# A Multi-Group Structural Equation Modeling For Assessing Behavioral Intention of Using Mobile Cloud Computing-The Case of Jordanian Universities During The Covid19 Pandemic

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**Abstract:** *The adoption of new technologies in Jordanian Universities related to cloud services, shows differences in practices between faculty and staff members. Resistance to adoption may accrue by faculty and staff members who are accustomed and favoring old practices. A questionnaire was developed based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model to identify factors that affect behavioral intentions that lead to the use of mobile cloud computing during the covid-19 pandemic, taking into consideration Work-type as the mediating factor. Five Jordanian Universities participated in this study, with a total response of 153 faculty and staff members. The conceptual proposed model was tested to ensure the fitness of the structural model for providing correct estimations. The collected sample was subjected to confirmatory factor analysis to ensure construct, convergent and discriminant validity. The results came positive in terms of composite reliability as they were above 0.70, for Average Variance Extracted (AVE) it came more than 0.05and Cronbach alpha exceeded 0.70. The results revealed the fitness of the proposed model to measure differences in behavioral intentions towards adopting mobile cloud services between faculty members and employees. Moreover, the results showed that work type had some interesting moderating impact on the tested relationships. Moreover, the results showed that there is a high Behavioral Intention (BI) between faculty and staff to use mobile cloud services and solutions within their workplace. In addition, the results showed some inequalities of the behavioral intention toward the adoption of mobile cloud services in Jordanian Universities between the two groups. These results call the university administration to clarify these factors for user groups to obtain a better judgment on investment and future practices for using new technologies.*

**Keywords:** *Mobile cloud computing, structural equation modeling, UTAUT model, Jordanian universities.*

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## 1. Introduction

The covid-19 pandemic has resulted in many challenges for the educational sector worldwide, as it forced a new behavioral necessity for interacting with technological solutions. The use of different technologies within universities premises in Jordan have been found challenging with the new situational requirement of minimizing the level of interaction and downsizing the employees' presence [14]. As a result, many Jordanian Universities have shifted to the use of mobile/cloud computing services in order to perform the managerial and educational requirements as directed by the Ministry of Higher Education in Jordan. Prior to the governmental lock-down of educational establishments, the Jordanian government monitored the situational development in the region, and issued a preparation notice for all Universities for the possibility of lock-down [29]. Based on the preparation necessities, many Universities acted accordingly and initiated training programs for developing new skills of their staff and faculty members, on the mobile use of different systems and technologies. Most of the training programs where short and condensed with lots of information to undertake in such short time [14]. Moreover, in terms of e-learning use by faculty members, Jordanian Ministry of Higher Education did not approve the use of online e-learning as a method of delivery in Jordan except for some public Universities and in specific

courses that are defined as general courses. Private Universities did not have the same privileges, and the necessity of interaction with online learning brought many challenges for faculty members in terms of adequate preparation and training on the use of such systems, with lack of support towards the new methods of mobile interaction [20]. In terms of staff that have managerial responsibilities, the use of dedicated technologies online was another challenge, as many systems and operations needed to be transferred to the cloud using different technologies provided by companies like (Microsoft, Oracle, IBM, Blackboard, Moodle and Odoo). Training the staff on the use of mobile and cloud systems in short time, found challenges towards successful and fault free operations in completing and performing tasks [6]. In terms of transformation processes for traditional in campus systems to be mobile and within the cloud, it was mainly performed by IT centers with direct collaboration of the systems providing companies. The task was challenging, but due to the nature of the applied solutions, such as having flexible architecture, adaptive and intelligent nature, many challenges were overcome in timely manner [22]. Different Universities in Jordan had been found using cloud services as a response to the necessity of cutting the budget associated with buying and updating the systems and related requirements both as hardware and software. Those Universities were found to have lower impact of the covid-19 pandemic lock-down, and managed to perform their duties in more consistent manner [6]. In relation to the previously mentioned impact of mobile and cloud computing, the literature clearly states that different establishments adopting mobile and cloud computing technologies have had benefits and advantages that positively reflected on business needs, development, industrial specifications, better interaction and automation for business processes and practices [9, 19]. On the other hand, different research studies have investigated the challenges of adopting new technologies by creating dedicated frameworks and models to provide better understanding and identification of the affecting factors that hinders the adoption process and practices. In both mentioned stand points, it is important to understand that the corner stone for each case is the human acceptance and successful interaction with those technologies is what makes a positive or negative impact on any selected industry [24]. The driving force for human acceptance and interaction with respect to the controversy in both opinions towards the impact of adopting technologies has opened the path for further research studies [9]. Investigating the differences in factors affecting individuals behavior towards mobile and cloud computing technologies adoption, has been defined as the gap in literature with respect to Jordanian Universities and the aim of this research investigation. This research is believed to provide an opportunity of understanding the factors affecting behavioral intentionswith the presences of work type as affecting moderator. It is believed that the results of this research will serve in provision of better adoption response for Jordanian Universities, especially with the demand of online interaction during the covid-19 pandemic.

This paper has different sections, in section 1 it will address the literature supporting this research study, by introducing the architecture of the provided cloud/mobile services in general and the impact they have on each context of utilization. Moreover, it will address the theoretical framework, it will present the development of different tools and their relation to the proposed UTAUT model. The formed hypothesis using UTAUT Model are also presented in this section. Section 2, presented research methodology, the used constructs and questions with respect to the used model. Moreover, it presented the sampling and data gathering approach used for this research study. The used measures have been presented in this section focusing of model validity and reliability, also the test of the hypotheses have been shown using the structural equation modeling. Section 3 presented the findings and discussed the results. The final section 4 presented the conclusions of this research study.

## 2. Literature Review

### 2.1. Technological Adoption for Mobile Cloud Computing Services

The use of cloud computing services in the industry came as evolution of the grid computing technologies that was later commercialized by the huge impact of internet development and e-commerce technologies and transactions. Data centers were created to handle the different demands for storing, sharing and managing data access and privileges [7]. Cloud computing enabled direct interaction with data centers without the need for having additional hardware or software, which reflected in providing better engagement and utilization for resources and cost. The continuous development in the field of communication and mobile technologies has found a new approach for interacting with different cloud services using mobile enabled technologies, thus the terms mobile cloud computing was used in the industry and research studies. Mobile cloud computing inherited the features of cloud computing as the next generation's computing infrastructure and added the mobility and interaction at any place or time. Moreover, it enabled the implementation of rich mobile applications on different mobile devices with rich user experience and it provided different business opportunities for mobile network operators and cloud computing providers [15, 32]. Mobile cloud computing can be viewed as a collection of stacked services that are built on top of one another. There are three models that are used for

providing different services with respect to the context of industry's operations and services see Figure 1. The models are

- **Software as a Service (SaaS)**

In this model, software is deployed over the cloud and providers generate licenses as service on demand using a subscription in a pay-as-you-go model, or through advertisement model if services are provided for free [8, 26].

- **Platform as a Service (PaaS)**

In this model, software and tools are considered for end-users, to enable them to create and deploy different web and mobile applications and services on the cloud in efficient and faster manner [8, 26].

- **Infrastructure as a Service (IaaS)**

In this model, services are associated with Cloud Computing infrastructure demands such as (servers, networking, data centers, storage and operating systems) [10, 26].

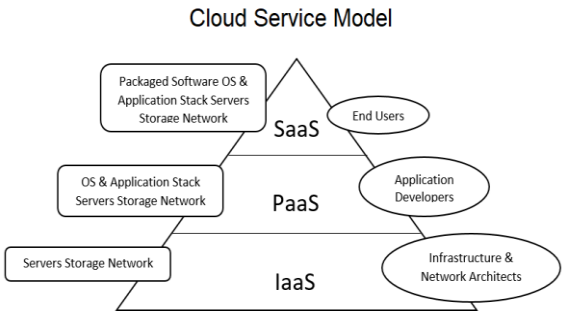


Figure 1. Mobile/cloud computing models.

The previous models provide different services for wide industry demands and operations, for example in university settings, all models have been used and tailored to fit the exact demand of each university's settings with respect to the needs of software, hardware and infrastructure [8]. In terms of Jordanian Universities utilization of the provided cloud services, it was found that Universities used different models to achieve better standing and performance for academic and staff services [6].

In terms of (SaaS/Mobile SaaS) services, it has been found that many Universities shifted the use of Learning Content and Management Systems (LCMS) from their university servers to the cloud, by services provided by (Moodle, Blackboard) [26]. Moreover, Google designed and provided Google Apps, IBM provided IBM cloud academy, which provides a forum for researchers. Other SaaS services were used for collaboration purposes, either between staff, faculty members and students such as (Microsoft Office 365) cloud services, or in some cases the use of google cloud services that are provided free of charge [5].

In terms of (PaaS/Mobile PaaS), it has been found to be less in demand by Jordanian Universities, some Universities used the PaaS model for research purposes only or with some IT related courses. The Mobile Platform as a Service (mPaaS) is the paid facility of an interactive Development Environment (IDE) for creating Mobile apps [8]. An example of some of PaaS companies that offer their services are (Microsoft Azure, Google App Engine, SAP Cloud Engine, Amazon Web Services, ZOHO, IBM, Oracle, and Blue Mix) [20].

In terms of (IaaS/Mobile IaaS), it has been found to be less in demand by Jordanian Universities, and more frequent usage compared with (PaaS/Mobile-PaaS). Using IaaS was found to be mainly by IT centers in Jordanian Universities. IaaS usage in Jordanian Universities was found to be related to test and development for specific applications, web site hosting, using web apps, storage, backup and recovery. The main providers for IaaS were (Microsoft Azure, Google Compute Engine and Amazon Web Services [20].

The previous usage status of the three Mobile/ cloud computing models in Jordanian Universities found through literature, align with the current findings of usage status in this research study (See Table 2).

The cloud/mobile computing architecture provides three different infrastructure deployment models that are (Public, Private and Hybrid) [11]. These models have been used by Jordanian Universities with respect to the objective and necessity of use as shown in Figure 2.

a) Public Clouds, are defined as clouds that are open for anyone to use, they operated by different venders and different applications can be used [26]. This model has been used by Jordanian Universities for academic purposes and student interaction with different tools with respect to the faculty and courses offered. In terms of staff member usage, less interaction was found in this model [4].
b) Private Cloud, provide more control over the data and services they use, as they are mainly built for specific organization. In private cloud, users have more security and better quality of services that are accessed by users belonging to that organization. Access permissions are needed in this model for interacting with available resources [26, 27]. This model is very popular by Jordanian Universities, and it has been used for academic purposes and staff operations [29].
c) Hybrid Clouds, merge some features of public and private cloud models. They are used for distributing and load balancing of applications and data processing [37]. This model is rarely used by Jordanian Universities, as it is considered a complex model, and it is used for performing complex operations [29].

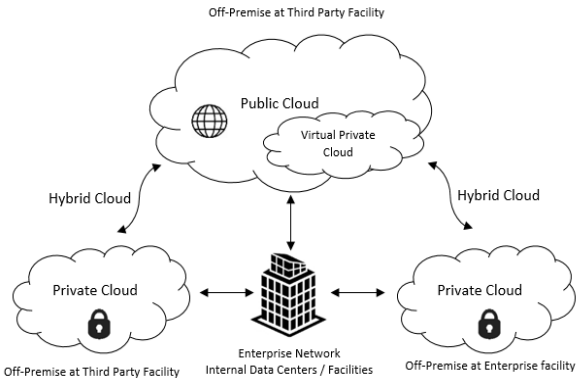


Figure 2. Mobile /cloud computing deployment model.

Different research studies related to the use of mobile/cloud computing in educational establishments, focused on defining the strength and challenges of using mobile cloud services among developed and less developed countries in the world, [18, 28]. The main theme of those research studies outlined that the usage of mobile cloud computing in Western countries Such as (USA, Canada, Europe) is more pervasive as they have larger tendency to adopt mobile cloud service technologies and overcome challenges, whereas countries in less developed countries and the Middle East are in favor of using traditional technology [1, 18, 28]. Jordan as a country in the Middle East was the focus of this study for outlining the behavioral intentions among faculty members and managerial staff in Jordanian Universities during the covid-19 pandemic [29]. Thus, for enhancing the adoption of mobile cloud computing services, it is important to minimize the resistance against adopted technologies, starting by understanding faculty members and staff behavioral intentions and affecting factors [29, 31]. This research aims to investigate the used model and factors affecting the acceptance of mobile cloud computing in Jordanian Universities taking into consideration the work type and responsibilities for the engaged staff as the moderating factor. The findings of this research study are believed to enrich the literature and to provide a guide for better understanding of technological implementations and acceptance in Jordanian Universities from different point of views related to work type in Universities with respect to the current practices during the covid-19 pandemic.

## 2.2. Theoretical Framework

Investigating the adoption and utilization of information technology has become a necessity to understand the potential value it provides for businesses along with the challenges and opportunities it creates. Different theories have been found to investigate information technology adoption such as (Innovation Diffusion Theory (IDT), Theory of Task-Technology Fit (TTF), Social cognitive theory, PC utilization model). Moreover, with the advancement and complexity of information technology solutions and the wide spread of its application in many industries, new theories were developed to provide better understanding for the adoption driving factors [16]. Through reviewing the literature, it was found that the most persuasive theories used by research studies for IT adoption were Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB) [4, 25], Technology Acceptance Model (TAM) [30], extended TAM2 [21], and lately, the Unified Theory of Acceptance and Use of Technology model (UTAUT) [16]. The origin of UTAUT was based on TRA and it was proposed in 1975 as TAM and TPB. The theory of TRA focused on predicting individual's behavior by measuring individual's intent of doing something and it was called Behavioral Intention (BI). Moreover, behavioral intention is found through individual's attitude and personal norm associated to the behavior in the provided questions [24]. On the other hand, Attitude is found by an individual's beliefs, and beliefs are formed by an individual's perspective on the probability that a definite behavior will result in each consequence [23]. Subjective norm is defined through the perception of individual related to others that are found important and influencing someone's behavior [36]. In terms of TAM model, it was based on TRA as mentioned previously, it focused on the perceived ease of use and usefulness as they affect user's intent and behavior of use [21]. The ease of use and usefulness are defined by individual's belief towards using the system as requiring little effort, Moreover, they are believed to have substantial impact of user's attitude to use the system. In terms of behavioral intention, it was found to define the actual usage behavior through defining the attitude and usefulness. According to [35], they proposed a new model that was called the extended TAM Model, which was built on TAM but added new factors that were used such as social and organizational factors that are related to output quality, subjective norms, impression, and the work significance. Both TAM and Extend-TAM or as abbreviated by TAM2, have been found very practical and they have been widely used in research studies [21]. In terms of TRA, it was found that it does not reflect the effect of control factors as it presumes that individuals are in control of accepting the use of any technology and their acceptance is not affected by individual's skill and external provisions [9]. On the other hand, this assumption supported by TRA was proved by many research studies to be infrequent and not applicable in many conditions [2, 3]. The use of TRA was modified to produce a new model called TPB, TPB managed to bring a new concept of perceived behavior control that was used to define and explain conditions in which users lacked considerable control over the tested behavior. TPB outlined that user's behavior can be defined by his intentions, which are affected by perceived behavioral control, Subjective norms and attitude. Further enhancements

were made through research studies by [33, 34], as they proposed modifications for perceived behavior and subjective norm through adding concepts to widen the evaluation applicability to information systems. The model was called Decomposable Theory of Planned Behavior (DTPB) [33]. The previously mentioned models have had an important and wide applications to define and justify the use and interaction with many IT systems and application. On the other hand, many research studies have argued and negotiated the deficiencies and shortcomings found in these models. A list of those challenges can be found in the following research studies [9, 16, 19]. In 2003, a promising model was proposed by [31], that was built based on revising eight different theories (including the previously mentioned theories) to combine and replace those models in order to provide a new model that is capable of justifying the adoption of Information Technology [16]. The model was called "Unified Theory of Acceptance and Use of Technology model" (UTAUT) [36]. The UTAUT model uses four key constructs that are (Effort Expectancy, Performance Expectancy, Social Influence and Facilitating Condition), these constructs are defined as direct determinants for behavioral intentions and use intentions [24]. The effort expectancy is defined as the extent of effort performed using the system, and it has the same concept of perceived ease of using in TAM Model [9]. The performance expectancy is defined as the extent of individual perception of the effect of the system on enhancing individual's productivity that results in performance improvements. Social influence, is defined as the extent of others opinion on individual's decision to use the system. Facilitating conditions, is defined as the individual's perception of organizations readiness in supporting individual's with different resources towards using the system. Based on different research studies by [23, 36], they confirm that "UTAUT model has been empirically tested with 70% of dependent variable variance accounted for (Adjusted R2), which is much higher that either TAM or TPB models". The UTAUT model has been widely used in research studies as it provided the theoretical foundations for adopting many technologies [23]. Searching the literature on the use and adoption of mobile cloud computing in Jordanian Universities with having work type as moderating factors for understanding the differences in technological adoption has not been found. This research study investigated the affecting factor based on UTAUT model on behavioral intentions to use mobile cloud computing. It is believed that the output of this research study will help in better understanding and improving the practices towards technological implementation and usage of mobile cloud computing, which is believed to result in enhancing the adoption level in Jordanian Universities with respect to work type during events that are cumbersome like the covid-19 pandemic. This research study adopted the following framework, which is built using eight hypotheses that are presented in Figure 3 showing the work type as a moderator factor.

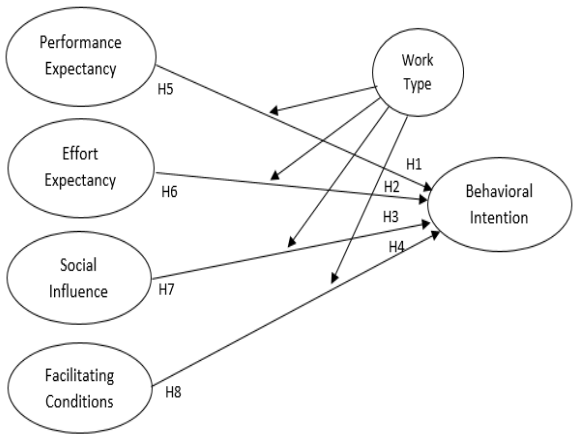


Figure 3. The structural model.

- **Hypothesis** 1: There is effect of Performance Expectancy (PE) on BI towards the adoption of mobile cloud computing services in Jordanian Universities.
- **Hypothesis** 2: There is effect of Effort Expectancy (EE) on BI towards the adoption of mobile cloud computing services in Jordanian Universities.
- **Hypothesis** 3: There is effect of social influence (SI) on BI towards the adoption of mobile cloud computing services in Jordanian Universities.
- **Hypothesis** 4: There is effect of Facilitating Conditions (FC) on BI towards the adoption of mobile cloud computing services in Jordanian Universities.
- **Hypothesis** 5: The effect of Performance Expectancy (PE) on BI towards the adoption of mobile cloud computing services in Jordanian Universities is equal for both faculty members and staff.
- **Hypothesis** 6: The effect of EE on BI towards the adoption of mobile cloud computing services in Jordanian Universities is equal for both faculty members and staff.
- **Hypothesis** 7: The effect of Social Influence (SI) on BI towards the adoption of mobile cloud computing services in Jordanian Universities is equal for both faculty members and staff.
- **Hypothesis** 8: The effect of Facilitating Conditions (FC) on BI towards the adoption of mobile cloud computing services in Jordanian Universities is equal for both faculty members and staff.

## 3. Research Methodology

### 3.1. Data

To test the proposed conceptual model, it is necessary to develop a measurement model that fits the

environment of mobile cloud services usage in educational and administrative practices in Jordanian Universities. Moreover, it is necessary to ensure the fitness of the structural model for estimating the behavioral intentions towards accepting the use of mobile cloud services, because these services are used by faculty members and staff [16]. The questionnaire was prepared depending on previous literature in UTAUT framework for technology acceptance according to studies by [9, 16, 23], the paragraphs were drawn up based on the pre-defined combinations of the UTAUT model considering the technology used in each university (see Table 1). The questionnaire (see Table 2) included questions to measure the dimensions of the study, the researchers used a five-point Likert scale, while demographic variables were measured with qualitative measures, face and content validity were confirmed by a group of experts and academics in different Universities.

Table 1. Construct and items.

| Constructs | Items | Questions |
|---|---|---|
| **Performance Expectations** | PE.1 | The use of mobile cloud computing services can be valuable for accomplishing responsibilities related to my job |
| | PE.2 | The use of mobile cloud computing Services will enable accomplishment of tasks in faster means |
| | PE.3 | The use of mobile cloud computing services will enhance my efficiency in my work. |
| | PE.4 | The use of mobile cloud computing services, will expand my prospects towards gaining better performing assessment |
| **Effort Expectation** | EE.1 | I expect to find it easy to develop skills in using Mobile cloud Computing Services in short time |
| | EE.2 | I expect to find the use of mobile cloud services easy. |
| | EE.3 | I expect that understanding the use of mobile cloud computing services is going to be easy for me |
| | EE.4 | I expect that using mobile cloud computing services is going to be clear and comprehensible for executing tasks. |
| **Social Influence** | SE.1 | I find that co-workers who have influence on my opinion and performance, believe i should use mobile cloud computing services |
| | SE.2 | I find that co-workers who are important to me, believe I should use mobile cloud computing services |
| | SE.3 | I find that university management has been helpful in encouraging and promoting the use of mobile cloud computing services |
| | SE.4 | I find that university management has supported effectively the use of mobile cloud computing services |
| **Facilitating conditions** | FC.1 | In my university I find that the needed resources for using mobile cloud computing services are available |
| | FC.2 | I am confident that I possess the needed knowledge for using mobile cloud computing services |
| | FC.3 | I find that university management has afforded the needed technical staff for Supporting the use of mobile cloud computing services. |
| | FC.4 | I find that using mobile cloud computing services matches well with my working duties |
| **Behavioral Intention** | BI.1 | I expect to use mobile cloud computing services in my work in the next 6 months. |
| | BI.2 | I predict to use mobile cloud computing services in my work in the next 6 months. |
| | BI.3 | I Intend to use mobile cloud computing services in my work in the next 6 months. |

## 3.2. Sampling and Data Gathering

This research study aims to provide understandings of the behavioral intention leading to accepting the use of mobile cloud services in Jordanian Universities. A total of five Universities participated in this study by having managerial staff and faculty members interact with the designed questionnaire. The list of employees contact information were obtained from the official website of each university, and a link to the questionnaire were attached with an introduction defining the aim of this study and the importance of their voluntary participation. The questionnaire was designed to be filled online using Microsoft forms and in total the respondents came from 153 valid responses out of 782 emails sent, the valid responses were used in the analysis presented in this study. The demographic information for the respondents, considered satisfactory for this research study, they are presented in the following Table 2.

Table 2. Demographical information.

| Category | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Gender** | Male | 121 | 79.1 | 79.1 | 79.1 |
| | Female | 32 | 20.9 | 20.9 | 100.0 |
| | Total | 153 | 100.0 | 100.0 | |
| **Age Group** | Below25 | 11 | 7.2 | 7.2 | 7.2 |
| | 25-34 | 28 | 18.3 | 18.3 | 25.5 |
| | 35-44 | 60 | 39.2 | 39.2 | 64.7 |
| | 45-54 | 40 | 26.1 | 26.1 | 90.8 |
| | More than 55 | 14 | 9.2 | 9.2 | 100.0 |
| | **Total** | 153 | 100.0 | 100.0 | |
| **Educational Level** | Diploma | 8 | 5.2 | 5.2 | 5.2 |
| | BA | 16 | 10.5 | 10.5 | 15.7 |
| | Master | 38 | 24.8 | 24.8 | 40.5 |
| | PHd | 91 | 59.5 | 59.5 | 100.0 |
| | Total | 153 | 100.0 | 100.0 | |
| **University Type** | Public | 53 | 34.6 | 34.6 | 34.6 |
| | Private | 100 | 65.4 | 65.4 | 100.0 |
| | **Total** | 153 | 100.0 | 100.0 | |
| **Cloud Service Used** | Mobile-PaaS | 3 | 1.9 | 1.9 | 1.9 |
| | Mobile-IaaS | 54 | 35.2 | 35.2 | 37.1 |
| | Mobile-SaaS | 96 | 62.7 | 62.7 | 100.0 |
| | **Total** | 153 | 100.0 | 100.0 | |
| **Cloud Infrastructure** | Public | 9 | 5.8 | 5.8 | 5.8 |
| | Private | 143 | 93.4 | 93.4 | 99.2 |
| | Hybrid | 1 | 0.6 | 0.6 | 100 |
| | **Total** | 153 | 100.0 | 100.0 | |
| **Work Type** | Educator | 107 | 69.9 | 69.9 | 69.9 |
| | Managerial | 46 | 30.1 | 30.1 | 100.0 |
| | **Total** | 153 | 100.0 | 100.0 | |

## 3.3. Measures

The sample collected was subjected to confirmatory factor analysis to ensure construct, convergent, and discriminant validity. Following the procedures of [13, 17], items with a low factor loading (<0.50) were deleted because as they affected fitness indices and construct validity indicators. Fitness indices for the measurement model were confirmed, all were within acceptable thresholds CMIN/DF=1.689 <3.00, RMR=0.078<0.08, GFI=0.866 close to 1.00,

AGFI=0.817 close to 1.00, CFI=0.949 close to 1.00, and RMSEA=0.067 <0.08.

Then, the researchers confirmed the validity and reliability of the measurement model. Fitness indices indicate that the construct validity has been achieved, as there are no significant differences between the proposed measurement model and the estimated model where CMIN/DF=1.689 also be called $\chi 2$ / df was less than 3.00. Other fitness indices were found to be within the acceptable thresholds, which means that the model is suitable to investigate behavioral intentions towards mobile cloud services in Jordanian Universities [12]. High factor loading values are an indication of an item's correlation with constructs. Keeping items with high factor loading means that the observed items are converging with their underlying constructs and inevitably convergent validity. Convergent validity can also be inferred based on the Average Variance Extracted (AVE), AVE should exceed 0.50 to indicate convergent validity for each construct. On the contrary, convergent validity differs from discriminant validity, discriminant validity indicates the difference of the underlying constructs from each other in the measurement model, that the latent construct measures itself and does not measure others [13]. In other words, the correlation between the observed item and it's respected latent construct should be high, and low with another construct [12]. Discriminant validity can be evaluated based on the square root of the AVE, if the square root of the AVE values is higher than all correlations in rows and columns in the correlation matrix, this considered evidence indicating that discriminant validity has been achieved. The results in Table 3 show that all loading coefficients exceeded 0.60 according to [13], AVE values exceeded 0.50 threshold, and all square root values of AVE are higher than all correlation coefficients between constructs.

Finally, to confirm the measurement scale reliability, the researcher used AVE, Composite Reliability (CR), and the Cronbach alpha coefficient. Following [13] procedures, the measurement model is considered reliable if the CR is more than 0.70 and AVE more than 0.50, in addition to the Cronbach alpha coefficient should exceed 0.70 to indicate consistency of the paragraphs [12]. The results in Table 3 demonstrate that all values of the CR exceeded 0.70, as well as all AVE values, were more than exceeded 0.50, while the Cronbach alpha values were greater than the 0.70 thresholds. Based on the above results, the developed measurement model is considered valid and gives convincing and consistent results without errors.

Table 3. Measurement model validity and reliability.

| Construct | Items | Loadings | AVE | CR | Cronbach | √AVE | Correlations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | PE. | EE. | SI. | FC. | BI |
| PE. | PE1. | 0.54 | 0.51 | 0.71 | 0.77 | 0.71 | -- | | | | |
| | PE2. | 0.80 | | | | | | | | | |
| | PE3. | 0.74 | | | | | | | | | |
| | PE4. | 0.75 | | | | | | | | | |
| EE. | EE1. | 0.82 | 0.67 | 0.82 | 0.89 | 0.82 | 0.616 | -- | | | |
| | EE2. | 0.82 | | | | | | | | | |
| | EE3. | 0.84 | | | | | | | | | |
| | EE4. | 0.78 | | | | | | | | | |
| SI. | SE1. | 0.79 | 0.52 | 0.72 | 0.87 | 0.72 | 0.41 | 0.28 | -- | | |
| | SE2. | 0.77 | | | | | | | | | |
| | SE3. | 0.68 | | | | | | | | | |
| | SE4. | 0.63 | | | | | | | | | |
| FC. | FC1. | 0.74 | 0.52 | 0.72 | 0.77 | 0.72 | 0.49 | 0.58 | 0.67 | -- | |
| | FC2. | 0.55 | | | | | | | | | |
| | FC3. | 0.77 | | | | | | | | | |
| | FC4. | 0.81 | | | | | | | | | |
| BI. | BI1. | 0.82 | 0.74 | 0.86 | 0.89 | 0.86 | 0.58 | 0.55 | 0.45 | 0.65 | -- |
| | BI2. | 0.86 | | | | | | | | | |
| | BI3. | 0.90 | | | | | | | | | |

## 3.4. Testing The Hypotheses

The researchers used Structural Equation Modeling (SEM) for testing the hypotheses [30]. Whereas, the path model demonstrates the effect of (PE, SE, EE, FC) on BI. The fitness indicators for the structural model have not been reported because it is a saturated model, therefore the model is considered appropriate to measure the effect of independent variables on the dependent variable [17]. Figure 4, which includes both the Invariant Model and the results in Table 4 indicated that both PE and FC have a statistically significant effect in BI, as the standardized estimates (β) were respectively 3.834 and 4.879. The results did not support the effect of SE, EE, as their statistical significance was high for both groups.

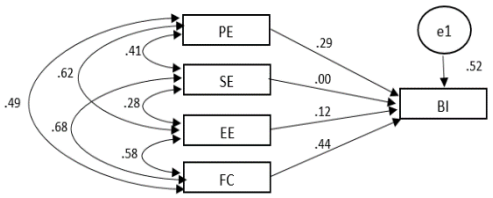


Figure 4. The structural model (total model n= 153).

Table 4. Research hypotheses testing (total n= 153).

| Hypotheses | Unstandardized Estimate | | | Standardized Estimates | S.E. | C.R. | P | Decision |
|---|---|---|---|---|---|---|---|---|
| BI | ← | PE | 0.373 | 0.287 | 0.097 | 3.834 | *** | Supported |
| BI | ← | SE | -0.001 | -0.001 | 0.066 | -0.011 | 0.992 | Not supported |
| BI | ← | EE | 0.156 | 0.12 | 0.104 | 1.494 | 0.135 | Not supported |
| BI | ← | FC | 0.481 | 0.443 | 0.099 | 4.879 | *** | Supported |

The main aim of this study is to investigate whether there are differences between faculty members and staff groups in the expectation of using mobile cloud computing in Jordanian Universities during the covid-19 pandemic and their impact on BI. Does this effect differ from one group to another? To achieve this, researchers used Multi-group SEM analysis to confirm whether there were statistically significant differences in the path model according to both groups as suggested by [12, 13]. Before testing the hypotheses, it

was necessary to verify the fitness of the model for both groups [17]. As shown in Table 5, all fitness indicators were achieved acceptable levels. Multi-group SEM analysis included making sure that the regression weights (structural weights), structural covariance, and structural residuals are not significant [13]. To indicate the fitness of the model, the value of $\chi 2$ should be statistically insignificant for both structural weights, structural covariance, and structural residuals, as it indicates that there is no difference between the elements of group measurement as indicated by [17]. It also indicates that the interpretation of the paragraphs of the measurement model does not differ by faculty members and managerial staff, this means that the measurement model is also suitable for measuring the impact of independent variables on the dependent variable for both groups.

Table 5. Multi-Group testing model fit.

| Constrained (Invariant) | $\chi 2$ | df | p-value | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|---|---|
| **Structural weights** | 5.14 | 4 | 0.273 | 0.987 | 0.997 | 0.983 | 0.043 |
| **Structural covariance** | 16.648 | 14 | 0.275 | 0.957 | 0.992 | 0.989 | 0.035 |
| **Structural residuals** | 16.86 | 15 | 0.327 | 0.956 | 0.995 | 0.993 | 0.029 |

Table 6. Testing hypotheses (educator n= 107).

| Hypotheses | Unstandardized Estimates | Standardized Estimates | S.E. | C.R. (t-value) | P-value | Decision | | |
|---|---|---|---|---|---|---|---|---|
| **BI** | ← | PE | 0.32 | 0.245 | 0.116 | 2.76 | 0.006 | Supported |
| **BI** | ← | SE | -0.057 | -0.07 | 0.081 | -0.714 | 0.475 | Not Supported |
| **BI** | ← | EE | 0.098 | 0.071 | 0.127 | 0.775 | 0.439 | Not Supported |
| **BI** | ← | FC | 0.605 | 0.564 | 0.114 | 5.322 | *** | Supported |

Table 7. Testing hypotheses (managerial n= 46).

| Hypotheses | Unstandardized Estimates | Standardized Estimates | S.E. | C.R. (t-value) | P-value | Decision | | |
|---|---|---|---|---|---|---|---|---|
| **BI** | ← | PE | 0.485 | 0.378 | 0.176 | 2.759 | 0.006 | Supported |
| **BI** | ← | SE | 0.109 | 0.132 | 0.11 | 0.989 | 0.323 | Not Supported |
| **BI** | ← | EE | 0.337 | 0.282 | 0.197 | 1.707 | 0.088 | Not Supported |
| **BI** | ← | FC | 0.133 | 0.12 | 0.195 | 0.682 | 0.495 | Not Supported |

The results in Tables 6 and 7 show explanatory power of PE in BI is higher for both groups, as the path model of PE was statistically significant $\beta$=0.245, CR=2.76, ($p<0.01$) for educators, and likewise, for managerial $\beta$=0.378, CR=2.759, ($p<0.01$). While the effect of FC on BI differs between educators and managerial, for educators, the path model for the effect of FC on BI was statistically significant ($\beta$=0.564, CR=5.322, ($p<0.01$), while it was statistically non-significant for managerial. As for other path models (SE -> BI, EE -> BI), it was found that there is no statistical significance for all groups (educators, managerial) Figures 5 and 6 show the structural models of groups, while the results are in Tables 6 and 7 illustrate the hypothesis test for the two groups also.

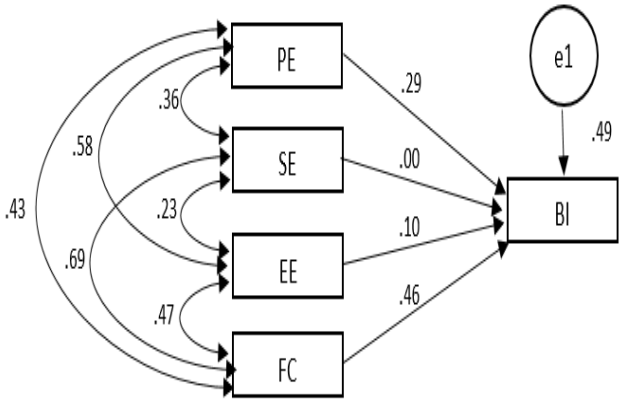


Figure 5. Model for educator (n= 107).

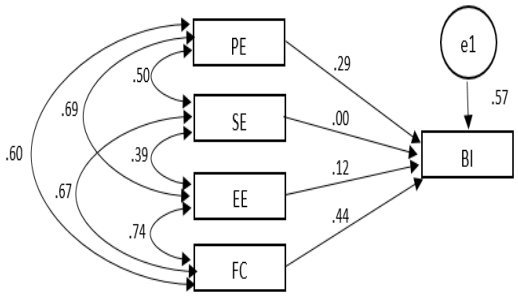


Figure 6. Model for managerial (n= 46).

## 4. Findings and Discussion

Analyzing the data using structural equation modeling showed that all participants supported hypothesis (H1, H4) that does not consider work type as affecting moderator. The previous results reflected positive BI of university employees towards using mobile cloud services to perform their tasks and duties at Jordanian Universities during the covid-19 pandemic. The results showed that performance expectancy and facilitating conditions were found to be the main factor affecting behavioral intentions for all employees at Jordanian Universities. Performance expectancy focuses on accomplishing responsibilities related to work tasks either by having better quality, faster accomplishment, enhanced efficiency and gaining better work-related assessment. On the other hand, facilitating conditions are found to focus on available resources in support for learning and working with the system to achieve

desired outcomes for duties and tasks. The previous results suggest that for the use of mobile cloud computing services during the covid-19 pandemic the training sessions in Jordanian Universities should have a strict focus on the mentioned elements related to performance expectancy and facilitating conditions, which impacts the behavioral intention of using mobile cloud computing services. Moreover, the results showed that university's management support directly affects the behavior intention of using mobile cloud computing services. The two other factors of (social influence and effort expectancy) showed that they are not affecting factors on behavioral intention for using mobile cloud computing services in Jordanian Universities. This research also investigated behavioral intentions for each group based on work type as affecting moderator. Work type was chosen as external factor to be investigated and to investigate the effect it has on behavioral intention for the two groups as it is believed that each group plans on using the technology differently due to the differences in tasks and responsibilities implied during the covid-19 pandemic. The results found that hypothesis (H5) is supported, hypothesis (H6, H7) are rejected, and the differences concerning the groups came in hypothesis (H8) as faculty members group supported the effect of facilitating conditions on behavioral intention, while the staff group did not. The results from hypothesis (H5, H6, H7, H8) if compared with the previous results found in hypothesis (H1, H2, H3, H4) shows the direct effect of work type as affecting moderator on the factors related to behavioral intentions. The result found by this study suggests that there should be more considerations for future training in Jordanian Universities, as most of the training sessions are planned and executed without the direct considerations of work type and responsibilities associated with work duties. Effective and dedicated planning with consideration for work type should be provided during training sessions on using mobile cloud computing services during the short and condensed training sessions being provided for the covid-19 pandemic. Moreover, the results show that there should be more focused support for facilitating conditions for faculty members, as it proved to be an affecting factor on behavioral intentions. This consideration for faculty members can be ascribed to their role, as it proves to be more diverse, as it includes teaching responsibilities for students and managerial responsibilities for students, as well as sessions and material preparation using cloud computing services.

## 5. Conclusions

This research focused on investigating the factors affecting behavioral intentions towards adopting mobile cloud computing services among staff and faculty members in Jordanian Universities during the covid-19 pandemic. The mobile usage of technological services was a necessity during to the lockdown enforcement practiced by the Jordanian government. Prior to the foreseen lockdown, every university in Jordan equipped its staff and members with condensed training session on the use of mobile services and technologies. This research study investigated the effecting factors on behavioral intentions of the participants towards the use of mobile cloud computing services using UTAUT model. Structural equation modeling was used for analyzing and testing the hypothesis found by this research. The result of this study found that participant in general are keen to use mobile cloud services for performing tasks and duties if they are confident that mobile cloud services technology will assist in having better performance for their tasks and duties with the support of facilitating conditions especially with the demands implied by the covid-19 pandemic. The need for supporting policies by university management is also an important issue to be considered, especially in providing motivations and support for proper training on using technologies during emergency events such as the covid-19 pandemic. The results of this research showed support and evidenced from theory and practice, as it used the UTAUT model based on the support found in existing literature [35], and the results enabled better understanding for the factors affecting the adoption of mobile cloud services in Jordanian Universities in general and with having work type as influencing factor. The results outlined in this research are believed to support Jordanian Universities in understanding the challenges of adopting mobile cloud services technologies during emergency events such as the covid-19 pandemic. However, it is believed that the results will enrich the current literature towards educational establishments in general, and it can be used as a guidance for future challenges and practices in Jordan.

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