Adoption of 4G Mobile Services from the Female Student's Perspective: Case of Princess Nora University

[1] College of Business and Administration,
Princess Nora University (PNU), Riyadh
drxbrl@yahoo.com

Awni Rawashdeh [1]

ABSTRACT

The aim this study was to examine the relationship between the perceived usefulness, perceived ease of use, perceived entertainment, attitude and the users' intention toward using the fourth-generation (4G) wireless mobile services. Data of this study were collected by survey with a cross sectional approach. The data were analyzed with factor analysis, as well as correlation and regression analyses. The findings reveal that the combination of perceived usefulness, perceived ease of use, perceived entertainment value and attitude are together responsible for determining the users' intention to use the 4G mobile services. However, the chief predicting factor influencing user intention to use the 4G mobile services is perceived entertainment value. A study of the factors identified should result in a more successful adoption of 4G.

Keywords: *wireless mobile services, 4G, adoption, technology acceptance model (TAM), attitude, intention, AMOS, SEM*

INTRODUCTION

The fourth generation mobile communication and technology service, 4G, is a combination of 3G and WLAN, with the ability to transmit high quality video images and image transmission comparable in quality to high-definition television technology products (Haitao & Xiaomin, 2012). The 4G system can download at a speed of 100Mbps, about a thousand times faster than the dial-up Internet access, upload at 20Mbps speed, and meet nearly all the user's requirements for wireless services (Krikke, 2004; Yang, 2012). As users are most concerned about the cost, the 4G is comparable in price to the fixed broadband networks and the billing is more flexible, as users can determine the services required depending on their needs (Pabst et al., 2004). Besides, 4G uses DSL and cable modems in those areas without deployment coverage, and then extends it to the rest of the areas. Thus, 4G enjoys unmatched benefits.

The adoption of the 4G mobile has showed steady growth across the world (Lee, Marcu, & Lee, 2011). However, a wide range of 4G diffusion levels is observed across countries. Saudi Arabia is in second place with no changes in its telecoms rating score (ITU, 2012). The 4G services initiated by Mobily, Saudi Telecom Company (STC) and Zain in September 2011 justified Saudi Arabia's comparatively high Industry Rewards score of 55, about 9.9pp over the regional average (ITU, 2012). Although the Saudi Arabian operators were the first, in the Middle East, to commercially launch the next-generation data services, it is a fact that these services entered the country's mobile broadband industry at a favorable time when the regulatory data showed a rapid acceptance of the 3G-based mobile broadband (ITU, 2012). Due to the higher-speed mobile data connections available, companies also promptly increased their efforts in the mobile application space by launching new services, thus providing more revenue-generating channels (ITU, 2012).

In June 2013, ITU estimated that there were 2.1 billion active mobile-broadband subscriptions across the world (including those having a 3G or 4G connection), which is 29.5% of the global population. By recent estimates, USA with 62.5 million users moving to 4G networks is top ranked in the world followed by Japan and South Korea (ITU, 2012). According to Informa (Q2 2013), based on market penetration, the leaders are South Korea, Singapore and Japan. Active SIMs in Morocco, Saudi Arabia and the United Arab Emirates have already exceeded 100% of the population, with respect to the penetration rates and will surpass 100% in Algeria in 2012 and Egypt in 2011. In Saudi Arabia, the three MNOs, Etisalat-Mobily, Zain Saudi Arabia and Saudi Telecom Company (STC), had launched long term evolution (LTE) services in 2011 (Ren21, 2011).

Despite the provision of 4G Mobile access at reasonable prices, the demand for 4G Mobile has not increased as expected in Saudi Arabia and many countries such as Jordan. Researchers are suggesting that the provision of broadband is more "demand constrained" than "supply constrained" (Dwivedi, Alsudairi, & Irani, 2010). This means that in order to enhance the homogenous adoption of 4G Mobile and to reduce the digital divide, it is appropriate to focus on understanding the factors influencing the decisions of 4G Mobile users (Dwivedi et al., 2010), including students. Previous research undertaken on technology adoption, such as the TAM model by individual consumers, has also emphasized the role of the demand perspective (Dwivedi et al., 2010).

Several studies have offered insights on the adoption of 4G Mobile (Shin, 2011; Soon, Lama, Hui, & Luen, 2012) to understand the 4G Mobile adoption in the developed world as well as in the leading countries, such as the USA and the UK. However, fewer studies have focused upon the developing countries (Soon et al., 2012). In other words, as compared to the developed countries, Saudi Arabia is considered slow in the adoption and diffusion of 4G Mobile adoption. This may be due to the delayed rollout of broadband services, slower infrastructure growth, lower tele-density and slower pace of adoption that contribute to the lack of 4G Mobile adoption research (Dwivedi et al., 2010). Because Saudi Arabia, in comparison with the UK – a developed country, is presently lagging in the level of 4G Mobile adoption, it is essential to undertake research that may assist in explaining the factors that may hasten 4G Mobile adoption. Furthermore, it believed that 4G Mobile Services can help advance Saudi Arabia education to a higher level, enhancing the well-being of its people by assisting in the release of education, health and telecommunications services at a more affordable rate to a larger population. Given such perceived benefits, it is essential to comprehend the factors presently affecting the consumption, acceptance of 4G Mobile services among Saudi Arabia students and, subsequently, how to further encourage adoption of 4G Mobile services for education.

The proliferation of online information resources have resulted in college students increasing their campus library information retrieval productivity (Chen & Adviser-Dehart, 2008; Soon, et al., 2012). In addition, the trend of using the World Wide Web to retrieve information is rising fast (Chen, 2008). Students are evolving to be behaviorally different from other generations (Soon et al., 2012). This student way of life which insists on the intense usage of telecommunication is now awakening several internet service providers to target this emerging and exceedingly profitable target group (Dwivedi et al., 2010; Soon et al., 2012).

The discussions presented above have provided the motivations, for conducting research on the student adoption of 4G Mobile amongst Saudi students. Therefore, research on the acceptance 4G technology will be highly useful in providing pertinent information, particularly at this stage in 4G mobile Internet development and implementation.

This study aims at examining the relationship between perceived usefulness, perceived ease of use, perceived entertainment, attitude and users' intention towards using 4G mobile services with the Technology Acceptance Model (TAM) as the guiding principle. According to standard practice, the researcher constructed variables to fully explore students' perceived ease of use, perceived entertainment and perceived usefulness of the system as well as their intention to use the 4G Mobile. The following two questions were posed:

Question 1: What are the factors influencing students' intention to adopt 4G Mobile?

Question 2: What are the factors influencing students' attitude to adopting 4G Mobile?

This study will chiefly benefit the mobile services providers, as they can better understand the students' perception of the 4G Mobile services. Further, the results of this study can allow them to segment and target the market much better.

LITERATURE REVIEW

As the number of 4G users increased significantly, it indicated the users' willingness to accept advanced wireless technology and participate in activities using 4G-supported systems which can offer wider opportunities than other wireless services. By drawing on the attributes of the Technology Acceptance Model (TAM) which is an established methodology in technology based product acceptance research, Soon et al. (2012) examined the factors influencing the intentions of Malaysian college and university students to adopt 4G Mobile for academic and for pleasure purposes. Soon et al. (2012) proposed four independent variables, namely perceived ease of use, perceived usefulness, subjective norm and perceived enjoyment. The dependent variable of this study is Intention to Use (Soon et al., 2012).

Elwood, Changchit, and Cutshall (2006) examined students' perceptions and their acceptance of implementing a laptop program by adopting TAM as the theoretical framework (2006). Fadare, Babatunde, and Theophilus (2011) examined the factors affecting students' intention to use mobile learning based mainly on the TAM (Fadare et al., 2011). Karjaluoto (2007) investigated 3G Mobile services from a marketing perspective. This study examined the success factors and user acceptance of the 3G mobile network and its services (Karjaluoto, 2007). Another research by Abubakar and Ahmed (2013) examined the factors affecting 3G technology perception and adoption. In the theoretical framework of the study, TAM and the Unified Theory of Acceptance and Use of Technology (UTAUT) are used as guidelines. In order to analyze 3G users' perception and behavioral intention, external variables (perceived usefulness, perceived ease of use, price, variety of 3G services, service quality and social influence) are analyzed through a survey study. The results show that perceived usefulness, variety of 3G services, service quality and social influence are influencing factors in the behavioral intention of 3G usage (Abubakar & Ahmed, 2013). Pagani (2004) conducted a study to identify the factors involved in the adoption of 3G mobile multimedia services and found that perceived usefulness, ease of use, price, and speed of use are the most important determinants.

Performance expectancy positively influences behavioral intention and user behavior (Carlsson, Carlsson, Hyvonen, Puhakainen, & Walden, 2006; Martins, Oliveira, & Popovič, 2014). However, the practicability of the system continues to rank as the main influential factor that guides the users to use the technological service. Facilitating conditions positively influence intention and usage (Chang & Cheung, 2001). Social influence of the 3G mobile telecommunication services positively affects intention and use (Ho, Hung, & Chen, 2013; Lu, Yao, & Yu, 2005). The behavioral intention of the 3G mobile telecommunication services users positively influences use behavior (Davis, Bagozzi, & Warshaw, 1989; Kuo & Yen, 2009). Throwing light on the factors that influence the acceptance of technology in the user context, the TAM, as seen in Fig. 1, represents the most useful factors in predicting the use of such technology. Davis, Bagozzi, and Warshaw (1992), proposed a model based on construct and relationships in view of the Theory of Reasoned Action (TRA). The TAM, derived chiefly from the TRA (Liao, Tsou, & Huang, 2007), posits that individuals' willingness, rational decision-making, attitude and subjective norm positively affect their behavioral intention. The subjective norm relates to the individuals' conviction that they should express a particular behavior which is expected of them by those they consider important (Davis et al., 1989; Rawashdeh, 2011). TRA shows that attitude and subjective norms independently affect intentions (Davis et al., 1989; Rawashdeh, 2013), whereas in the TAM, perceived usefulness and perceived ease of use have been found to directly affect attitude (Davis et al., 1989; Rawashdeh, 2013). According to Davis et al. (1992), the subjective norm had no significant effect on the intentions more than perceived usefulness and perceived ease of use, and therefore, it was omitted from the original TAM.
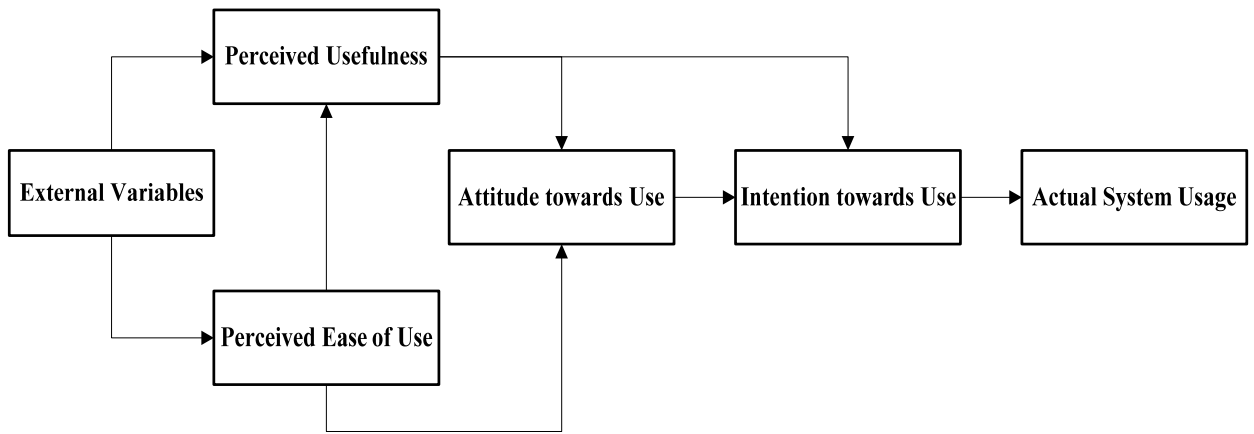
Fig. 1. **The Technology Acceptance Model.**

The basic constructs of TAM, without any external variables being applied on the acceptance of online business management and industry effect were empirically tested by Ortega, Martinez, and De Hoyos (2006). Using the 4G wireless technology, operators can provide 4G services containing an assortment of entertaining and engaging services.
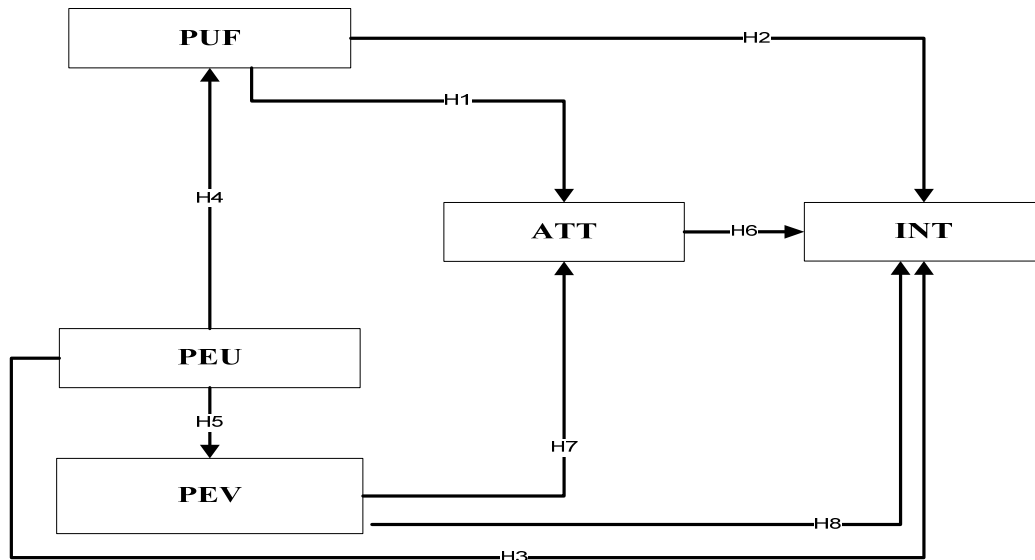

Fig. 2. **The Proposed Model for 4G use.**

Thus, this study aims at providing a theoretically justified research model that extends TAM by proposing the inclusion of perceived entertainment value (PEV) along with the use of 4G services, and to empirically test the factors influencing the use of 4G mobile services (Fig. 2).

2.1 Perceived Usefulness (PUF)

Davis et al. (1992) defined perceived usefulness as "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organisational context". Based on this definition, usefulness was ascertained as the key determinant in the usage behavior and intention (Pynoo et al., 2012). Subramanian (1994) reiterated two belief measurements (perceived usefulness and perceived ease of use) by employing a new data set for two different technologies. He found that only perceived usefulness, and not perceived ease of use, directly affected usage behavior by employing the Structural Equation Modelling (SEM). The direct effect of perceived usefulness on intention was attributed to performance expectancy having a direct influence on intention, regardless of the affective reaction, in workplace contexts. However, other research has found the effect of attitude on intention to be quite important (e.g., Mathieson, 1991). Further, in social psychology, the role of attitude as a determinant

of behavior has been well-documented (see Ajzen, 2002) Also, Ajzen (2002) noted that in social behaviors, attitude captures both affect and evaluation.

Therefore, perceived usefulness is described as the extent to which an individual believes that use of 4G mobile services will improve their communicational performance. The following hypotheses are proposed based on this fact:

H1. *Perceived usefulness will positively affect* attitude toward *using the 4G mobile services.*

H2. *Perceived usefulness will positively affect behavioral intention toward using the 4G mobile services.*

Perceived Ease of Use (PEU)

In the IT literature, connections have been empirically verified between the perceived ease of use, perceived usefulness and attitude in the TAM theory. Various studies have employed different usage measures and found them to concur with the TAM results, in which its two beliefs bear a close correlation to attitude (Adams, Nelson, & Todd, 1992; Igbaria, Zinatelli, Cragg, & Cavaye, 1997). Many studies have also tested the effects of the external variables on the perceived ease of use (Hong, Thong, Wong, & Tam, 2002; Igbaria et al., 1997), and found such an effect fully independent of perceived ease of use (Liao et al., 2007).

According to Davis (1989) and Davis et al. (1992), perceived ease of use influences perceived usefulness, and perceived usefulness and perceived ease of use will influence behavioral intention and actual usage. There is also significant evidence supporting the role of perceived ease of use as a determinant of perceived usefulness which is based on the rationale that the easier a technology is to use, the more useful it can be (e.g., Davis et al., 1989; Venkatesh & Davis, 2000). On the other hand, Igbaria, Parasuraman, and Baroudi (1996) found support for a positive relationship between perceived entertainment value and system usage. By contrast, perceived complexity was negatively correlated with perceived entertainment value (Igbaria et al., 1996). These findings lead to the expectation that the easier sensory enabling 4G are to use, the greater the perceived entertainment value of the communicational performance.

Here, the researcher defines perceived ease of use as the degree to which the use of the 4G mobile services by the user is perceived as easy or effortless. Thus, the following hypotheses have been proposed:

H3. Perceived ease of use will positively affect the behavioral intention toward using the 4G mobile services.

H4. Perceived ease of use will positively affect the perceived usefulness of using the 4G mobile services.

H5. Perceived ease of use will positively affect the perceived entertainment value of *using the 4G mobile services.*

Attitude (ATT)

Attitude is well recognized as a cause of intention. In terms of the 4G mobile services, their features can be seen simply as an extension of the G3 services with significant differences in the speed and bandwidth to gain access to the wireless network. A majority of today's customers will probably have been exposed to 4G mobile phones and developed a range of attitudes, from very favorable to highly unfavorable, toward using them. Earlier empirical studies have revealed such generalized attitude and its influences on the evaluation of the new technology in similar situations (Lederer, Maupin, Sena, & Zhuang, 2000; Moon & Kim, 2001; Vijayasarathy, 2004). In this research, attitude is hypothesized as being a result of the influences of the intention toward using 4G mobile services. It is defined as the degree to which an individual's attitude is disposed, favorably or unfavorably, towards the 4G mobile services usage. Thus, the following hypothesis has been proposed:

H6. Attitude will positively affect behavioral intention toward using 4G mobile services.

Perceived Entertainment Value (PEV)

Entertainment value, simply means spending time/having fun, particularly in situations when access to wired entertainment appliances is not possible e.g. kill or fill time while traveling to university. Igbaria et al. (1997) have indicated that perceived entertainment value significantly affects intention to use computers. Blanco, Blasco, and Azorin (2010) found that the entertainment and information that the users perceive through mobile advertising affect their attitudes. The users' perceptions of the entertainment value have a positive correlation with their attitudes (Van der Waldt, Rebello, & Brown, 2009). Gardner and Amoroso (2004) in their study analyzed the individual acceptance and usage of a website using the extension provided by TAM, which added the perceived entertainment value, in which perceived entertainment value and attitude had a significant relation. This study showed that from the point of website usage perceived entertainment value is an important factor. According to Hwang and Lee (2013) entertainment will become the biggest driver for mobile services because people have a natural limit to the time they spend on applications such as banking and governance. For instance, a person may spend a whole day watching movies or videos, but is less likely to spend as much time on education and health care services. Thus, the following hypotheses are proposed:

H7. Perceived entertainment will have a positive effect on attitude toward *using the 4G mobile services.*

H8. Perceived entertainment will have a positive effect on behavioral intention toward using 4G mobile services.

Behavioral Intention (BI)

Behavioral intention to use a service is a measure of the possibility that one will adopt the application, whereas the TAM uses the actual usage to represent a self-reported measure of time or frequency of adopting the application (Davis et al., 1989). However, it is neither easy nor practical to obtain an objective measurement of an individual's intention to express a particular behavior. Several researches have shown the existence of both theoretical and empirical support for a strong correlation between the intention to engage in a particular behavior and the actual behavior itself (Dabholkar & Bagozzi, 2002; Lucas & Spitler, 1999). To maintain instrument brevity, behavioral intention is adopted as an individual's intention to use 4G mobile services.

METHODOLOGY

To study the success factors that could influence the users' attitude toward 4G in Saudi Arabia, the study sample was chosen at random from the registration department in Princess Nora Bint Abdulrahman University (PNU) based on the registration numbers. Their selection is justified by the fact that they represent the highly educated sector of society, they possess smart phones with 4G and may have had prior experience in using 3G.

Out of 500 questionnaires, only 280 were found to be usable (response rate 56%), for further analysis. Previous research of this type conducted by Soon also had an extremely low response rate, with only 120 usable responses in the sample (Soon et al., 2012). Likewise, Oh, Ahn, and Kim (2003) based their conclusions on 211 questionnaires (response rate 52.75%). The questionnaire itself consists of two main parts: the demographic profile of the respondents and their perceptions and attitude toward using 4G mobile services. The items used were measured by adapting from Davis et al. (1989). Then the cross-sectional data were collected by a survey and analyzed using AMOS 20 and SPSS 17 software.

DATA ANALYSIS

Profile of Respondents

A statistical elaboration of the sample was done, since this study is a case study of the PNU. PNU is a women's university in Saudi Arabia and the largest women-only university in the world. The gender distribution of the survey respondents is 100% females. The results also indicated that 100% of the sample was aged between 18 and 25 years.

Factor Analysis

Factor analysis was then performed on the pilot study data. The test results were satisfactory, with three factors corresponding to the five intended factors (Perceived Usefulness (PUF), Perceived Ease of Use (PEU), Perceived Entertainment Value (PEV), Attitude (ATT) and Behavior Intention (BI)) being revealed with factor loading values between 0.634 and 0.850 (Table 1).

Table 1 Rotated Component Matrix

	PUF	PEU	PEV	ATT	INT
PUF1	0.806	0.034	0.053	0.117	0.173
PUF2	0.797	0.110	0.041	0.067	0.090
PUF3	0.796	0.066	0.049	0.152	0.069
PUF4	0.788	0.085	0.071	0.075	0.126
PEU1	0.145	0.793	0.097	0.082	0.037
PEU2	0.072	0.738	0.094	0.038	0.011
PEU3	-0.006	0.634	0.118	0.067	0.209
PEU4	0.069	0.748	0.028	0.058	0.078
PEV1	-0.013	0.070	0.817	0.170	0.271
PEV2	0.107	0.076	0.812	0.081	0.116
PEV3	0.055	0.167	0.796	0.163	0.073
PEV4	0.067	0.074	0.797	0.132	0.100
ATT1	0.094	0.052	0.096	0.844	0.107
ATT2	0.100	0.052	0.254	0.754	0.247
ATT3	0.140	0.081	0.113	0.770	0.150
ATT4	0.114	0.104	0.125	0.772	0.232
INT1	0.215	0.173	0.208	0.297	0.828
INT2	0.190	0.117	0.190	0.253	0.850
INT3	0.172	0.130	0.206	0.257	0.828

Reliability Analysis

The reliability of scale reveals that the study is random-error free. In this study, internal consistency is measured with Cronbach's coefficient alpha (α), which gives an indication of the average correlation among all the items constituting the scale. Values range from zero to one, in which the higher values indicate greater reliability. Table 2 shows the result of the analysis of the Cronbach's alpha scale for perceived usefulness, perceived ease of use, behavior intention, perceived entertainment, and attitude, where its value is more than .7. This implies that the survey instrument (questionnaire) is a reliable tool with which to consistently measure all the constructs. Moreover, all the measures of the constructs had been used in prior studies, and have thus been validated (Table 2).

Table 2 Cronbach's coefficient alpha

Variable	Cronbach's coefficient alpha
Perceived Usefulness (PUF)	0.83
Perceived Ease of Use (PEU)	0.73
Perceived Entertainment Value (PEV)	0.86
Attitude (ATT)	0.85
Intention (INT)	0.92

Correlation Analysis of Variables

To identify the correlations between the five variables (Perceived Usefulness (PUF), Perceived Ease of Use (PEU), Perceived Entertainment Value (PEV), Attitude (ATT) and Behavior Intention (INT)), the Pearson correlation was calculated. It was also used to describe the relationship between the dependent variable and the outcome. All the major variables were correlated together employing the correlation test. The average score of the multi-items for a construct was computed as a single construct in the questionnaire and was measured by multiple items. The score was later used in further analysis such as correlation analysis and regression analysis (Wang & Benbasat, 2007). As cited by Wong and Hiew (2005), the correlation coefficient value (*r*) ranging from .10 to .29, is considered weak; from .30 to .49 it is considered medium; and from .50 to 1.0 it is considered strong. However, according to Blunch (2012), the correlation coefficient should not cross .8, to avoid multicollinearity. As the highest correlation coefficient value in this research is .536, which is less than .8, the multicollinearity problem does not exist here (Table 3).

Table 3 Correlation Matrix and Mean Values

	PUF	PEU	PEV	ATT	INT
PUF	1.000				
PEU	0.214	1.000			
PEV	0.180	0.259	1.000		
ATT	0.303	0.220	0.374	1.000	
INT	0.384	0.310	0.434	0.536	1.000
Mean	4.772	5.231	5.718	6.010	6.012
Std. Deviation	0.470	0.363	0.508	0.642	0.854

Model Assessment

For investigating conformance on expanding expected parameter estimates, to start with it is vital to assess fit of individual parameters in the hypothesized model for determining viability of their estimated values. Generally parameter estimates exhibit correct size and sign and are consistent with underlying theory; unexpected estimate will indicate either inappropriateness of the model or missing input data. Results show that estimates were much normal as well as acceptable. In examining parameter estimates reliability, another test statistic is C.R. (critical ratio) that represents parameter estimate divided by SE (standard error). As a rule of thumb, the critical ratio must be >± 1.96 for an estimate to be acceptable (Jöreskog & Sörbom, 1996; Lien, Lytle, & Komro, 2002). The results showed that every C.R. value was bigger than 1.96 hence indicating that all of them were acceptable. For the fit statistics review, on reviewing the fit statistics from Table 4, it was noted that all fit statistics indicate goodness of fit. Key fit statistics displayed value of χ^2 equal to 149.081, 0.369 as *p*-value, 0.948 as GFI, 0.944 as NFI, 0.998 as CFI, 0.998 as TLI, 0.017 as RMR, 1 as PCLOSW and 0.011 as RMSEA. All these statistics show marginal very good fit as per commonly suggested criteria (Table 4).

Table 4 Fit Statistics of Model

Fit Statistic	Suggested	Obtained
Chi-square		149.081
DF		144
Chi-square significance	$p > 0.05$	0.369
Chi-square/DF	< 5.0	1.031
GFI	> 0.90	0.948
TLI	Close to 1 indicates a very good fit	0.998
NFI	> 0.90	0.944
CFI	> 0.90	0.998
RMR	<0.05	0.017
PCLOSE	> 0.50	1.000
RMSEA	< 0.05	0.011

Structural Model Results and Tests of Hypotheses

This study employs the structural equation modeling (SEM) to test the hypotheses. The first step in model estimation involved examining the model fit results of the hypothesized model. Some common fit indices reported in structural equation modeling are designed to identify model goodness-of-fit. Common criteria for SEM have been previously suggested and the results are presented in Table 4 (Jöreskog & Sörbom, 1996). In these results, the structural model presented here indicates adequate fit with the observed data, compared with the suggested fit criteria.

Fig. 3 presents results from the path analysis of the combined hypotheses. The first two hypotheses proposed that perceived usefulness would predict attitude toward using the 4G mobile services (Hypothesis 1), and behavioral intention toward using the 4G mobile services (Hypothesis 2), both with positive signs. The path for Hypothesis 1 was significant (β = 0.41, C.R. = 4.251); the path for Hypothesis 2 was significant (β = 0.44, t = 3.688). Thus, Hypothesis 1 and Hypothesis 2 were supported. This result is analogous to Dabholkar and Bagozzi (2002) and Davis et al. (1989) and implies that perceived usefulness is a major determinant of attitude and intention toward using the 4G mobile services.

On further investigation, the third, fourth and fifth hypotheses proposed that perceived ease of use would be a positive predictor of the behavioral intention toward using the 4G mobile services (Hypothesis 3), perceived usefulness of using the 4G mobile services (Hypothesis 4) and perceived entertainment value of using the 4G mobile services (Hypothesis 5). The path for Hypothesis 3, (β= 0.32, C.R.=2.028), the path for Hypothesis 4, (β= 0.35, C.R.= 2.73) and the path for Hypothesis 5, (β= 0.46, C.R.= 4.071) were significant. Thus, Hypothesis 3, Hypothesis 4 and Hypothesis 5 were supported. The positive intention of the user to use the 4G mobile services is because it is easy to learn quickly to use the 4G services and understand how easy it is to use it. This corroborates the findings by Davis et al. (1989). The hypothesis regarding the impact of perceived ease of use on perceived usefulness is in line with the findings of previous literature (e.g., Davis et al., 1989; Venkatesh & Davis, 2000). Similar to Igbaria et al. (1996), the findings lead to the expectation that the easier sensory enabling 4G are to use, the greater the perceived entertainment value of the communicational performance. Hypothesis 6 proposed that attitude will have a positive effect on behavior intention toward using the 4G mobile services. Attitude revealed a significant relationship with behavior intention toward using the 4G mobile services (β = 0.57, C.R. = 6.065). Its p-value is = .0000, positing that Hypothesis 3 is strongly supported. This implies that using the 4G services is a good attitude and a good idea. Thus, the role of attitudes in shaping behavioral intention is evident when the relationship between attitude and behavioral intention is significant (Davis et al., 1989). The assumption that attitudes strongly, positively and directly influence the intention to use the mobile devices/services is reinforced when the coefficients of attitude are studied (Table 5).

The seventh and eighth hypotheses proposed that perceived entertainment value would predict attitude toward using the 4G mobile services (Hypothesis 7), and behavioral intention toward using the 4G mobile services (Hypothesis 8). The path for Hypothesis 7 was significant (β= 0.57, C.R. = 5.878), and so was the path for Hypothesis 8 (β= 0.46, *t* = 3.756). Thus, Hypothesis 7 and Hypothesis 8 were supported. Summarized results for the hypothesis tests are shown in Table 5. The great diversity in the 4G services can inspire the users with more imagination space that will encourage them to experience enjoyment in using the 4G mobile. These results are consistent with prior studies on perceived entertainment by Hwang and Lee (2013), who indicated that perceived entertainment significantly influences intention to use social network mobile (Table 5).

Table 5 Regression Weights: (Group number 1 - Default model)

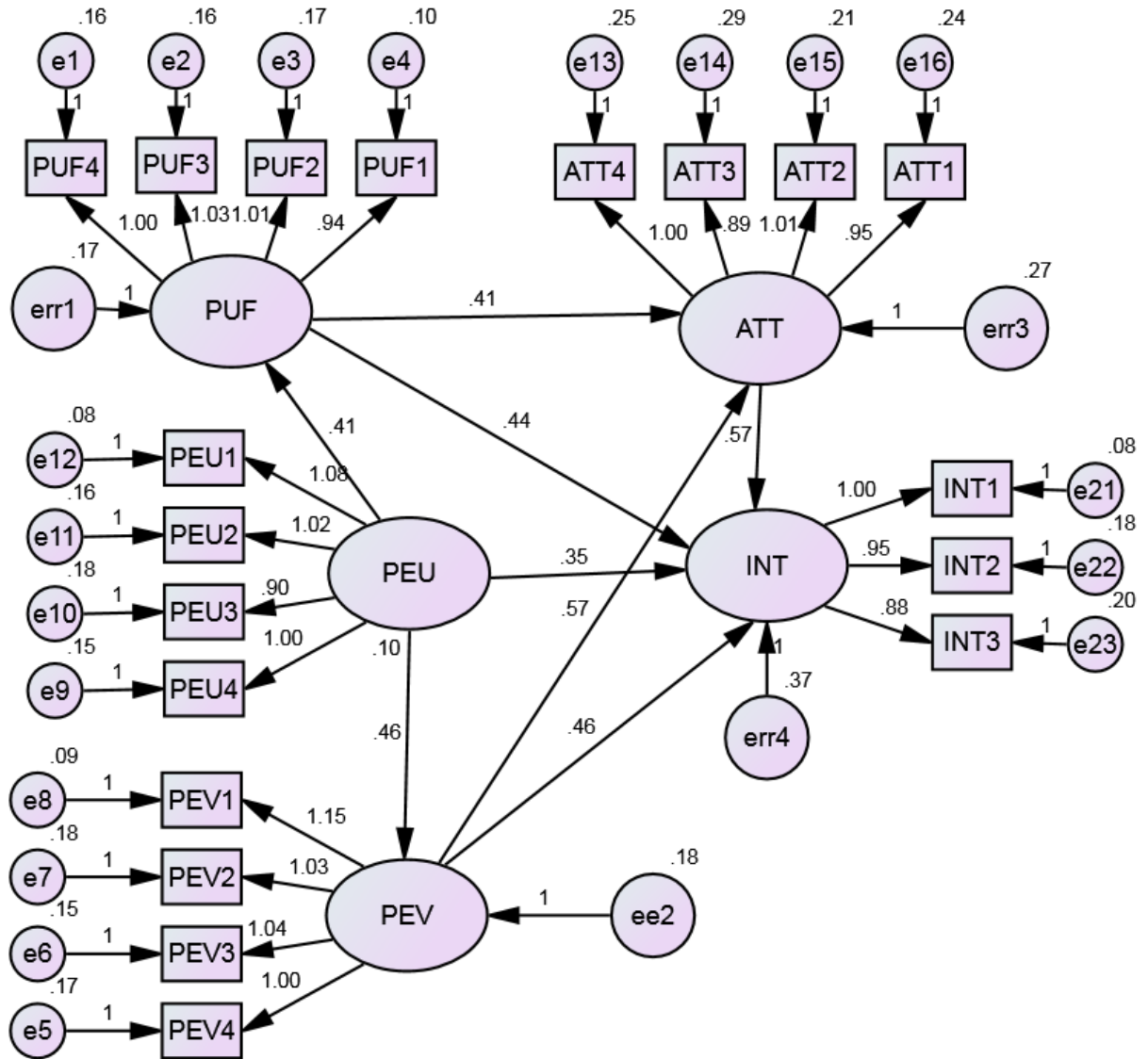|			Estimate	S.E.	C.R.	*p*
PEV	<---	PEU	0.456	0.112	4.071	***
PUF	<---	PEU	0.409	0.11	3.729	***
ATT	<---	PEV	0.565	0.096	5.878	***
ATT	<---	PUF	0.406	0.095	4.251	***
INT	<---	PUF	0.444	0.12	3.688	***
INT	<---	ATT	0.567	0.093	6.065	***
INT	<---	PEV	0.462	0.123	3.756	***

Figure 3. AMOS **Graphic of the Model**

In addition to the tests of hypotheses, direct and indirect effects of each variable are presented in Table 6.

Table 6 Direct, indirect and total effects

	PEU			PEV			PUF			ATT		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
PEV	0.46	0.00	0.46	0.00		0.00	0.00		0.00	0.00	0.00	0.00
PUF	0.41	0.00	0.41	0.00		0.00	0.00		0.00	0.00	0.00	0.00
ATT	0.00	0.42	0.42	0.57		0.57	0.41		0.41	0.00	0.00	0.00
INT	0.35	0.63	0.99	0.46	0.32	0.78	0.44	0.23	0.67	0.57	0.00	0.57

CONCLUSION AND RECOMMENDATIONS

The contribution of this study toward theory is that it integrates the TAM model with perceived entertainment value in order to enhance knowledge of 4G Mobile adoption from the students' perspectives.

This article studied the relationship between perceived usefulness, perceived ease of use, perceived entertainment value, attitude and the students' intention of using the 4G mobile services. The results indicate that the students' intention to use the 4G mobile services is determined by their understanding regarding the usefulness and its ease of use and access to the 4G mobile services' functions. Further, the results highlighted the importance of the perceived ease of use toward the 4G mobile services in terms of how easy or effortless it is to communicate with one another.

The major theoretical offering of this research was to confirm the role of entertainment variable when explaining the actual adoption of 4G Mobile. This was considered to be one of the important research issues of this study, which is to investigate the entertainment value in order to determine its effect on the adoption of 4G Mobile. Empirical findings from the Venkatesh and Brown (2001) study established that, when adopting a technology, the role of perceived entertainment value (PC games and video games) was important as a factor for consideration in the user decision-making process (Venkatesh & Brown, 2001). The perceived entertainment value of a PC was much more enhanced by the advent of the Internet (Venkatesh & Brown, 2001). The Internet offered the opportunity to play online games (Visser, Antheunis, & Schouten, 2013), download music and video, chat, and send online messages (Farias et al., 2013). However, this potential was severely hampered by the slow speed of 3G (Ali, 2013). This barrier is being overcome by 4G, which offers faster download speeds and streaming capabilities to Internet users, and hence more convenience and compelling environments (Ali, 2013).

Considering the perceived entertainment value that 4G offers in comparison to 3G mobile services, it was expected that users who perceive 4G mobile services as a good entertainment medium will eventually adopt the technology (Eizan Azira & Omar, 2013). The findings support the underlying study hypotheses that states perceived entertainment value will have a significant positive influence on the attitude and behavioral intention toward using the 4G mobile services. The findings were consistent with previous literature (Ali, 2013; Eizan Azira & Omar, 2013) suggesting that a key factor in determining broadband adoption was the PC bang phenomenon in South Korea. The findings are also supported by Morgan and Ravindran (2014), who maintained that broadband users are more likely to use the Internet for entertainment in comparison to narrowband users. In light of the above, the current findings significantly enhance the appreciation of user acceptance of the mobile communication services. A serious consideration of the factors thus far identified will go a long way toward ensuring a more successful adoption of 4G. The results suggest that the 4G mobile services users must be provided with more varied and entertaining ways of communicating, which are at the same time easily accessible and convenient to use.

This study in the context of Saudi students will provide ample 4G Mobile resources for other Arab cities or countries such as Oman, Jordan and Egypt). This study is one of the initial efforts that provide primary data in the context of the students in Saudi Arabia and supports the aforementioned theory. The findings of the current study clearly illustrate that the Saudi Arabia 4G Mobile users (students) do tend to use the 4G Mobile to increase productivity for their homework/study-related tasks.

Considering the inhomogeneous adoption of 4G Mobile adoption this research also provides implications for policy makers and the providers of 4G Mobile in order to encourage and promote homogenous adoption. Considering the slow adoption of 4G Mobile for education purpose, the policy makers -- in this case the education industry -- holds a particular interest in the findings of this study. Policy makers are currently investigating how to increase diffusion of 4G Mobile within their own universities, and so information on other universities' experiences will be useful. On other hand, the telecommunications companies are interested in determining how to improve their strategies. Therefore, this study offers an understanding of the 4G Mobile adoption strategies at the student level. This is particularly useful as there are few studies published on student adoption of 4G Mobile in Saudi Arabia. Future research is warranted to evaluate and analyze the 4G market, as well as to investigate the financial and industrial implications associated with the 4G market.

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