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Assessing Faculty's Use of Social Network Tools in Libyan Higher Education via a Technology Acceptance Model

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ABSTRACT Recently, many educational institutes are expanding their education delivery methodologies to incorporate online, remote, and flexible learning, which is a strategic response to facilitate and fulfil the increasing demand for access to higher education. Unfortunately, online education requires substantial investments in different online education platforms, technologies, and infrastructure, creating obstacles for realising the online education strategy for many developing countries. In this paper, we argue that we could use social networks as one of the delivery platforms for online education, due to their easy access and popularity among young generations. Therefore, we carried out this study to measure and analyse the acceptance of faculty and educational stakeholders for social networks adoption as an educational delivery platform. Hence, we adapted the Technology Acceptance Model (TAM) to determine and analyse the factors and variants affecting faculty's acceptance. We used the TAM as an internal variable, and we used privacy, infrastructure, institutional support and access devices as external variables to assess the faculty needs for adopting social networks into educational settings. The study examined 14 hypotheses corresponding to these factors using data collected from 382 respondents in six different universities within Libya, performing structural equation modelling, descriptive analysis, and confirmatory factor analysis. Results show that privacy, institutional support, perceived usefulness and perceived ease of use were seen to have a significant effect on behavioural intention. Additionally, perceived ease of use and behavioural intention contributed significantly towards the actual usage of social networks. The results also show that faculty and educational stakeholders have not provided enough for institutions or encouraged the use of social networks within the context of educational institutions across Libya.

INDEX TERMS Acceptance, adoption, higher education, Libya, social network, technology.

I. INTRODUCTION

Social network tools (SNTs) have become the commonly used applications for social space through which it connects friends, colleagues, and family members. SNTs are social interaction tools that make it effortless for people to network information as well as engage others with their life experiences [1], [2]. According to [3], SNTs are applications that can be employed in updating, analysing and sharing information, establishing casual relationships; and supporting informal learning practices through interaction and communication [3], [4]. Although the traditional method in academic settings to attract educational users, with social networks, also provide the opportunity to access new ideas via subliminal, reliable, and seamless educational learning activities. Furthermore, many information systems (IS) researchers are still working on how to predict users' continuance intention, post-acceptance and continuance theories, particularly on the relationships between individuals or different groups through means of understanding technology acceptance, behavioural intention, actual use and several conventional theories [5].

The Technology Acceptance Model (TAM) is a vital instrument that examines the adoption and different dimensions of user behaviours to critically and fully integrate a conceptual model to a learning environment and overall help with providing useful implications related to different concerns [6]. The TAM has always been used to find determinants for educational technology purposes [3]. It is important to understand

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the purpose of the faculty's adoption of SNT in teaching and learning practices. That is because of the potentials and advantages of SNTs (such as; podcast, videos and collaborative learning) and the rapid growth of SNT implementation in higher education [8]. Based on the exponential use of SNTs in the education sector, the current literature on SNTs has focused mainly on the potential benefits, social issues, environmental factors and privacy concerns of SNTs in HE [7], [9], [10], which helps with understanding the importance of SNTs for teaching and learning. However, to ensure that SNTs are effective teaching tools in education, there is a need for faculty to accept SNT adoption, and understand the external factors that affect faculty acceptance or rejection of SNTs, especially in developing countries. Hence this study aims to analyse how variants affect faculty acceptance of SNTs in higher education (HE).

In this study, the main focus is on four determinant factors, with a TAM as the base model: privacy, infrastructure, institutional support, and access devices [8]. This study proposes new perceived constructs, namely, privacy, infrastructure, institutional support, access devices, perceived ease of use, perceived usefulness, attitude and actual use of SNTs. At the end of the study, we expected that factors dynamically aiding faculty's acceptance of SNTs in Libyan higher education will be determined.

Generally, this study contributes to the body of knowledge by the following:

- Empirically examining how privacy, infrastructure, institutional support, and access devices affect actual faculty's acceptance of SNTs in Libyan universities.
- Applying the TAM to the construct as an amended model to examine external factors.
- Examining whether faculty perception has a positive effect on SNTs in Libyan universities.

The rest of this paper is organised as follows. In section 2, we review the research background on social network services and the TAM in educational settings, particularly at the faculty level. In section 3, a research model and hypotheses are developed. The research methods and research model results are explained in section 4. Section 5 continues with discussions on the overall results of the analyses. In section 6, we present the general implications of the research and its impact on educational management. In section 7, we present the limitations and future direction of the research. Finally, the conclusions are presented in section 8.

II. LITERATURE REVIEW

A. THE APPLICATION OF SNTs IN HIGHER EDUCATION

There are many studies on the positive outcome of the use of SNTs for the teaching-learning process [10], [11]. Most of these studies are based on security and privacy perceptions of the use of SNTs, mostly in HE [12], [13]. For instance, [14] pointed out how SNTs have been used in social media to connect formal and informal learning by allowing students to relate in new and meaningful ways in order to expand learning content in different formal and informal learning settings. The authors highlighted a certain number of perils, barriers and concerns such as information security and privacy, poor infrastructure, adequate time commitment, monitoring and control of information about students' activities. However, many authors have also stressed that there are several challenges, especially in developing countries, related to the adoption of SNTs to improve the learning environment and working on barriers that will help in the development of SNTs as a new and reliable tool for instruction and learning.

In another study, [15] stated some number of difficulties and concerns presented by SNTs that require scholars attention in future research studies. Some of these challenges are related to distraction, traditional roles, privacy management, issues with administration, an institutional concern of pedagogical and instructional matters, allotted time spent, support for the institution and technical integration of tools for professional development. These challenges imply that SNT usage is presently inadequate and restricted and that faculty are unwilling to deploy these mechanisms for some motives. Concerning reviews related to education and SNTs, [16] emphasized variability in the use and acceptance of SNTs. However, the authors also stressed initial studies on SNTs as a new medium for informal discussions rather than research on SNTs to improve the social community. Au and Lam [17] cautioned against the possible tension that concerns security and changes involved in the institutional, educational approach. Because of the potentials and benefits of SNTs for learning and teaching, institutions suggest that the integration SNT methodology should be a step-by-step approach to measure effective teaching and learning processes.

B. FACULTY'S PERCEPTION OF THE USE OF SOCIAL NETWORK TOOLS

In recent years, SNTs have been one of the applications that build on the idea of how people should communicate and interact with each other [2]. These tools exist mostly on internet websites, via which millions of people share their social interests on different views and disciplines through various means, such as sharing files, videos, and photos; creating and posting blogs; sending messages; and managing interactions.

By 2018, Facebook passed 2.32 billion users, LinkedIn had over 610 million members, Twitter hit over 67 million users, and YouTube reached 1.9 billion users [18]. With the new trend, the focus on SNTs is now trending towards the educational sphere. The dependence of educational technology on the theoretical approach of SNTs through conversant and multiple groups is becoming the focus of the learning system.

According to [9], educational technology solely depends on six grounding foundations - communication, interaction, environment, culture, instruction, and learning. However, the combination of the grounding theories of [19], [20] and [21] contributes to the foundation of the SNT approach in the learning environment, and other critical aspects of SNTs, including learning networks, optimization, evaluation and educators, have vital roles in the development of SNTs [4].

Thus, the proper understanding and behaviour of SNTs is a potentially valuable source of information for educators and researchers, and this makes social media with technologies serve as facilitators for social interaction, collaboration and all aspects of educational stakeholders.

However, the perception and use of SNTs among faculty have helped in integrating curriculum with social media for informal learning and to investigate educational practices based on SNT usefulness, control and issues such as faculty's prior openness, interactivity and sociability in the institution of higher learning [15], [22], [23]. In a study on faculty openness, interactivity and sociability in institutions [15], the results show that SNTs are still limited in use, and only a few academics are ready to accept these applications into their teaching practices for some rational reason - cultural resistance, or institutional supports.

Additionally, the results show that beliefs among academics on the ways to implement SNTs and the perceived usefulness of SNTs mostly focused on the old scientific way of teaching. Overall, the faculty's attitudes towards SNTs benefit learning, while the challenges of SNTs present disadvantages. Similarly, [22] reported that both educators and students acknowledge the importance of integrating SNTs for delivery, and assessment of courses also provides a positive impact on students through the deep learning experience, engagement, enhanced collaboration and organizational skills.

Furthermore, [23] investigate instructors' experiences on SNTs by investigating five instructors through their experiences on the use of such a platform for their courses. The study results indicate that SNTs can be utilized positively through expectations, different use of the platform, and distinct instructional objectives. Nevertheless, a few limitations were captured, and the study suggested that there is a need for technology design, implementation, and research on differences between SNTs as learning environments and SNTs for learning.

C. TECHNOLOGY ACCEPTANCE MODEL (TAM)

Several theories have worked on, such as the Theory of Reasonable Action (TRA) [24], the Theory of Planned Behaviour (TPB) [25], the Decomposed Theory of Planned Behaviour [26], and the Technology Acceptance Model (TAM) [27]. Other versions of the TAM by [28] include Technology Acceptance Model 2 (TAM2) [29], Unified Theory of Acceptance and Use of Technology (UTAUT) [30] and Technology Acceptance Model 3 (TAM3) by [31].

The TAM is an improvement of the Theory of Reasonable Action, which focused on modelling users' acceptance of information systems or technologies [32]. The TAM's simplicity, usefulness and the prevalent predictive tool for testing user acceptance of new technologies have made it popular among other theories, and the result of this theory has produced many studies on technology acceptance [3], [33]–[35]. The TAM has been tested, validated and expanded over time due to its precise ability to predict the adoption and usage intention of information systems [36].

However, despite the popularity of the TAM, studies have shown it is not adequate for conceptualization in terms of classroom technology integration, and it does not specify what kind of specialized knowledge is required by instructors for the teaching and learning of the effective integration of this technology [37]. Wu and Wang [38] suggested that specific additional variables needed to be added to the TAM in order to provide a sturdier model. However, many researchers suggested that the TAM must be given additional variables to provide an even more robust model [38], [39].

The extension of existing results to understand the influence of some variables after correcting or controlling the effects of others would be highly desirable to make the results applicable to the management of SNTs [40]. Our study suggests adding external variables, privacy, infrastructure, institutional support, and access device, which not covered in other studies [41]–[44]. Hence, our study contributes to the body of knowledge and filling the vacuum in the literature.

III. RESEARCH MODEL AND HYPOTHESIS DEVELOPMENT

For the objectives of the research to be realized, we examined each variable and proposed hypothesis individually based on a review of preceding studies.

A. PRIVACY AND SOCIAL NETWORK TOOLS

Privacy has defined as the capability of a person to attain control over the kind of information they share with others, which is considered to be personal [45]. According to [46], ''privacy is stated to be the boundary control process where a person can define whom they interact with, and the kind of communication carried out''. Some studies on information privacy have found that individuals are willing to disclose personal information in exchange for some economic or social benefits [47]–[49].

Manca and Ranieri [15] stated that SNTs are perceived as a waste of time, a great concern about privacy and a risk of weakening traditional role learning. With the advancement of technology today, it is simple to maintain records of people's online routines, which may jeopardize their safety [14]. However, numerous stages of security structures can be integrated into SNTs in order to alleviate user concern in relation to privacy and trust [50]. As there are many kinds of external open social network sources available, issues related to privacy could have tremendous consequences on the acceptance of SNTs by users via the moderation of relationships among TAM model component [51].

For the use of communication technology, perceived ease of use and perceived usefulness have also been investigated in past research. Braun [52] investigated perceptions of the usefulness of SNTs and perceptions of ease of use towards SNTs. This study intends to measure the effect of privacy on

the perceived ease of use and perceived usefulness of SNTs. In line with this, the following hypotheses are proposed:

***H1**: Privacy affects PE of SNTs.*

***H2**: Privacy affects PU of SNTs.*

B. INFRASTRUCTURE AND SOCIAL NETWORK TOOLS

Infrastructure can be defined as the essential systems and services required by an organization to work properly and effectively [53]. Infrastructure includes the internet, communication devices, and computer labs. References [54] and [55] suggested that infrastructure as ''internet/computer access, electricity, and systems efficiency plus availability'' is a common thread and should be addressed to guarantee the success of ICT-supported learning. The quality of the internet connection, which comprises internet reliability and speed, is considered a significant factor in the infrastructure that can provide a suitable medium for using SNTs in classes, labs, and other areas in universities [41].

Additionally, a lack of access to the internet, poor internet connection, the high cost of the internet, a lack of facilities provided by universities such as computer labs, and a lack of knowledge on how to use the system are contributory factors that can hinder the use of SNTs in learning [55]. For instance, without a stable internet connection, a user will not be able to access online technologies, which signifies their incapacity to pledge resources, assign ICT infrastructure for some durable vital concerns and to understand the potential of using SNTs in learning. Although research on the infrastructure role in SNTs is scarce [55]; [56], however, found a robust association amid the degree of acceptance of the internet and the framework of organizations. In line with this, the following hypotheses are proposed:

***H3**: Infrastructure affects PE of SNTs.*

***H4**: Infrastructure affects PU of SNTs.*

C. INSTITUTIONAL SUPPORT AND SOCIAL NETWORK TOOLS

Institutional support can be defined as the standards that include activities to ensure a suitable environment for quality distance education and the policies that guide the development of education over the internet [57]. These standards relate to such matters as technical infrastructure, technology plans, and professional incentives [58]. Abdullah and Toycan [59] explain that the institution should have the capability to transfer the learning content online for faculty, students and researchers. However, collective decision-makers mostly determine system adoption as well as technology adoption at the institutional stage. Reference [60] examined the precursors of PU and PE to provide a proper explanation of the determinants influencing institutional support. Therefore, it is anticipated that the more administrative support is gained, the higher the PU and PE are for SNTs. In line with this, the following hypotheses are proposed:

***H5**: Institutional support affects PE of SNTs.*

***H6**: Institutional support affects PU of SNTs.*

D. ACCESS DEVICES AND SOCIAL NETWORK TOOLS

Access devices can be defined as devices used in exploring most of the SNTs. While access online is one of the advantages of using social networks on mobile devices, the configuration of SNTs on some mobile devices may not be available [14]. In terms of the technical barrier that hinders the utilization of SNTs in higher education, the emergence of several mobile devices contributed mostly to the issue. Recent mobile technological development has made it much easier due to regular software updates, which makes certain outdated functions obsolete [17].

Additionally, there are some limitations concerning device access, e.g., small screen, high cost, battery life, and memory capacity, which can frustrate the use of mobile technology to a high degree in the field of learning [61]. Functionally, user-friendly features should help incorporate them into access devices, and the overall user experience may be less than a technical barrier [62].

Notwithstanding, as access devices are continually being advanced and marketed in the present context of growing SNTs, diverse theoretic models have been suggested to elucidate the technology acceptance procedure [63]. In particular, the TAM and UTAUT models have been widely used to explain and discuss users' acceptance of different access technologies [64]. Generally, the outcome of these models proposed on PE and PU are always the critical factors of adoption and use on access devices. In line with this understanding, the following hypotheses are stated:

***H7**: Access devices affect the PE of SNTs.*

***H8**: Access devices affect the PU of SNTs.*

E. PERCEIVED EASE OF USE (PE) AND SOCIAL NETWORK TOOLS

Many paucities of literature on information technology (IT) have always identified PE as the main construct to examine and access users' acceptance of new digital technology [65]. However, this helps in building more theoretical and empirical evidence that supports PE as a significant factor for assessing user attitude towards SNTs.

Upon the introduction of information systems, several studies have investigated the vital connection that exists between information systems and PE [8]. For example, within the SNT context, the more comfortable individuals find a particular technology to use, the more positive feelings they develop towards that technology. That is, users' perceptions of new technology are always based on ease of use, which encourages continued use; ease of use improves positive attitudes towards that technology [66].

According to [67], in the technology adoption model, PE is directly influenced by attitude and has an indirect influence on attitude through the PU. From the results, it is affirmed that PE is vital in discussing the SNT utilization/adoption intentions of PU. PU and PE have a direct effect on SNT usage, and perceived usefulness can also serve as a mediator of the effect of perceived ease of use [68]. Generally,

PE and PU influence attitudes towards SNT use either directly or indirectly [69]. Accordingly, from the above discussion, the following hypotheses are proposed:

***H9**: PE has a positive effect on attitude towards the use of SNTs.*

***H10**: PE has a positive effect on the PU of SNTs.*

F. PERCEIVED USEFULNESS (PU) AND SOCIAL NETWORK TOOLS

PU is defined as ''the degree to which a person believes that using a particular system would enhance his or her job performance'' [8]. As introduced before, PE affects intention either directly or indirectly through PU and is closely correlated with attitude [70]. PU of digital technology and PE predict usage intention and attitude as significant determinants of the adoption and usage of a particular technology. Also, a variety of literature models stated that both PU and PE are predictors of new technology adoption [71], and this suggests that from the TAM, PE has a significant effect on PU. Hence, PU is a useful determinant and easy to incorporate into any specific technology adoption and is useful for users as well.

Additionally, it is common knowledge that PU is an essential factor for behavioural intention (BI) and attitude both in off-line and online technology acceptance models [29]. For users to accept SNTs, their first impression must be that it is a useful tool that can improve communication and efficiency and offer more convenience for social activities with friends, colleagues and others. These characteristics help users perceive social networks as a useful tool with a positive attitude towards its usage and strong continuance behavioural intention [72]. Therefore, an individual's perceived usefulness of technology should impact the individual's attitude regarding a social networking site [66].

Therefore, an individual's perceived usefulness of technology should impact the individual's attitude regarding a social networking site [66].

Prior researchers have found PU in a great relationship to use than PE, but the two factors were found to have a strong relationship with the intention to use [52], [73]. The TAM framework has been a dominant framework in the prediction and explanation of user behaviour about just three theoretic concepts of PE, PU, and BI [74] and for SNT usage. Praveena and Thomas [67] confirm that the TAM model posited that PU affects the behavioural attitude and the intention to use. Therefore, PU attributes towards SNTs help maintain relationships, connect with people, and the intention to use different SNTs. From the above discussions, these hypotheses are proposed:

***H11**: PU has a positive effect on attitude towards the use of SNTs.*

***H12**: PU has a positive effect on behavioural intention towards the use of SNTs.*

G. ATTITUDE AND SOCIAL NETWORK TOOLS

The link between attitude and intention in the TAM indicates that attitude acts as an investigative predisposition to behavioural intention [75]. According to [76], the TAM can be used to analyse the relationship between attitude and intention to use an online system. This relationship analysed by different researchers in the field of technology advancements such as the adoption of IT, IS and SNTs. Based on this, [77] proposed a comparative model to evaluate the intention to utilise SNTs and the variances in this intention among numerous user groups. The results indicated that intentions to use SNTs supported the intention to utilise SNS, and the feelings and attitudes of users should also be considered. Generally, the attitude towards using SNTs has been regarded as the degree to which an individual perceives a positive or negative feeling related to SNTs. Hence, it is expected that attitude has a positive influence on behavioural intention to use SNTs. In line with this, the following hypotheses are proposed:

***H13**: Attitude has a positive effect on behavioural intention to use SNTs.*

H. BEHAVIOURAL INTENTION AND SOCIAL NETWORK TOOLS

Behavioural intention is defined as a deliberate plan to make efforts to perform a behaviour [78], [43]. By considering full attainment of use on the intention, users are believed to handle each intention as a privilege to actual use the SNTs with the intention of the antecedent of behaviour. In other words, the behavioural intention of social media users to use SNTs depends on their intention to exhibit the inclination to use SNTs. In line with this, the following hypothesis is presented:

***H14**: Behavioural intention has a positive effect on the actual use of SNTs.*

IV. RESEARCH METHODS

The questionnaire items utilized in this research were developed from literature reviews on SNTs and the TAM. The items were adapted, revised to form a structured instrument that used to collect data with a five-point Likert scale. That comprises privacy, infrastructure, institutional support, access devices, perceived ease of use SNTs, perceived usefulness of SNTs, attitude towards using SNTs, behavioural intention to use SNTs and actual use of SNTs, as shown in Figure 1.

However, to ensure adequate measurement of the validity of the instrument, this study started with confirmatory factor analysis (CFA), as shown in Table 2, to understand the internal structure of constructs and to understand the validity measures. Generally, the purpose of using CFA is to evaluate factor loadings - relationships between the variables and their corresponding factors.

A. DATA COLLECTION

The research aims to empirically examine how privacy, infrastructure, institutional support, and access devices affect actual educational acceptance of SNTs in Libyan universities. This research aims to help researchers and educators express their views on social network applications. This study provides an opportunity to study faculty acceptance of social

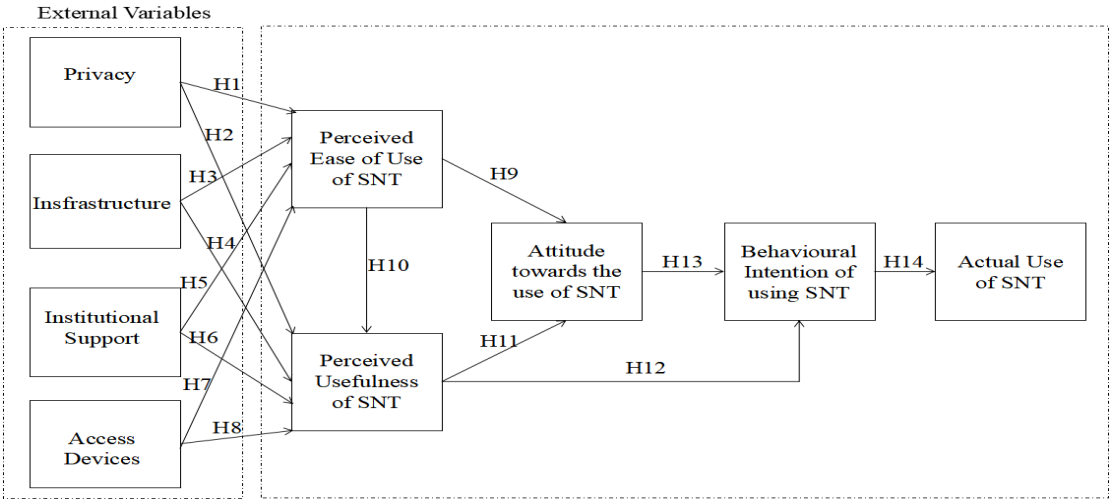

FIGURE 1. Proposed mod.

network variations in six universities in the North-West of Libya, which is chosen target for the research. These universities are Elmergib, Misurata, Sirte, Al Asmarya, Azzaytuna and Bani Walid, which are located in three urban and six rural areas of Libya with a total population of 5887. These universities had already adopted SNTs in different forms into their curriculum compare to other universities within that zone which are still inadequately empowered on the use of SNTs. The research used stratified sampling since it attributes to different research populations. Additionally, the research model is a cross-sectional examination. The equation given by [76] was used to calculate the finite population, as shown below:

$$n = \frac{N}{1 + N(e)^2}$$

where n is the sample size, N is the population size, and e is the level of precision. When this formula is applied to the above sample size calculation, we obtained 375 as the minimum sample size,

$$n = \frac{5887}{1 + 5887(0.05)^2} = 375$$

However, the adopted questionnaire was revised and translated to an Arabic version, and it was given to bilingual educators to approve it. The approved Arabic version was given to a professional Libyan translator who is specialized in Arabic linguistic. The questionnaire was built by Google Form, posted on the universities' Facebook pages, and re-posted again at the beginning of each week. The questionnaire stated clearly that participation in the survey was voluntary and not out of compulsion; giving respondents the freedom either to participate or not. Since the questionnaire was posted online, the data were collected and saved directly to Google Drive. The collected data were saved in an Excel file. The collection of data started 12/02/2019, and data were received until 12/04/2019. From the above sample size calculation, a minimum of 375 respondents was expected to participate, and 382 respondents were included.

B. DATA ANALYSIS

To attain the aim of this study, the researchers utilized the SPSS 26.0 and AMOS 26.0 statistics package to validate the data, model fit and hypothesis testing. SPSS 26.0 was utilized for descriptive analysis that explains the features and characteristics of the respondents of the survey and shows the results of the preliminary investigation of the sample, such as Cronbach's alpha, to test reliability, extracted average variance and composite reliability. Additionally, AMOS 26.0 for confirmatory factor analysis was used to prove the validity of each variable, test hypotheses and determine the structural model fit.

1) RESPONSE RATE

Table 1 summarises the response rate, and a total of three hundred and eighty-two (382) questionnaires were collected with valid data. The total population of educators by sex and age group were obtained from six universities across Libya. These data were compared with the gender, age, level of education, academic grade, profession, number of times using SNTs, teaching experience with using SNTs in course devices, and SNTs used to test its representativeness. In terms of gender, the distribution of the sample was 73.3% male and 26.7% female. This result shows that the sample appeared to be male dominant in gender distribution. Having analysed the demographic characteristics of age distribution, it was concluded that most of them (45%) were between 31 and 40 years, followed by those in the age group of 41-50 years (40.6%). The population of Libyan educators is higher than that of the working class. In addition, in the level of education, Masters (61%) dominated the PhD (39%). The universities had more assistant lecturers at (41.4%) compared to other academic grades. Additionally, most educators use SNTs as

TABLE 1. The demographic characteristics of the sample.

		Frequency	Percent
Gender	Female	102	26.7
	Male	280	73.3
Age	30 years and less	21	5.49
	31 - 40 years	172	45
	41 - 50 years	155	40.6
	51 - 60 years	27	7.06
	More than 60 years	7	1.8
Level of Education	PhD	149	39
	Master	233	61
Academic Grade	Professor	15	3.93
	Assoc. Professor	18	4.71
	Asst. Professor	53	13.9
	Lecturer	138	36.1
	Lecturer Asst.	158	41.4
Profession	Dean	9	2.35
	Vice Dean	6	1.57
	Head Department	90	23.5
	Teacher	277	72.5
Number of times of using SNTs	Many times a day	275	71.9
	Many times a week	57	14.9
	Once a day	46	12
	Once a week	4	1.05
Teaching Experience of using SNTs in courses	5 years and more	328	85.9
	3 - 4 years	40	10.5
	1 - 2 years	8	2.09
	Less than 1 year	6	1.57
Devices for using SNTs	Smart-phone	120	31.40
	Laptop	12	3.14
	PC	8	2.09
	IPAD, Smart-phone	13	3.40
	PC, Smart-phone	51	13.40
	Laptop, Smart-phone	147	38.50
	Tablet, Smart-phone	4	1.05
	PC, Laptop	9	2.35
	More than 2 Devices	18	4.71
SNTs used	Facebook	51	13.6
	Facebook, Instagram	7	1.8
	Facebook, LinkedIn	4	1.05
	Facebook, Twitter	6	1.57
	Facebook, WhatsApp	40	10.47
	Facebook, YouTube	26	6.81
	Twitter, LinkedIn	2	0.52
	Facebook, Others	4	1.05
	More than 2 SNTs	242	63.4

Note: others- Messenger, Drive, DropBox, Skype, Zoom, WeChat. These were selected based on SNTs that are currently used in the universities.

TABLE 2. Validity and reliability test for the structural equation model.

Construct	Items	factor loadings	α (> 0.7)	CR (> 0.7)	AVE (> 0.5)
Privacy (PR)	PR1	0.859	0.891	0.897	0.821
	PR2	0.789			
	PR3	0.815			
Infrastructure (IN)	IN1	0.710	0.797	0.820	0.708
	IN2	0.745			
	IN3	0.669			
Institutional Support (IS)	IS1	0.720	0.739	0.761	0.665
	IS2	0.654			
	IS3	0.591			
Access Device (AD)	AD1	0.631	0.789	0.808	0.702
	AD2	0.761			
	AD3	0.715			
Perceived Ease of Use SNTs (PE)	PE1	0.815	0.891	0.919	0.721
	PE2	0.710			
	PE3	0.769			
	PE4	0.715			
Perceived Usefulness of SNTs (PU)	PU1	0.824	0.887	0.919	0.752
	PU2	0.733			
	PU3	0.693			
	PU4	0.727			
Attitude toward using SNTs (AT)	AT1	0.695	0.82	0.905	0.698
	AT2	0.768			
	AT3	0.777			
	AT4	0.578			
	AT5	0.670			
Behavioral Intention to use SNTs (BI)	BI1	0.775	0.863	0.869	0.709
	BI2	0.681			
	B13	0.738			
	BI4	0.641			
Actual Use of SNTs (AU)	AU1	0.569	0.762	0.772	0.579
	AU2	0.625			
	AU3	0.562			
	AU4	0.558			

many times as possible in a day (71.9%), and most of them prefer using their laptops and smartphones (38.5%) with more than two SNTs (63.4%), as presented in Table 1.

2) EXPLORATORY AND CONFIRMATORY ANALYSIS

First, an exploratory analysis must be measured. Fornell and Larcker [80] stated that the criterion for measuring exploratory analysis includes convergent, discriminant validities, internal consistency, composite reliability (CR) and average variance extracted (AVE). According to Anderson and Gerbing [81], convergent validity (CV) is defined as the extent to which the same construct is measured in different ways to confirm how the constructs are strongly correlated with one another. Table 2 shows the model measurements for the validity and reliability test, which include factor loading, composite reliability (CR), average variance extracted (AVE), and Cronbach's alpha (α) values. However, the following construct items, PR4, IN4, AD4, PE5, PU5 and BI5, were not used in the analysis because their loadings are lower than the recommended threshold (0.4) suggested by [82]. Thus, all the valid indices were used to test the model.

Table 2 shows that factor loadings are all greater than 0.4, which exceeds the suggested values [83], [84]. This implies that constructs are strongly correlated with one another and that all AVEs exceed 0.5, all-composite reliability (CR) values exceed 0.7 and Cronbach's alpha (α) values exceed 0.7, signifying the existence of robust reliability and convergent validity. Additionally, for discriminant validity, the extent to which the same construct is measured in different ways to confirm whether the constructs are different from one another is tested by comparing the square root of each AVE construct with the correlation of all constructs [85], [81]. The discriminant validity is tested as seen in the table (3), and the value of the total square root of AVE is a greater than the correlation of the variables which implies a very good discriminant validity and satisfies the requirements needed to proceed to the next step - confirmatory factor analysis.

According to [86], to determine very good model indices, the constructs must exceed the optimal levels, as recommended by [85], and this is achieved by determining how to fit the model is from the following statistical estimates - Goodness of Fit Index (GFI), Normed Fit Index (NFI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and many more. In this study, the CFA presented a convincing model fit. (Chi-square (X2) = 1014.21, and $df = 482$, $X2/df = 2.10$, Goodness of Fit index (GFI) =.860, Adjusted Goodness of fit index (AGFI) =.837, Normed fit index (NFI) = 0.903, Incremental Fit Index (IFI) =.916, Tucker-Lewis Index (TLI) =.907, Comparative Fit Index (CFI) =.915, Root Mean Square Error of Approximation (RMSEA) =.054, where RMSEA must be <= 0.08 as recommended by [87]–[89]. All the above fit

TABLE 3. Correlation among constructs.

Construct	AD	IS	IN	PR	PE	PU	AT	BI	AU
AD	**0.837**								
IS	0.005	**0.807**							
IN	0.087	0.093	**0.841**						
PR	0.005	0.168	0.039	**0.906**					
PE	0.020	0.009	0.038	0.092	**0.867**				
PU	0.009	0.000	0.004	0.105	0.346	**0.862**			
AT	0.000	0.001	0.007	0.002	0.026	0.006	**0.835**		
BI	0.001	0.000	0.003	0.001	0.034	0.024	0.223	**0.842**	
AU	0.001	0.000	0.001	0.000	0.034	0.016	0.059	0.132	**0.760**

Note: the square root of AVE in bold

TABLE 4. Coefficient of model fit.

Model Coefficient	X^2	*Df*	X^2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI	IFI
Recommended value	-	-	< 3.0	< 0.08	> 0.8	> 0.8	> 0.9	> 0.9	> 0.9	> 0.9
Actual Value	1041.21	482	2.10	0.054	0.860	0.837	0.903	0.907	0.915	0.916

indices met the criterion recommended by [90], [85], and the results of the measurements show that the proposed model reasonably fit. Thus, the result provided in Table 4 shows that the model is acceptable.

3) PATH COEFFICIENT

The path coefficient of model testing estimates the model using SEM to check on the hypotheses and to determine the level of significance. As listed in Table 5, the factors include the relationship between PR and PE ($\beta = -.246$, $\rho < 0.01$) showed negative significant effect; PR and PU ($\beta = .145$ $\rho < 0.01$) which has a positive and significant effect; IN and PE ($\beta = -.211$, $\rho < 0.01$) has a significant negative effect; IN and PU ($\beta = -.073$) has an insignificant effect; and IS and PE ($\beta = .130$ $\rho < 0.01$) has a significant positive effect; IS and PU ($\beta = .092$) has an insignificant effect; AD and PE ($\beta = .230$, $\rho < 0.01$) has a significant positive effect. While, AD ($\beta = .043$) has an insignificant influence on PU; and PE ($\beta = .787$, $\rho < 0.01$) showed positive and significant impact on AT. As well, PE and PU ($\beta = .692$, $\rho < 0.01$) has a significant positive effect; PU and AT ($\beta = .755$, $\rho < 0.01$) has a significant positive effect; PU and BI ($\beta = .181$, $\rho < 0.01$) showed positive and significant effect; AT and BI ($\beta = .491$, $\rho < 0.01$) which has a positive and significant effect; and BI and AU ($\beta = .475$, $\rho < 0.01$) has a significant positive effect. Therefore, all paths except H4, H6 and H8 are supported. Table 5 provides the details of the path original coefficients standard errors, critical ratio, and levels of significance (p-value) as suggested by [91]. Overall, the predictive power of the model is moderate, with R^2 for PE, PU, AT, BI and AU standing at 59%, 22%, 17%, 33% and 18% respectively.

V. DISCUSSION

The current study was designed to explore the utilization of SNTs in higher education (HE) with the adoption of the Technology Acceptance Model and other new variables. This research used structural equation modelling (SEM) to examine the faculty's use of SNTs in Libyan Higher Education and the adoption of the TAM as the new educational technology model to improve the usage of SNTs in universities across the globe.

The study used the structural model to measure the technology acceptance model (TAM) variables such as PU, PE, BI and AT towards the actual utilization of SNTs. Thus, this study is of importance to the body of knowledge by considering privacy, infrastructure, institutional support, and access devices to enhance the TAM and to understand better the faculty intention on the adoption of SNTs in higher education. However, the study results showed that the reliability of each construct is strongly correlated. Therefore, the measures of reliability and discriminant validity are acceptable based on the exploratory factor analysis, and this study research

TABLE 5. Path coefficient of the model.

Hypothesis	Effect	Estimate (β)	Standard Error (S.E.)	Critical Ratio (CR)	Significant Value (P)
H1	PR → PE	-.246	.041	-5.976	***
H2	PR → PU	.145	.033	3.285	***
H3	IN → PE	-.211	.051	-4.138	***
H4	IN → PU	-.073	.039	-1.848	.065
H5	IS → PE	.130	.061	2.115	***
H6	IS → PU	.092	.047	-1.949	.056
H7	AD → PE	.230	.058	4.002	***
H8	AD → PU	.043	.044	.982	.326
H9	PE → AT	.787	.089	8.889	***
H10	PE → PU	.692	.063	11.028	***
H11	PU → AT	.755	.042	18.066	***
H12	PU→ BI	.181	.060	-3.022	***
H13	AT→ BI	.491	.053	9.276	***
H14	BI→ AU	.475	.076	6.260	***

Where IN - Infrastructure, IS - Institutional Support, AD - Access Devices, PR - Privacy, PE - Perceived Ease of Use, PU - Perceived Usefulness, AT - Attitude, BI - Behavioural Intention, AU – Actual Use.

model is in-line and validates the existing research on the TAM [8], [32], [93].

This section explains the relationships among the variables based on hypotheses in Table 5 above. Specifically, Table 5 explains the summary of relationships between TAM and privacy, infrastructure, institutional support, and access devices constructs. First, H1, H2 and H3 show that the relationship was accepted, as shown in table 5, and H4 was rejected because there is a need for stakeholders to work on perceived usefulness of SNTs based on access to the internet, poor internet connection, the high cost of the internet. Also, the lack of facilities provided by universities such as computer labs and the knowledge of using the system [55].

In contrast, a positive effect of IN and PU might help faculty' improving and attain the full potential of using SNTs in the learning environment. H5 and H7 explain the synergistic relationships between IS and PE, and AD and PE variables which accepted, as shown in table 5. These hypotheses show that IS and AD support PE that is the decision-makers help by all means to support faculty towards the full implementation of system adoption and technology adoption within the institution. Also, to support faculty in term of technicality, accessibility, the functionality of SNTs and the overall user experience [61] and [62].

In contrast, H6 and H8, which concerns how IS and AD insignificant effect on PU that fails to support PU. This result implies that IS and AD have no direct influence on faculty' perceived use of SNTs. However, there are possible reasons for these insignificant effects. Institutions are not supporting - policies and guidance for faculty' perceived use of SNTs. Also, the provision of modern and advanced access devices for faculty' perceived use of SNTs as the world is moving exponentially in the use of modern digital technology [94]. H9 and H10 suggest that PE is significant to AT and PU, in-line with [67], [68] that PE has a significant relationship with faculty' behavioural attitudes and perceived use of SNTs.

Additionally, H11 and H12 suggest that PU is significant to AT and BI, in support of [67] and [74] that PU has a significant relationship with faculty' behavioural attitudes and behavioural intention of SNTs use. H13 suggests that AT is significant to BI to use SNTs based on Table 5 the result shows that faculty' attitude towards using SNTs has a high degree to which faculty' perceives a positive feeling towards SNTs. Hence, AT supports faculty BI towards SNTs use. Finally, H14 stated the behavioural intention of SNTs to use depends on their actual intention to use the technology as shown in table 5, faculty' BI, support and has a significant relationship with actual intention to use SNTs to improve professional and increase digital world. Generally, this study shows that faculty and educational stakeholders have not provided enough for institutions or encouraged the use of SNTs within this context of educational institutions across Libya.

Additionally, this study on faculty acceptance of SNTs and relationship to SNTs has helped in showing some areas that need to be developed in order to improve the Libyan educational sector. In addition, the social network technology in developing countries is at the developing stage. However, there are many areas of significance, acceptance and reforms before the adoption of SNTs to the educational curriculum

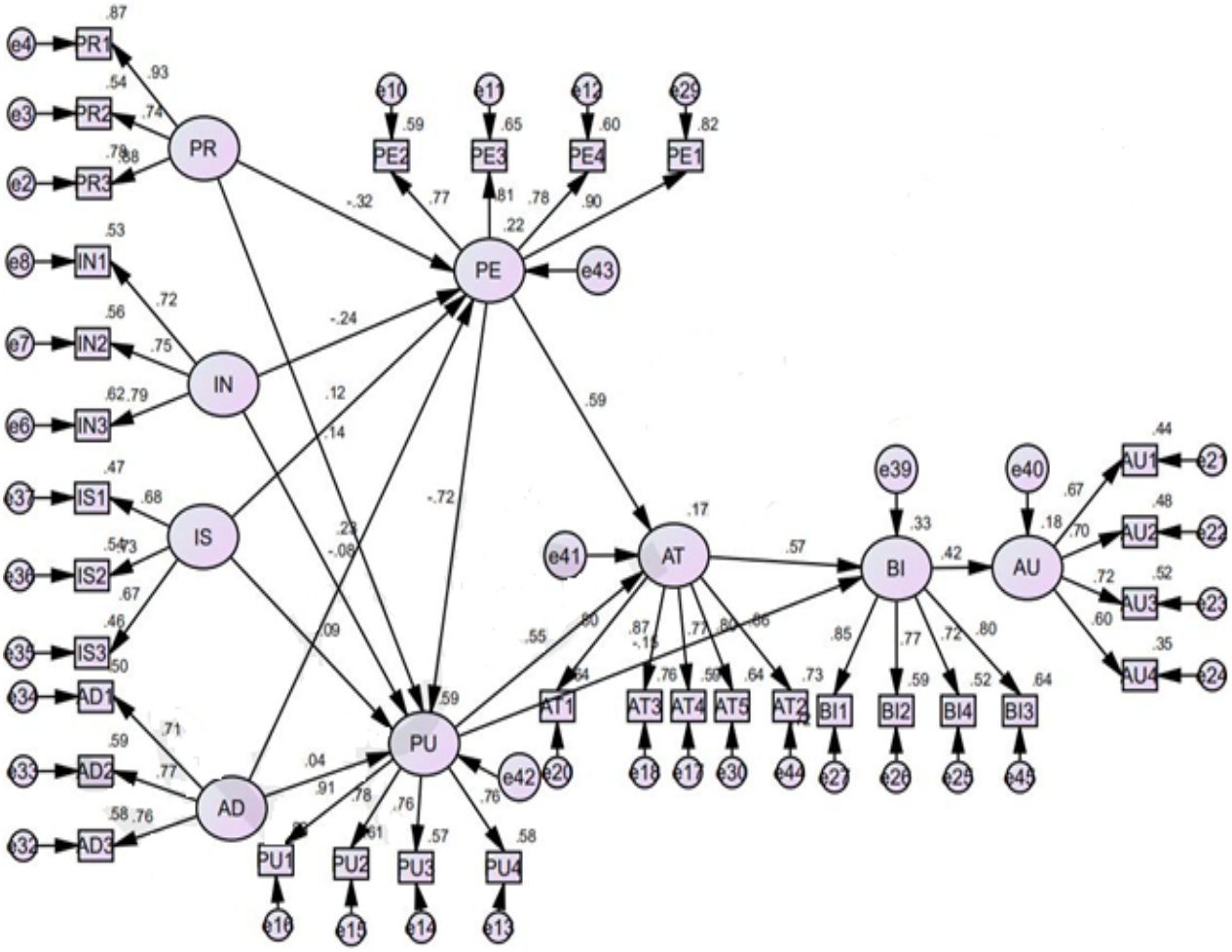

FIGURE 2. Results of the model fit.

in developing countries. Given the context of faculty acceptance, this study aims to highlight the challenges to faculty employing SNTs based on TAM.

VI. IMPLICATIONS

A. IMPLICATIONS OF THE STUDY

SNTs are the new trending applications for teaching and learning practice. The TAM has been tested in different settings, including educational settings [43], [94]. This study focuses on validating the current proposed model for privacy, infrastructure, institutional support, and access devices on the use of SNTs by the faculty. However, the TAM model extended via the addition of external variables and technology-agreeable factors with the sole aim of developing a robust model for the adoption of SNTs. This approach serves as one of the first attempts within the context of faculty adoption of SNTs in educational settings, which may, therefore, be considered an academic contribution towards educational technology development in Libya.

B. IMPLICATIONS FOR EDUCATIONAL PRACTICE

According to Article 14 of the Libyan 1969 constitution declaration, "Education is an important responsibility to all Libyans" However, the declaration is merely written rather than implemented because education in Libya is still faced with many internal and external challenges. According to the National Report on Educational Development in Libya, the main priority is to transform Libya's educational institutions into a strong context that transforms the instructional approach and the type of curriculum used in the Libyan education system [93]. However, educational implications of TAM and privacy, infrastructure, institutional support, and access devices construct the combination of TAM and challenges faced by faculty provide a more extensive approach of the usage of SNTs for teaching and learning than using TAM which has been used by many scholars. Some of these relationships are inconsistency with previous results, which indicate that there is a significant effect between privacy, infrastructure, institutional support, and access devices constructs and TAM [39], [44], [52].

TABLE 6. Measures of key constructs used.

Construct	Items	Questions	Reference
Privacy	PR1	Using Social Networks Tools in teaching have security risks for personal information	Manca & Ranieri, 2017
	PR2	Using Social Networks Tools in teaching makes me uncomfortable and check my account many times a day	Sobaih et al 2016
	PR3	Using Social Networks Tools in teaching annoying me because I cannot control the access to my content	Celik, I., & Schoreels, 2014
	* PR4	Using Social Networks Tools in teaching is risky because of tracking activities by others	Sobaih, & Moustafa, 2016
Infrastructure	IN1	There is a difficulty in adopting Social Networks Tools in teaching because of the lack of internet availability	Ameen, & Willis, 2017
	IN2	There is a difficulty in adopting Social Networks Tools in teaching because of poor internet speed	Ameen, & Willis, 2017
	IN3	There is a difficulty in adopting Social Networks Tools in teaching because of lack of computer labs	Ndume et al, 2008
	* IN4	There is a difficulty in adopting Social Networks Tools in teaching because of lack of communication devices (e.g. Modems, Antennas, WIFI, Satellites)	Dumpit, & Fernandez, 2017
Institutional Support	IS1	The use of SNTs is not a priority for my university	Sobaih, & Moustafa, 2016
	IS2	There is a lack of policies and rules governing the use of Social Networks Tools in teaching	Sobaih, & Moustafa, 2016
	IS3	There is no support from top management to use Social Networks Tools in teaching	Abdullah, & Toycan, 2017.
Access Device	AD1	It is difficult to use Social Networks Tools in teaching because of the high cost of access devices	Alzaza, & Yaakub, 2011
	AD2	It is difficult to use Social Networks Tools in teaching because of devices variety	Sobaih, & Moustafa, 2016
	AD3	It is difficult to use Social Networks Tools in teaching because the use and upgrading of access devices requires advanced skills	Au & Lam, 2015
	* AD4	It is difficult to use Social Networks Tools in teaching because of technical problems of access devices	Alzaza, & Yaakub, 2011
Perceived Ease of Use Social Networks Tools	PE1	Using Social Networks Tools in teaching does not require a lot of my mental effort	Holden, & Rada, 2011
	PE2	I find it easy to get Social Networks Tools to do what I want it to do	Alharbi & Drew, 2014; Rauniar et al, 2014
	PE3	My interaction with Social Networks Tools is clear and understandable	Holden, & Rada, 2011; Alharbi & Drew, 2014; Rauniar et al, 2014
	PE4	Using Social Networks Tools in teaching is flexible to interact with faculty and students	Holden, & Rada, 2011; Alharbi & Drew, 2014; Chuttur, 2004
	* PE5	Using Social Networks Tools in teaching is easy for me to get what kind of information I want	Holden, & Rada, 2011; Al-Ghaith, 2015 ,6 ,Rauniar et al, 2014
Perceived Usefulness of Social Networks Tools	PU1	I could improve my teaching performance by using Social Networks Tools	Alharbi & Drew, 2014; Chuttur, 2004
	PU2	I could enhance my teaching effectiveness by using Social Networks Tools	Al-Rahimi et al, 2013; Alharbi & Drew, 2014; Chuttur, 2004; Rauniar et al, 2014
	PU3	I could increase my learning productivity by using Social Networks Tools	Alharbi & Drew, 2014; Chuttur, 2004; Park, 2009
	PU4	Using Social Networks Tools would enable me to accomplish tasks more quickly	Alharbi & Drew, 2014; Chuttur, 2004
	* PU5	Using Social Networks Tools enables me to stay connected with faculty and students	Al-Rahimi et al, 2013; Al-Ghaith, 2015 ,Rauniar et al, 2014

TABLE 6. *(Continued.)* **Measures of key constructs used.**

Construct	Items	Questions	Reference
Attitude toward using social networks tools	AT1	I like using Social Networks Tools in teaching37	Alharbi & Drew, 2014; Masrom, 2007
	AT2	I think it is worthwhile to use Social Networks Tools for academic and related purposes	Park, 2009
	AT3	In my opinion, it is very desirable to use Social Networks Tools for academic and related purposes	Al-Ghaith, 2015; Park, 2009
	AT4	I have a generally favourable attitude toward using Social Networks Tools	Al-Ghaith, 2015; Park, 2009; Masrom, 2007
	AT5	I think Using Social networks tools for teaching is a good idea	Alharbi & Drew, 2014; Al-Ghaith, 2015; Park, 2009; Masrom, 2007
Behavioural Intention to use social networks tools	BI1	I intend to use Social Networks Tools to assist my academic activities	Masrom, 2007; Rauniar et al, 2014
	BI2	I intend to use Social Networks Tools to communicate with people	Park, 2009; Rauniar et al, 2014
	B13	I intend to use Social Networks Tools frequently for academic and related purposes	Al-Ghaith, 2015; Park, 2009; Masrom, 2007
	BI4	I will reuse Social Networks for relevant teaching activities	Al-Rahimi et al, 2013; Masrom, 2007; Rauniar et al, 2014
	* BI5	I will frequently use Social Networks Tools in the future	Al-Rahimi et al, 2013; Al-Ghaith, 2015
Actual Use of social networks tools	AU1	I'm using Social Networks Tools in announcement of activities	Al-Ghaith, 2015
	AU2	I'm using Social Networks Tools in making group discussion	Al-Ghaith, 2015
	AU3	I'm using Social Networks Tools in receiving homework	Al-Ghaith, 2015
	AU4	I'm using Social Networks Tools in preparing the lectures time	Al-Ghaith, 2015

Note - * Items were deleted which having low factor loading.

Therefore, in-line with this current study, the privacy, infrastructure, institutional support, and access devices contributes towards the effects of perceived usefulness, perceived ease of use, attitude, behavioural intention and actual use of SNTs. This contribution could also result into further study and more research on faculty's use and implementation of SNTs. Study's results show that regarding privacy: Individuals are willing to disclose personal information for social benefits of SNTs. Faculty perceive SNTs to be resourceful and easy to use technology in learning environments, as indicated in Table 5. Moreover, perceived ease of use increases as more privacy issues are worked out.

Educational implications of infrastructure and institutional supports in this study show the importance of these factors in technology acceptance of SNTs as part of educational technology development. These factors show a significant influence on the perceived ease of use of SNTs and insignificant influence on the perceived usefulness of SNTs. Therefore, the perceived use of SNTs on infrastructure and institutional supports need faculty's training and seminars to understand the usefulness of SNTs. The results for access devices imply that as the stakeholders provide new and trending access devices, the more faculty's perceived ease of use and SNTs usefulness. Thereby, the availability of updated SNTs utilities the more it increases the ease of use and its usefulness in the learning and teaching environment.

Finally, on educational implications of the technology acceptance as indicated by the results the more faculty' perceived use of SNTs the easier to use, the more resourceful for the faculty. Therefore, the usability of the SNTs help promote and increase faculty' behavioural attitudes towards SNTs. Also, to improve on behavioural intention to use the SNTs, the greater the faculty's actual use of SNTs [3], [9], [72]. This study therefore, serves as a way to support the development of the Libyan educational blueprint for HE at the management and organizational levels. Since this design involves SNT infrastructure, privacy, support from the institution and access devices, it is vital for faculty, government and educational consortium to work hand-in-hand to integrate SNTs into learning approaches as part of the best teaching strategies to meet educational needs.

VII. LIMITATIONS AND FUTURE WORK

The limitation of this study is that it covered only top management, administrative staff and lecturers. We believe that the scope of the study should be increased to include public professionals, and educational experts from other countries, as the current data are obtained from six public universities in Libya.

Second, the research was only based on a cross-sectional approach; the longitudinal approach can, however, be applied in future studies. In addition, further studies can be conducted to include different communities in Libya to check the changes in educational trend; which might help improve learning and teaching approaches in Libya.

Third, the study used a self-reported method, which can also have some issues, such as biased reports and privacy issues. This might have a negative or insignificant impact on the significance level of the measurement. Furthermore, a moderator can be added – a sustainable effect of SNTs on faculty's self-efficacy – to strengthen the relationship between two other variables.

VIII. CONCLUSION

The focus of this research is to assess the use of SNTs in higher education via the TAM. The study has identified crucial challenges facing faculties in SNT adoption in Libya. This research used the TAM as an internal variable and privacy, infrastructure, institutional support and access devices as external variables to faculty needs of adopting SNTs into educational settings. As indicated by the result, privacy, institutional support, perceived usefulness and perceived ease of use were seen to have a significant effect on behavioural intention. Additionally, perceived ease of use and behavioural intention contributed significantly towards the actual usage of SNTs. However, there is a need for institutional management, government and academics staff to provide SNT learning infrastructure and educational access devices. Additionally, management should organize conferences and seminars on the benefits of using SNTs and do much more to provide the necessary support for the adoption of SNTs. In conclusion, the results indicated that there is a need for proper planning and implementation of necessary technology acceptance tools that include not only a social network but also modern tools that drive education to greater heights in developing countries.

APPENDIX

See Table 6.

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