. PU and PEU showed significant direct effect on DSS usage at 0.001 and 0.10 level in consequence confirmed all earlier cited studies about TAM. This would confirm earlier studies (Davis, 1989, Igbaria, 1997). As TAM proposes, both PU and PEU are important in technology acceptance and usage. However, their relative importance in the acceptance process has been shown to be different in previous studies. For instance, (Davis, 1993) found that usefulness dominated ease of use, whereas (Adams, Nelson, & Todd, 1992) ease of use to be more influential than usefulness. The results of this research showed that PEU direct effect on DSS usage was (0.95) while PU (0.72) which may suggest that decision makers managers in local authorities use DSS technologies primarily on the basis of ease of use and user friendliness

Table 3: Recommended values of goodness-of-fit measures

Goodness of fit measure	Recommended Value
Chi-square	p ≥ .05
Chi-square/degree of freedom	≤3.0
Goodness-of-fit Index (GFI)	≥.90
Adjusted Goodness-of-fit Index (AGFI)	≥.80
Normed Fit Index (NFI)	≥.90
Non-Normed Fit Index (NNFI)	≥.90
Comparative Fit Index (CFI)	≥.90
Root Mean Square Residual (RMSR)	≤.10
Incremental Fit Index (IFI)	≥0.90

Adapted with modifications from (Hartwick & Barki; 1994, Segars & Grover, 1993)

Table 4: Fit measures for task characteristics model

Fit Measure	Task Characteristics model
Discrepancy (CMIN)	246.58
Degrees of freedom	225
P	0.15
Number of parameters (NPAR)	100
Discrepancy / df (CMINDF)	1.10
RMR	0.06
GFI	0.94
Adjusted GFI	0.91
Parsimony-adjusted GFI	0.65
Normed fit index (NFI)	0.68
Relative fit index (RFI)	0.57
Incremental fit index (IFI)	0.96
Tucker-Lewis index (TLI)	0.94
Comparative fit index (CFI)	0.95
Parsimony ratio (PRATIO)	0.75
Parsimony-adjusted NFI (PNFI)	0.51
Parsimony-adjusted CFI (PCFI)	0.72
RMSEA (PCLOSE)	0.02
P for test of close fit	1.00

Figure 2: Research model

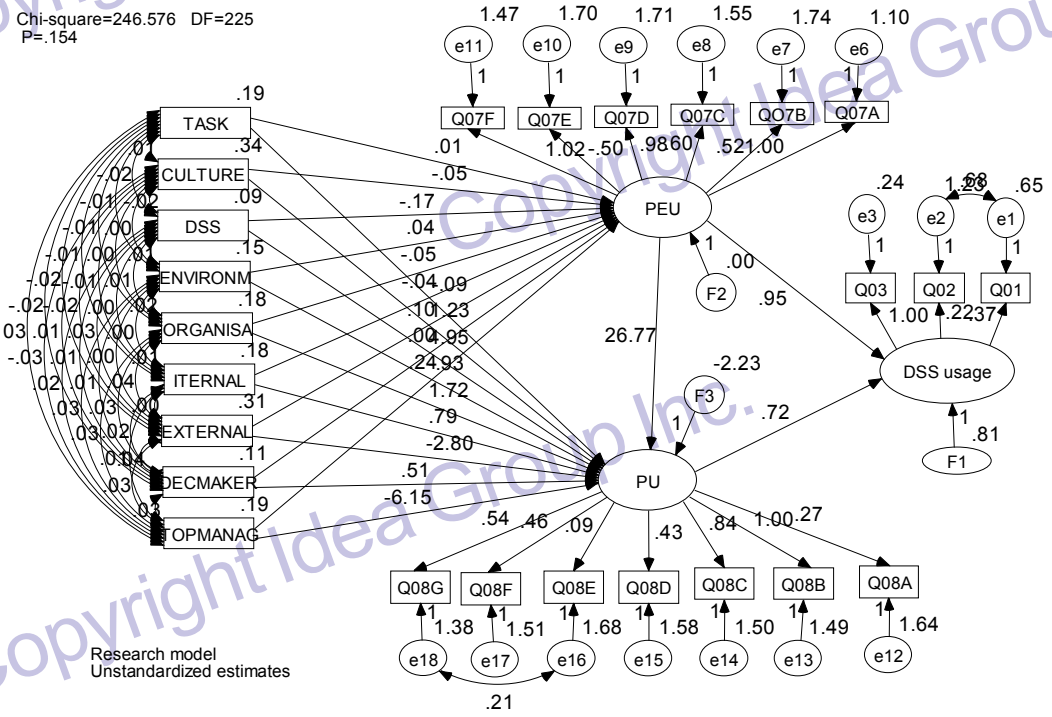


Table 5: Regression weights

Parameters		Estimate	SE	p
PEU	← External support	0.10	0.07	0.14
PEU	← Internal support	-0.04	0.08	0.62
PEU	← Top management	0.24	0.10	0.02**
PEU	← Decision maker	0.00	0.11	0.98
PEU	← Culture	-0.05	0.06	0.43
PEU	← DSS	-0.17	0.12	0.17
PEU	← Environmental	0.04	0.09	0.64
PEU	← Organisational	-0.05	0.08	0.56
PEU	← Task	0.01	0.07	0.92
PU	← Decision maker	0.51	2.89	0.86
PU	← Top management	-6.15	59.56	0.92
PU	← Internal support	0.79	9.70	0.93
PU	← External support	-2.80	25.16	0.91
PU	← Organisational	1.72	12.26	0.89
PU	← Environmental	-0.93	10.24	0.93
PU	← DSS	4.95	42.34	0.91
PU	← Culture	1.23	11.41	0.91
PU	← Task	-0.09	2.70	0.97
PU	← PEU	26.77	250.75	0.91
DSS usage	← PU	0.72	0.21	0.00***
DSS usage	← PEU	0.95	0.54	0.08*
Q07D	← PEU	0.98	0.54	0.07*
Q07C	← PEU	0.60	0.45	0.19
Q07B	← PEU	0.52	0.47	0.26
Q02	←DSS Usage	0.22	0.10	0.03**
Q07E	← PEU	-0.50	0.46	0.27
Q03	←DSS Usage	1.00		
Q01	←DSS Usage	0.37	0.14	0.01**
Q08E	← PU	0.09	0.19	0.62
Q08D	← PU	0.43	0.20	0.03**
Q08C	← PU	0.84	0.24	0.00***
Q08G	← PU	0.54	0.20	0.01**
Q08F	← PU	0.46	0.20	0.02**
Q08A	← PU	0.27	0.19	0.16
Q08B	← PU	1.00		
Q07A	← PEU	1.00		
Q07F	← PEU	1.02	0.53	0.05**

Note: Data are maximum likelihood estimates. Estimates without a P value are fixed parameters. P values significant at 0.10 are followed by *, at level 0.05 followed by ** at level 0.001 followed by ***.

and second because of the functions it perform for them. Decision makers with difficulties in using the system might, as a consequence of their lack respective skills or the training that they get, be discouraged from using the system and may not be able to observe the potential benefits. This emphasises the importance of features and services that are supporting the usability of the system, which seems to be very important from the viewpoint of decision makers in local authorities in Egypt. The previous result consistent as well with (Agarwal & Prasad, 1999) and many other researchers where ease of use predicts usefulness, which may suggest that a reduction in effort is a significant component of the utility an individual derives from a system. The reduction in effort expended can, in turn, free up time for decision makers to perform other tasks, thereby increasing overall productivity and effectiveness of SDM (Agarwal & Prasad, 1999).

Further results in the study have shown that the top management characteristics i.e. understanding of DSS and involvement in the process of design and development, influences the PEU while non of the research constructs affect PU. From another side the research results indicated that all the research constructs variances are significant as indicated in table (5) in the appendix.

The results showed a strong direct and positive relationship between perceived usefulness from one side and DSS characteristics and PEU from another side. Also the were a negative direct relationship between PU and both top management and external support characteristics. These results for PU are some what surprising because I expected that top management characteristics and support to have a positive direct effect on PU. This expectations from my side is supported by an earlier result of this research regarding the relation between PEU and top management where it was positive relationship. One plausible explanation for this result might be that decision makers think that the central government represent a barrier for them to benefit from the functionality that DSS could offer to them by making most of the strategic decision centrally which was obvious from the interviews with CEO and IT managers.

IMPLICATIONS AND CONCLUSIONS

This study is of considerable theoretical and practical importance because it is one of the leading few studies dealing with TAM in developing countries and in this type of application which is DSS usage in SDM.

Implication for research: From the perspective of theory development, this research posited and found support for a theory of how TAM as an adequate and parsimonious conceptualisation of acceptance and usage of DSS in SDM. Most empirical studies of TAM have examined relatively simple end-user technologies (Agarwal & Prasad, 1999) but this research examined the application of the main constructs embodied in TAM which are PEU and PU on the actual usage of DSS in SDM. Also the study make some amendments on TAM to make it suitable for the context of local authorities in Egypt where DSS is compulsory adopted by local authorities under direction from the central government which make the most important construct is the actual usage not the intention of use and the deletion of attitude because the system is already used.

Evidence for the assumption of mediation of PEU and PU between DSS usage and new external constructs raises some intriguing implications for the construction of research models related to examining information technology adoption phenomena. This new constructs need to be re-examined in different contexts to confirm the validity of these constructs. Another implication follows when the results of this research juxtaposed with other results obtained from previous research with regard to the relative importance of PEU and PU. It appears that the relative importance of PEU is higher than PU, although both were so important, suggesting that usability of DSS is crucial for its actual use in SDM in local authorities in developing countries in general and in Egypt in particular. This may intrigue other researchers to link between the relative importance of these two constructs and the stage of DSS implementation and the environment of implementation as well.

Implications for Practice: Perhaps the most significant implication of the findings of this research is the necessity of moving toward decentralisation regarding making strategic decisions where top management were found to have a negative relationship with PU. Also integrating technical improvements and functionality of DSS from side and usability and decision maker support from another side is an imperative if success of DSS in SDM in local authorities is to be insured. The results also showed a negative relationship between external support and PU suggesting depending on internal support to guarantee productive usage of DSS.

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APPENDIX

Table 6: Variances

	Estimate	S.E.	C.R.	P	Label
EXTERNAL	0.31	0.03	12.08	0.00	par-73
DECMAKER	0.11	0.01	12.08	0.00	par-74
TOPMANAG	0.19	0.02	12.08	0.00	par-75
ITERNAL	0.18	0.01	12.08	0.00	par-76
TASK	0.19	0.02	12.08	0.00	par-77
CULTURE	0.34	0.03	12.08	0.00	par-78
DSS	0.09	0.01	12.08	0.00	par-79
ENVIRONM	0.15	0.01	12.08	0.00	par-80
ORGANISA	0.18	0.01	12.08	0.00	par-81
F2	0.00	0.03	0.11	0.91	par-82
F3	-2.23	20.13	-0.11	0.91	par-83
F1	0.81	0.35	2.33	0.02	par-84
e10	1.70	0.14	12.08	0.00	par-85
e9	1.71	0.14	11.91	0.00	par-86
e8	1.55	0.13	12.07	0.00	par-87
e7	1.74	0.14	12.08	0.00	par-88
e6	1.10	0.09	11.61	0.00	par-89
e18	1.38	0.11	12.07	0.00	par-90
e17	1.51	0.12	12.10	0.00	par-91
e16	1.68	0.14	12.09	0.00	par-92
e15	1.58	0.13	12.10	0.00	par-93
e14	1.50	0.13	11.76	0.00	par-94
e13	1.49	0.13	11.35	0.00	par-95
e3	0.24	0.34	0.70	0.49	par-96
e2	1.23	0.10	11.83	0.00	par-97
e1	0.65	0.07	9.02	0.00	par-98
e11	1.47	0.12	11.80	0.00	par-99
e12	1.64	0.14	12.10	0.00	par-100

Table 7: Direct effects

Var.	ORG	ENV	DSS	CUL	TASK	INTE	TOPMAN	DECM	EXTER	PEU	PU
PEU	-0.05	0.04	-0.17	-0.05	0.01	-0.04	0.24	0.00	0.10	0.00	0.0
PU	1.72	-0.93	4.95	1.23	-0.09	0.79	-6.15	0.51	-2.80	26.8	0.0
DSS usage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.72