Evaluating the Intended Use of Decision Support System (DSS) via Academic Staff: An Applying Technology Acceptance Model (TAM)

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Abstract: ***Since the beginning of the expansion of information systems, people have been considering using them for making decisions. Decision Support System (DSS) is a computer technology solution that can be used to support complex decision making and problem solving. In order to produce a high quality education decision, managers have to be equipped with wide range of relevant information which makes the process of decision making even more complex. In situations like this, use of DSS can be a logical solution. The aim of this research is to investigate the intended use of DSS within academic staff at Universiti Tun Hussein Onn Malaysia by applying Technology Acceptance Model (TAM).In this research were employed structural equations modelling (SEM) approach with SmartPLS software to investigate students' adoption process. Findings indicates that the perceived ease of use, perceived usefulness have a positive impact and substantially associated with intend to use DSS among academic staff at universities. The study concludes that academic staffs at universities in Malaysia have positive perceptions towards DSS and intend to practice it for educational purposes. Also, the study indicates the importance of perceived usefulness and perceived ease of use as core factors which influence on the perception of using DSS to support management decision process.***

Keywords: Structural Equation Modeling (SEM), (DSS), Academic Staff, TAM.

I. INTRODUCTION

Much research in the area of Decision support systems (DSS) has been conducted for 35 years providing evidence of the usefulness of these systems in supporting both unstructured and semi-structured problems [1]. Through the use of DSS, users get to use various tools to develop their own process of decision-making leading to more sensible decisions. Although, the field of DSS has witnessed much development, the use such systems is still limited [2]. It is observed that the majority of the DSS are from functional management backgrounds such as logistics and marketing while the use of these systems is limited by academic staff [3]. While some research in this area has been conducted on universities examining the acceptance of DSS [4], this research is taking a step forward. In addition of investigating DSS acceptance by academic staff, the study also examining the relations among the Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and one's intention as well as behavior in using decision-making system. In particular, this research aims at achieving a number of aims. This research aims at investigating and identifying the intention to use and the Perceived Usefulness. Moreover, it aims at uncovering the relation between intention to use and DSS usage. The process of decision- making in both universities and business should be characterized by reliable, transparent and comprehensive planning and resolving manners [5].

Management units in universities can be more efficient if they are equipped with the right organizational cultures accompanied with knowledge transfer. Such skills also need to be accompanied with a good level of knowledge related to management strategies including the use of ICT within these strategies. For the success of any organization, decision making is also supposed to be in a good level of quality taken in the rights times. Decision supporting tools with the right skills such as creativity and imagination are needed for the process of decision making [6]. Recently, the issue of assessment in this area is getting much attention. A number of decision support systems (DSS) have been proposed in research in terms of planning, evaluation, advising and comparison [7] and these models, based on DSS, aim at planning and responding instantly in making decisions within academic environments.

Policies of admission, academic demand predictions, the demand of certain courses, different majors' impacts, program standards and other changes are examples of such models and decisions.

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There are several criteria for the systemizing of DSS headed by the mode of assistance criterion. This model identifies and differentiates between five types of DSSs namely: Communication-driven, Model-driven, Knowledge-driven DSS, Data-driven and Document-driven [8]. Decision support system DSS has been the interest for many researchers during past years. Recently, there has been a new stream of research concerning DSS. This study highlights the fact that the area of looking at DSS in higher education and understanding its influence on learning and academic achievement has received little attention by researchers. Thus, there is a need to conduct more studies on how DSS can impact the quality of education and the process of learning in Malaysian higher education institutions. Some studies were done in some of the developed countries such as UK, Australia and the United states. Tripathi [10] suggested that future can be strongly influenced by the existing information system of the higher education in UTHM and any mistakes can have consequences in future especially in university environments where teaching, community service and scientific research take place. Preparing and developing the performance of the academic stuff is the responsibility of universities in order to meet the different academic requirements and overcome the different problems they might face as they conduct their academic duties [11]. Absorbing new academic staff into universities runs according to a formal structured system that aim at easing this process of accommodation. The point this study highlights is that new university staff members are not inducted enough with professional stamina so that they can attend properly to their job requirements and face the different challenges they may find in their way [12]. The current research is an attempt to address this gap. In particular, this research aims at looking at the relationship between perceived usefulness and perceived ease of use and their impacts on Decision Support Systems (DSS) in the context of UTHM in Malaysia.

A. Decision Support Systems and Decision Making Processes in Learning

Decision Support Systems (DSS) have been given many definitions [13] and most of them agrees on the fact that such systems are developed to help in the decision processes in terms of identifying and resolving problems [9]. Most of these definitions also share the description of these Systems stating that they are the applications that help in supporting and not replacing decision making [14]. DSS should have certain characteristics in order to be efficient. Such characteristics are simplicity, strength, easy to control, adapting, being comprehensive in terms of issues. Moreover, these systems are supposed to be easily accessible for communication and flexible for users to use in analyzing important blocks of data [15]. DSS is a terms refers to those systems that provide assistance for those who use knowledge. This help is in terms of decision making and solving any problems they encounter in order to enhance their performance and for the good of their organizations. In addition to enabling managers to presenting information, effective decision support systems help their users to figure out the intended use of those elements themselves. Providing assistance in terms of information necessary for the process of decision-making exceeding the limits of decision-makers is the starting point of DSS. Some factors playing an important role in the process decision-making have been highlighted in literature [5]. One of these factors is Responsibility and transparency. It refers to the set of rules set to be respected by both individuals and organizations during the process of decision-making. Another factor is called Examination which refers to the fact that the knowledge of the expert should be the base of all decisions taken. Moreover, Coordination and economy are also considered significant factors. The former refers to fact that no synchronization in the transfer of orders nor in the process management of decision-making means that prime solutions are not enough. The latter refers to point that common sense is important for decision making in the sense that it can compensate and make up for some of the losses that can occur sometimes.

B. Decision Support Systems in Higher Education Institutions

Educational resource planning is known as a complicated administrative procedure as it comes as a result of all-encompassing analysis of the whole data in relation to educational frameworks. Examples of these frameworks can be teaching resources, offered degrees or course structure. a broad analysis of big data sets is required by strategic management in universities. The problem is that some time the data might be vague to the users in the sense that they can be unavailable to the decision makers in an appropriate form or hidden or crucial data might not be available because the data set was not properly evaluated. Thanks to globalizations, now researchers in universities can move to general strategic management models from individual solutions. This benefit can be altered to meet the requirements of the different institutions. Several models are now accessible to facilitate strategic decision-making [17]. Again, the unavailability of the crucial data is the main reason for such problems. In the field of information system, researchers are mostly concerned by some important educationalist issues. These issues are considered administrative academic processes such as effective resource distribution, automation of academic staff and student admission and registration, management of various academic and service departments and academic staff and student record management. Back in the 1980s, the formulation of the general principles and approaches of model-based Decision Support Systems (DSSs) within academic environments used to be under the academic decision theory [18].

Fig 1: The Architecture of Adaptive E-learning with Decision Support System [16]

C. Identifying Decision Support System (DSS)

The decision support system (DSS) aims at supporting decision makers in the process of decision-making. DSS was first introduced back in the middle of 1960s [19]. DSS has no precise definition as different researchers have proposed different definitions [20], defined DSS as a computer application that enhances individual or group's capability in the decision-making process. The said ability is supported by a class of computerized information system [21]. DSS also has been defined as a system that enhances quality and effectiveness of the provided resolutions or improving the process and output of the decision-making process [22]. A decision support system (DSS) is an information system that supports business or organizational decision-making activities. DSSs serve the management, operations and planning levels of universities (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance for example unstructured and semi-structured decision problems. DSS's is the area of Information Systems (IS) discipline that is paying attention on holding up and civilizing managerial decision-making [23]. DSS has stimulated from a deep-seated progress that altered the way information systems is perceived in higher education's, to a mainstream IT progress that all organizations take on.

D. Concept of Decision Support System (DSS)

According to Keen Dan Scoot Morton Decision Support System is a merger of the source the source of intelligence with the ability of individual components to improve the quality of decisions. Decision Support System is also a computer-based information system for management decision-making that deal with the problem of semi structure [20]. The definitions provided during the last 30 years for DSS show, according to [24], "both what DSS is and what it is not", with consequences on both the scientific basis, and the credibility of the decision support applications. Essentially, a DSS is a computerized system which improves the activity of decision-makers situated on different levels in the chain of command (from supervision of different processes to leading positions in politics). At the same time, DSS stimulates the decision-maker to improve the decisional process and make the right decisions in order to obtain high and quickly visible performances [25].

II. The Research Model

Due to the advancement in the fields of science scientific networks and artificial intelligence, the area of Decision-making has witnessed an improvement. Furthermore, decision-making integration of management, operations research and conception sciences also contributed to this improvement. And rapid environmental and successive changes reflect managers of decision-makers' attitudes as the manager no longer needs to get the information only, "which represents a role of management information systems." DSS are collaborative information systems which provide information, modeling, and data manipulation. The systems were used to support decision making in cases of semi structured and unstructured cases, were nobody knows specifically how the decision should be made [26]. The premium goal the end goal of DSS is to supply managers with the information which is useful for understanding various administrative aspects of a problem and to select the best solution among the many alternatives for complex, managerial decisions [27]. TAM comprises of perceived ease of use (PEOU) and perceived usefulness (PU). To consider the acceptance behavior related to different decision methods, the widely studied reasoned action technology acceptance models (TAM) Davis, [28] are referred. TAM adapted the belief attitude intention behavior causal chain to model user acceptance of computers. TAM further identified beliefs by perceived usefulness and perceived ease of use. The behavioral decision theory further supported both perceived usefulness and perceived ease of use being determinant factors of computer use is the cost benefit paradigm. The following hypotheses are proposed based on the discussion above.

H1: There is a positive impact between perceived usefulness and intention to use DSS.

H2: There is a positive impact between perceived ease of use and intention to use DSS.

H3: There is a positive impact between perceived ease of use and perceived usefulness

Fig 1: Research Model

A. Perceived Usefulness

Managers and staff are forced to improve their work performance, which makes Perceived Usefulness an important factor when considering advantages that particular system usage brings to its users. Davis [28] defined perceived usefulness as a degree which refers to individual beliefs that using a precise system would improve and increase someone's job performance inside an organizational context. Bandura [29] also defined perceived usefulness as the extension to self-efficiency in which operations are associated with valued outcomes. psychology psychometric scales were used as the basis of measurement scales for perceived usefulness and perceived ease of use developed in the studies by [28]. Number of authors such as [30, 31] and others added extra items which are related with the quality of control of work, new technologies, speed of the tasks executed and critical job aspects support in order to measure Perceived Usefulness [32]. Responses obtained from these questions can be analyzed and used.

B. Perceived Ease of Use

Perceived case of use is defined as the prospective user's subjective probability that using a particular system would make him or her free of mental and physical effort [28]. Tornatzky and Klein [33] studied how innovation characteristics are connected with its adoption. They found that the complexity of innovation is the most important out of three factors which indicate the level of innovation acceptance. Moreover, found that it is expected that the user is going to use a system which is easy to use, rather than useful system. If it is complicated to use a certain system like DSS, its performance benefits will be fewer than the difficulties that a system usage will bring. Most frequently used items for measuring Perceived ease of use are related with the ease of operating level, rigidness and flexibility of system and effort needed to learn and use the system [32]. Authors such as [30, 34] have changed and adapted these questions for the researches in order to be used for the purpose of measuring the perceived ease of use [32].

C. Intention Use of DSS

When predicting behavioral intention to use DSS, it is important to consider both perceived usefulness and perceived ease of use Bandura's [29]. Swanson's research [35] similarly emphasized the importance of both determinants for perceived behavior. Instead of the term perceived usefulness, he used information quality and associated cost of access in his work, which is similar to the perceived ease of use. behavioral intention being directly influenced by both perceived usefulness and perceived ease of use is one of the findings of TAM [36]. Also, each of the two main constructs has an individual influence on Behavioral intention to use the system. Within their exploratory study, [37] found out that perceived usefulness is highly correlated with the predicted use of DSS. Robey [38] further supported the work of [37]. the Actual system use is also affected by behavioral intention to use explaining why this factor is presented within TAM, and not TRA [39]

III. Research Mythology

The main tool of data collected used in this study was a survey questionnaire. A total of 162 academic staff received this survey in the year 2017/2018. This survey required the respondents to talk about their experiences in using DSS. The hypotheses in this study are tested using a quantitative approach (positivism paradigm). 60 of the participants were males and 102 were females. In particular, students were asked to fill in the questionnaire about their experiences using DSS and its influence on academic performance. The participants of this research were also student studying in (UTHM).

A. Respondents

The questionnaires were randomly distributed among 162 academic staff in (UTHM). IBM SPSS Version 21 and Partial Least Squares Structural Equation Modeling (PLS-SEM) in Smart PLS package 3.0 were the major tools of analysis. Based on the study aims and objectives, the different factors of this study were developed. The instrument was also tested for its reliability and the result was positive as Cronbach's alpha 0.837. The questions in the questionnaire were made easy for the respondents to understand and they were also divided into five categories for organizational purposes.

B. Data Collection Procedures

As the main tool of data collection, a five-point Likert scale survey was adopted in the current study: 1 = strongly disagree and 5 = strongly agree. Before starting the actual study, A pilot study was conducted to make sure that the questions can be understood by the respondents and properly solicit the academic staffs' thoughts on the use of DSS impact on academic performance, examined with the help of TAM theory in one of the institutions of higher learning in Malaysia. 18 revised items were used in this questionnaire and the study took place at the end of the 2017/ 2018 semester. Every participant was provided the study background. The eighteen items designed attempted to measure the constructs in the research model; specifically, a subset of eighteen items adopted form Davis [15] measured perceived ease of use, perceived usefulness and intention to use DSS. The constructs of the survey were perceived usefulness (PU), perceived ease of use (PE) and intention to use e-learning (IU). Table 1 illustrated the items used in the current study and the resources they were adapted from.

Table 1: Construct measurement

Factors	Items	Measure
Perceived Ease of Use (PEU) of DSS	PEU 1	I found DSS easy to use.
	PEU 2	Learning to use DSS would be easy for me.
	PEU 3	My interaction with DSS was clear and understandable.
	PEU 4	It would be easy for me to find information at DSS.
	PEU 5	Using DSS is easy to understand.

	PEU 6	Using DSS does not require a lot of effort.
Perceived Usefulness (PU) of DSS	PU 1	Using DSS would enhance my effectiveness in learning.
	PU 2	Using DSS would improve my course performance.
	PU 3	Using DSS would increase my productivity in my course work.
	PU 4	I found DSS useful.
	PU 5	Using DSS improves the quality of our work.
	PU 6	Using DSS supports critical aspects of our work.
Intention to Use (IU) DSS	IU 1	I intend to use DSS during the semester.
	IU 2	I will return to DSS often.
	IU 3	I intent to visit DSS frequently for my course work.
	IU 4	I think that using DSS is a good idea.
	IU 5	I intend to fully integrate our work with DSS.
	IU 6	I intend to recommend the use of DSS to learning.

IV. Results and Discussion

The basic sample demographic was the base on which distribution of respondent was conducted and the data obtained on the respondents' backgrounds came from the questionnaire. First, 37.0% of the respondents forming 60 of the total number of the participants were males while the rest forming 37.0% were females. Second, the participants were classified into four groups based on age: between < 30, 31-35, 36-45 and 40 years old and above. These percentages of these respondents were 15.4%, 40.7%, 40.7% and 3.1% respectively. Regarding the participants level of study, 36.4% of them were master degree holders while 60.5% were PhD degree holders and only 3.1% were holding degree holders. Based on the faculties they belong to, 52.5% of them were from Fakulti Pengurusan Teknologi Dan Perniagaan (FPTP), 27.8 % were from Fakulti Sains Komputer Dan Teknologi Maklumat (FSKTM) and 19.8% were from Fakulti Kejuruteraan Elektrik Dan Elektronik (FKEE). The main tool of analysis used to analyze the data obtained was the Structural Equation Modeling (SEM). The analysis was of two main phases: first, construct validity of the measurements, convergent validity of the measurements, discriminant validity of the measures was conducted. Second, the structural model was analyzed. This approach was used based on the recommendations of Hair et al. [40].

A. Construct Validity of the Measurements

The ability of the items generated to assess and measure a particular concept is known as the Construct validity [40]. In order to make sure that this is the case, the loadings of these items should by higher on the constructs they are supposed to measure than on the other constructs. The items generate throughout the related literature have undergone this process. The items were categorized under the different constructs based on the results of factor analysis. Table 1 illustrates the loading of these items and shows that their loadings are the highest on their related constructs [41]. Table 2 also shows the significant loadings of these constructs on their constructs

Table2: Loading and cross-loadings of the items

No	Variables	Code	IU	PEU	PU
1	Intention to Use (IU) DSS	IU 1	0.826	0.504	0.445
2		IU 2	0.855	0.349	0.539
3		IU 3	0.824	0.425	0.546
4		IU 4	0.852	0.313	0.432
5		IU 5	0.822	0.424	0.356
6		IU 6	0.768	0.427	0.430
7	Perceived Ease of Use (PEU) of DSS	PEU 1	0.383	0.786	0.563
8		PEU 2	0.558	0.802	0.496
9		PEU 3	0.474	0.797	0.540
10		PEU 4	0.334	0.739	0.566
11		PEU 5	0.568	0.728	0.445
12		PEU 6	0.438	0.753	0.398
13	Perceived Usefulness (PU) of DSS	PU 1	0.484	0.418	0.799
14		PU 2	0.541	0.415	0.823
15		PU 3	0.454	0.486	0.792
16		PU 4	0.490	0.480	0.763
17		PU 5	0.549	0.516	0.815
18		PU 6	0.531	0.585	0.732

B. Convergent Validity of the Measurements

The values of composite reliability are shown in Table 2. It can be clearly observed that they are above the recommended value of 0.7 as they are ranging between 0.876 to 0.927. The same goes to the values of Cronbach's Alpha that are above 0.7. As illustrated in the table, these values range between 0.830 to 0.906. As for the values of average variance extracted (AVE), they also exceed the value of 0.5 as they range between 0.544 to 0.680 indicating that the results are satisfactory. Looking at previous studies, it can be noticed that these results are higher than the ones of the previous research [40, 42]. Table 3 further illustrates the results of CFA of the measurement model.

Table 3: Convergent Validity

No	Variables	Code	Factor Loading	Composite Reliability	AVE	Cronbach's Alpha	R Square
1	Intention to Use (IU) DSS	IU 1	0.826	0.927	0.680	0.906	0.509
2		IU 2	0.855				
3		IU 3	0.824				
4		IU 4	0.852				
5		IU 5	0.822				
6		IU 6	0.768				
7	Perceived Ease of Use (PEU) of DSS	PEU 1	0.786	0.876	0.544	0.830	0.000
8		PEU 2	0.802				
9		PEU 3	0.797				
10		PEU 4	0.739				

11		PEU 5	0.728				
12		PEU 6	0.753				
13	Perceived Usefulness (PU) of DSS	PU 1	0.799	0.907	0.620	0.877	0.534
14		PU 2	0.823				
15		PU 3	0.792				
16		PU 4	0.763				
17		PU 5	0.815				
18		PU 6	0.732				

C. Discriminant Validity of the Measures

The difference between a certain concept and its indicators on one side and another concept with its related indicators from another side is measured by the discriminant validity [43]. The value of AVE is found significant at p = 0.001 exceeding 0.5. This indicates that the discriminant validity of all constructs is satisfactory [42]. This indicates that the discriminant validity of all constructs is satisfactory [40] This indicates that the discriminant validity of all constructs is satisfactory. Table 4 illustrates the discriminant validity of the constructs.

Table 4: Discriminant Validity

Variables	IU	PEU	PU
Intention to Use (IU) DSS	0.911		
Perceived Ease of Use (PEU) of DSS	0.424	0.895	
Perceived Usefulness (PU) of DSS	0.571	0.429	0.832

D. Analysis of the Structural Model

As the results on the measurement model came satisfactory, the current study is taking a step forward and starts testing the hypothesis by looking at the relations between the different constructs. The PLS algorithm under Smart PLS 3.0 was used to test the various hypothesis in this study. Tables 2,3 and 5 illustrate the path coefficients generated.

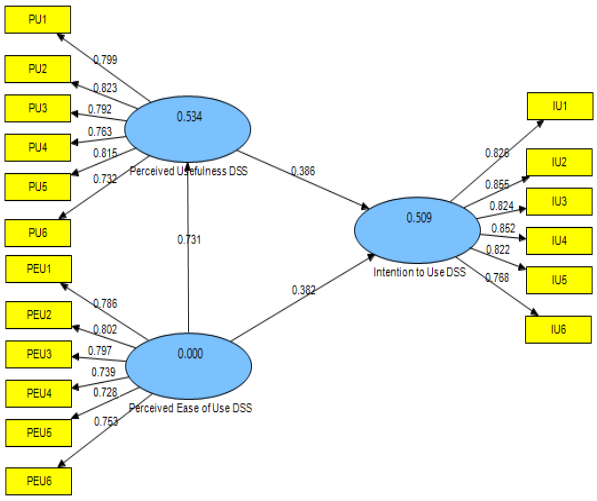

Fig 2: Path coefficient results

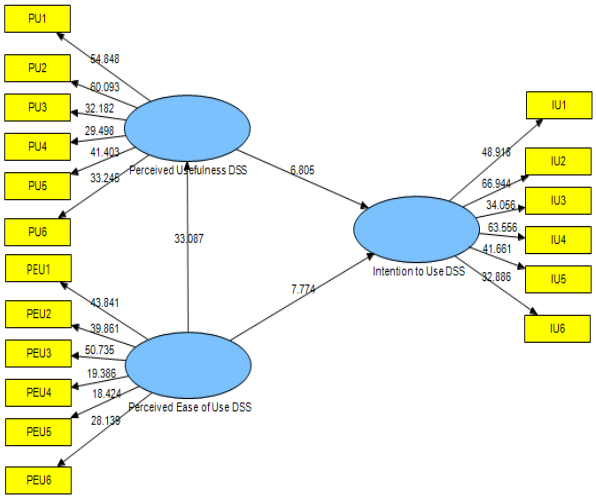

Fig 3: Path coefficients (T values)

Table 5: Hypotheses testing

H	Independent	Relationship	Dependent	Path	Mean	Standard Error	T values	Results
H1	PU	→	IU	0.386	0.386	0.056	6.805	Supported
H2	PEU	→	IU	0.382	0.387	0.049	7.774	Supported
H3	PEU	→	PU	0.731	0.733	0.0220	33.087	Supported

The results of the current study support all of the three hypotheses. The relation between perceived usefulness and intention to use DSS was found to be significant and positive (β=0.386, t=6.805, p<0.001). Therefore, the first hypothesis is supported. Moreover, the relation between perceived ease and intention to use was found to be positive as DSS (β=0.382, t=7.774, p<0.001) which provides support for the second hypothesis. Finally, according to the results of the current study, perceived ease of use and perceived usefulness were found to have a positive and significant influence on the intention to use DSS (β=0.731, t=33.087, p<0.001) providing support for the third hypothesis. The study aimed at exploring the relation between perceived ease of use and perceived usefulness and to investigate their impact on the intention to use DSS by academic staff within universities. The results of the current research concerning the different factors under investigation are well-supported by the findings of the previous related research [15, 17, 18]. It seems that DSS is helping academic staff working in the area of higher education to meet the requirements of the various tasks and research. This also becomes useful when assessing their academic achievement. As for formative assessment, the introduction of DSS has an influential impact on intention to use. The intention of using DSS can be predicted by perceived usefulness. The positive influence of intention on use DSS goes in line with previous research throughout related literature as users find out that DSS can be easy and useful to use [28, 29, 30, 31, 32, 37].

Moreover, this content needs to be informed for academic staff to use. Users of DSS are reported to be more likely to high intention to use, and this is normally in line with the content of their field of study [37, 38]. Overall, TAM was indeed proven to be a very popular model for explaining and forecasting system use [36]. Until now, there have been an impressive number of studies on TAM, and the research results have been, over the years, generally consistent. It was acknowledged that the efficiency of any change process relies on the interdependence between the technology, the organizational context, and the change model used to manage the change [44]. This supports the suggestion that it may be difficult to increase the predictive capacity of TAM if it is not integrated into a broader model that should also include organizational and social factors [32]. It was also determined that an effective IS implementation tends to follow a pattern where the management proceeds with disjoint periods of thorough implementation, rather than with a constant improvement [44]. Similarly, this research provides three empirical pieces of evidence. First empirical evidence to an evaluation of the intended use of (DSS) through academic staff. Second empirical evidence an applying Technology Acceptance Model (TAM) that in turn, affect intention to use (DSS). The third empirical evidence the substantial theoretical contribution to previous knowledge an evaluating the intended use of (DSS) via academic staff with Technology Acceptance Model (TAM) in the context of educational [45, 46, 47, 48].

V. CONCLUSION AND FUTURE WORK

Universities are expected to have a more advanced source of information to inform a better decision-making process and to influence how the staff members act if this system gets applied in these universities. Also, in this paper, the evaluation of academic staff intention to use DSS system inside UTHM was introduced. According to the results of this study, all hypotheses concerning exposure to intention to use DSS system in UTHM via TAM Model were accepted. Future research is recommended to follow the footsteps of this work and expand the range of investigation to include more aspects related to DSS environments' creation. Academic staff characteristics and the quality of services on the individual's intention to get involved in DSS is another issue that should be taken into consideration by future research. In particular, support for e-learning and its relationship to self-efficacy can be a significant issue to look at. Moreover, for the sake of generalizing the results, future research should be conducted on a bigger sample taking demographic factors into account. This study calls for future research to explore the area of academic staff potential of DSS and analyze other aspect in this regard. This work shows the trend taken by the expansion of DSS in future.

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