Exploring Consumers Intent to Download Mobile Application on Android vs. iOS Platforms in Saudi Arabia

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Abstract

Saudi Arabia is an emerging intelligent region in Middle East with large number of smartdevice users. The utility and capability of smart devices such as smartphones and tablets are further enhanced by mobile applications. Amongst all different platforms, iOS and Android offer a huge number of applications to the users ranging from entertainment to productivity. Hence, the present research was directed towards investigating the intent of app download between iOS and Android users in Saudi Arabia. For the purpose, the researcher proposed a theoretical model including the constructs of utility, cost, risk and app installation. The results indicated that the factor of cost along with risk significantly impacted the download intent both among the Android and iOS users, a finding not indicated in previous studies of similar nature. Hence, it can be concluded that cost and risk both play a major role in driving the young population of Saudi Arab in downloading apps from app market.

Keywords: Android, iOS, Intent, App download, Mobile Apps.

Introduction

Globally people are getting familiarized with the smartphone and internet revolution. The MEA (Middle East and African) region is also highly engaged in the evolving smartphone adoption as the number of smartphone usersis estimated to be 20 million in 2019. With the advent of smartphones, smart technologies have penetrated deeper into the everyday lives of users. A significant aspect of technology adoption by users on smart devices such as smartphones is the use of mobile applications which comprise a set of programs that can be run on an array of managed platforms such as blackberry, iOS, Android, Symbian and others. Many of these applications come pre-installed in phones while others can be downloaded from mobile application markets (Islam, Islam, & Mazumder, 2010). With the increasing adoption of smartphonescomes the issue of exploring consumers' intent to download an application. Although past studies have investigated the intent to install mobile applications, the Saudi Arabian landscape remains relatively unexplored. Hence, the purpose of the present study is to contribute further to the existing understanding of consumer intent to download mobile applications in Saudi Arabia across the two major platforms of Apple (iOS) and Google (Android). By adopting a trust-based consumer decision-making model with

added dimensions of utility and cost of app installation, an elaborative model (Figure1) was constructed to develop the understanding of App Installation Behavior in Saudi Arabia.

Figure 1. Conceptual Model for App Installation Developed by researcher (Structural Model)

Background

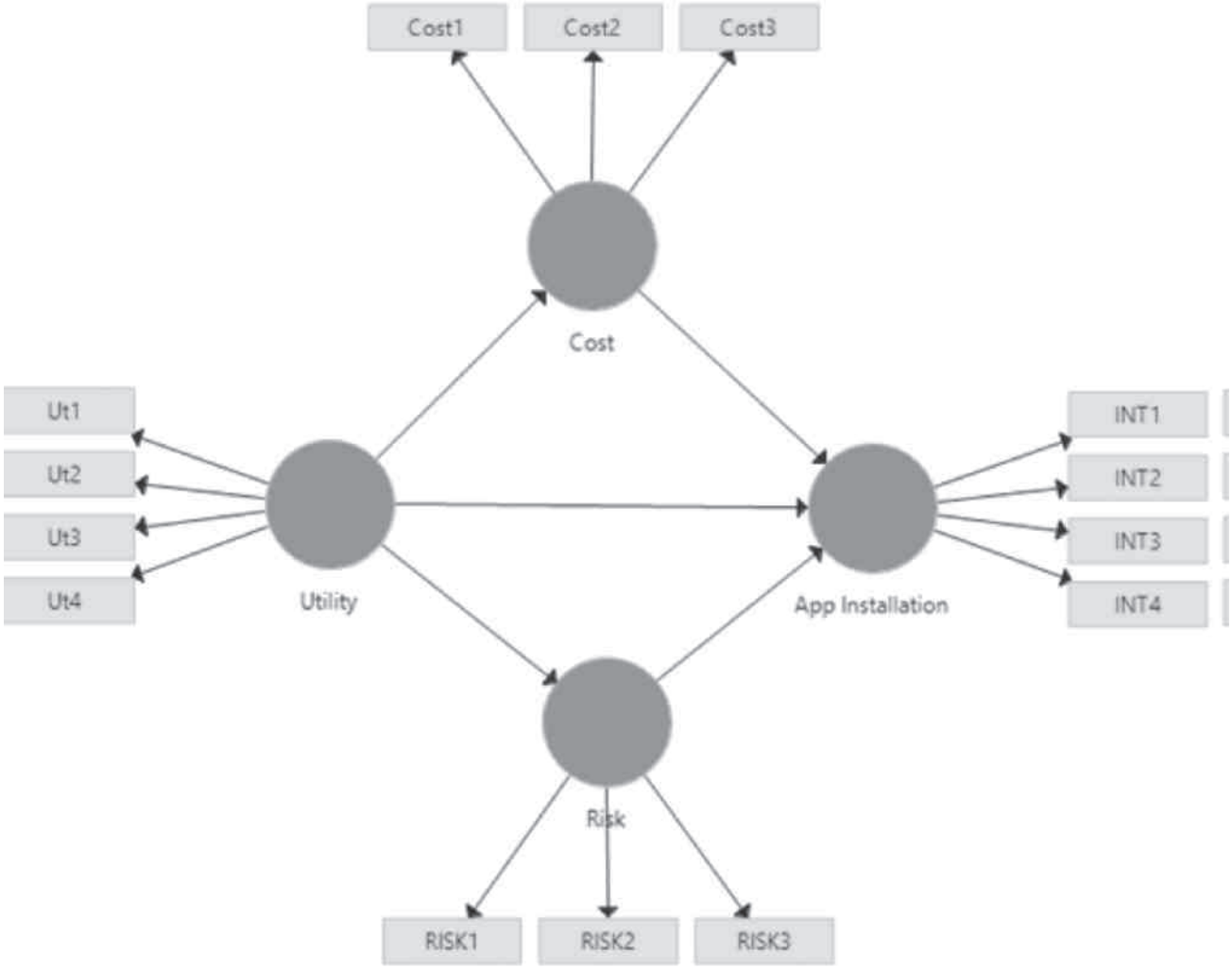
In 2019 there were approximately 2.2 million apps on iOS and 2.6 million apps on the android market. Apple App Store and the google play store are the two dominant players in this category, which run on iOS and Android platforms respectively. It is also estimated that in 2019 march onwards approx. 42 thousand apps were added on iOS and 142 thousand apps were added on play store per month (Business of Apps).Thus, the wide-scale adaption of iOS and Android platforms along with rapidly increasing downloads, place them as suitable spheres of investigation. Saudi Arabia in the Middle East is rising at a faster pace as compared to other countries in the region, with the Internet of Things set to revolutionize the region. Concerning smartphone usage, according to the Saudi General Authority for Statistics, (2019), a survey on the use of the Internet and telecommunications by families and individuals in 2018, 92.51% of Saudi families use the Internet directly. Hence, the burgeoning adoption of the smartphone is accompanied by large scale app download, yet the intent to download an app remains under-investigated. The purchase of apps also influenced by the shopping experiences(Tomar, 2019; Zia & Azam, 2013) which motivates consumers to download or uninstall an app. Mobile marketing gave rise to higher organizations penetration to the customers mind to understand their intent to install the app(Rekha & Pooja, 2018). The studies undertaken in Saudi Arabia have focused on the intention to use the mobile application, pertaining to specific domains such as online shopping (Alatawy, 2018; Mathew, 2018), mobile banking(Alkhalid, 2016; Patel, 2019; Zia, Adil; Khan, 2018; Zia, 2019b, 2019a, 2020), weight management (Aljuraiban, 2019), Mobile services(Zia & Hashmi, 2019) and others. Hence, the holistic understanding pertaining to different dimensions of intent to download an app needs to be understood.

Conceptual Model

The proposed theoretical structural model for the intended

investigations is shown in Figure1, and Figure 2. As previous researchers have found that the consumers can have positive as well as negative attitudes related to the App Installation, (Kim et al., 2008b), the present model is based on the proposed model of Peter & Tarpey, Sr., (1975) related to the risks and benefits of the consumers' attitude. As an extension of the model proposed by Kim et al., (2008b) and Peter & Tarpey, Sr., (1975)(Sreelakshmi, 2020), the researcher has proposed utility instead of benefit and cost of App Installation as a new dimension while the two factors of risk and app installation were maintained the same.

Figure 2 Conceptual model with observed and latent variables (Circle: Construct, Rectangle: Variable)



The conceptual understanding of the consumer decision-making model modified by Kim, Ferrin, & Rao, (2008b), was hereby extended to the concept of app installation. The research findings of Kim, Ferrin, & Rao, (2008b) model indicated the importance of information quality, security, third party seals, and reputation as necessary implications in defining consumer's motivations. Correspondingly, the application download from app marketplaces also finds relation with issues of trust(Le-hoang & Luu, 2019), safety(Nair, 2020), hedonic motivations, social influence, desensitization and others(Akgul, 2018; Chin, Harris, & Brookshire, 2018; Harris, Brookshire, & Chin, 2016; Harris, Chin, & Brookshire, 2015a). Thus, the model was utilized and modified to develop understanding concerning the cost, risk and utility associated with app installation in the present research. Further, using the proposed model, the researcher explored the factors responsible for consumers' decision to observe the mediator effect of Risk and the Cost on the App installation. Thus, the primary constructs in the present model are Utility, Cost, Risk, and App Installation.

In this conceptual model, the researcher presumes that the Cost and Risk, both the constructs jointly and individually, have an impact as a mediator for the App Installation. It is assumed that Cost and Risk mediate the relation between Utility and App Installation. Therefore to test their mediator effect, various statistical tests were performed and the details are discussed further.

Utility

The utility may be defined as the act of being useful, profitable or beneficial. In the mobile industry, the Utility of an App has a vast range of interpretations from playing games to online commerce and from social networking to digital communication (Nair, 2020). Consumers download Apps for games (Jiang & Deng, 2011), for banking-related tasks (Chemingui & Lallouna, 2013; C. S. Chen, 2013; Katagal, Mutkekar, & Garag, 2018; Lu, Yang, Chau, & Cao, 2011; Zhou, 2013) and much more. Thus, the utility can be defined as the belief in the minds of customers about the expected use of an App in their smart device which acts as a cue to download an App(Nair, 2020)(Chen, Yan, Fan, & Gordon, 2015; Wang, Wiegerinck, Krikke, & Zhang, 2013). Therefore, to test the behavior of consumers in Saudi Arabia related to the Utility and to observe and compare the behaviors of iOS and Android users, the researcher formulated the following hypothesis.

H1: Utility and App Installation for smart devices.

H1a: There is no significant impact of Utility on App Installation for Android smart devices.

H1b: There is no significant impact of Utility on App Installation for iOS smart devices.

H2: There is no significant difference in the Utility of an App among Android and iOS.

Cost

The cost of downloading one app to a smart device is referred to as CPI (Cost per install), which depends upon the platform on which they are downloaded. According to Geenapp company, the average cost of installing an app on the iOS platform is 0.86$ as compared to 0.46$ on the androidapp store. This cost is borne either by the consumer or the App developer. It is estimated that 90%of the total apps on iOS and 96% apps on play store are free to customers (42matters.com; Appbrain.com). Therefore, it can be said that only 10% of Apps are paid by consumers on iOS and only 4% are paid on Android. According to statistics, it is observed that iOS users are willing to pay for the apps as compared to the Android play store app users.

Figure 3a: Price Distribution for Android

Source: Play Store Source 42Matters

Figure 3b. Price Distribution for iOS

Source: iOS Source 42Matters

Also, the prices of apps on iOS are higher (Figure 3a) as compared to the Android App store (Figure3b). However, the majority of apps on both android and iOS are free. Thus customers are not much bothered about the cost of an app. (Kim, 2011a) found that there is no impact on the cost of an App on the App installation. It is also found that the apps which are free to download initially and ask for money later, face negative attitudes of the customers (Arora, Hofstede, & Mahajan, 2017).The data also reveals that the free apps are preferred over the paid apps;thus, the cost of acquiring an app can have a significant negative impact on the App Installation. To test this behavior of consumers in Saudi Arabia related to the App Installation and to observe and compare the behaviors of iOS and Android users, the researcher formulated the following hypothesis.

H3: Cost and the App Installation for smart devices.

H3a: There is no significant impact of Cost on the App Installation for Android OS.

H3b: There is no significant impact of Cost on the App Installation for iOS.

H4: There is no significant difference in the cost of an App Installation among Android and iOS.

Risk

There are a number of risk factors associated with App Installation. In terms of security, when compared among iOS and Android, the debate on which operating system provides better security continues (Barrera, Clark, McCarney, & Van Oorschot, 2012; Alepis & Patsakis, 2019). But it is evident from available studies and empirical evidence that Android's current signing architecture does not support required security practices (Ahmad, Musa, Nadarajah, Hassan, & Othman, 2013a), and it poses a higher risk as compared to iOS (Shah & Modi, 2019).Further, even the customers have a low to the fairly low level of awareness associated with app installation (Koyuncu & Pusatli, 2019). The magnitude and extent of risk vary from financial to social loss (Forsythe & Shi, 2003). Some of the e-commerce researches have shown that risk has a negative impact on App Installation (Forsythe & Shi, 2003; Kim et al., 2008b). Thus, to understand the implication of such conclusions in the context of Saudi Arabia,the following hypothesis is proposed.

H5: Risk and App Installation.

H5a: There is no significant impact of Risk on the App Installation for Android OS.

H5b: There is no significant impact of Risk on the App Installation for iOS.

H6: There is no significant difference in the Risk of an App Installation among Android and iOS.

App Installation

It is estimated that the total App downloads have reached 10% of the world's population and growing at a higher pace every month. In 2018, 72% of the total App Installation in the world was through the Google Play Store, whereas only 28% was on iOS (Qamar, Karim, & Chang, 2019; Shah & Modi, 2019). Thus, understanding the influence of utility, risk, and cost of installation in the Saudi Arabian context is essential as the Middle Eastern Region is an emerging intelligent market. In this research, it is hypothesized that Risk, Cost, and Utility play a significant role in the process of consumer choice of App Installation. Therefore, the researcher formulated the following hypothesis.

H7: Mediation of Cost between Utility and App Installation.

H7a: Cost does not mediate between Utility and App Installation for Android OS.

H7b: Cost does not mediate between Utility and App Installation for iOS.

H8: Mediation of Risk between Utility and App Installation.

H8a: Risk does not mediate between Utility and App Installation for Android OS.

H8b: Risk does not mediate between Utility and App Installation for iOS.

Material and methods

Survey instrument and sample

For this study, consumers using smart devices such as smartphones or tablets and studying at the University of Saudi Arabia constituted the research population. The primary data was collected through a self-administered questionnaire to measure the perceptions of the smart device users about the Apps and concerns related to the Utility, Cost, Risk and App installation-related issues. The questionnaire included questions related to the characteristics, benefits, cost, usability, and utilityof the Apps that the students as consumers had installed on their smart devices. Additionally, the primary demographic data were also collected for further analysis. In all 560 students submitted their responses for the research. Out of 560, 416 questionnaires were included in the study while others were excluded due to reasons for incomplete responses. This sample size was sufficient according to the recommended sample size (Ong & Fadilah Puteh, 2017) constituting a response rate of 72.75%. For this study, all the smart devices were considered to be similar products running on either iOS or on Android platform. The analysis was performed for overall users and iOS and Android users separately.

Calculation

The scales, to measure all the constructs, were partly adapted from the literature and partly proposed by the researcher. For all the items, the responses were collected using a five-point Likert scale which ranges from "strongly disagree" to "strongly agree." Details on the items of the questionnaire adapted to measure the constructs are provided in Appendix A. In this model. There were four constructs (Latent Variables), namely, Risk, Cost, Utility and the App Installation with the corresponding observed variables, as shown in (Figure 2). The first and second constructs were Cost and Risk respectively with each measured using three observed variables to measure their effect on the App Installation. The third and fourth constructs were Utility and App installation which were measured using four observed variables each. The model showed that all the four zero-order constructs i.e. Risk, Utility, Cost, and App Installation, were Reflective Models.

Data analysis

The model developed was estimated using SmartPLS3. The sample size of the present study fulfilled the recommended criteria for relationship modeling in SmartPLS(Ong & Fadilah Puteh, 2017). Further, as all the four zero-order constructs were reflective in nature, a consistent PLS Algorithm was applied (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014) including the calculation of Composite reliability of the model to evaluate the internal consistency of the constructs, the evaluation of the outer loadings of the indicators to measure the reliability of all the individual indicators and Average variance extracted (AVE) to measure the convergent validity of the items. Finally, the cross-loadings were checked using the Fornell-Larcker criterion to check the discriminant validity (Fornell & Larcker, 1981), and HTMT ratios were calculated (Henseler, Ringle, & Sarstedt, 2014). The PLS-MGA (Partial Least Square – Multi-Group Analysis) method was employed to test the significant difference among the two groups of data (Android and iOS).

Results

The 416 respondents comprised of 238 iOS users and 178 Android users. The sample consisted of 180 female and 236 male respondents of which 98 heldmaster's degree and 318 were Bachelor students of Saudi Arabian university. The age of the students ranged from 20 to 30 years, with average age Mean ± Standard Deviation. 293 students were between the age group of 20 to 25 years and 123 students were of the age of 26 to 30 years of age. No respondents were below the 20 year and no one was over 30 years of age.

Table 1 Individual Item Reliability

Construct	Items	Loadings	skewness	Kurtosis	Composite Reliability	AVE	Cronbach α	roh
Cost	1	0.892	0.816	-0.317	0.866	0.685	0.865	0.875
	2	0.859	1.114	0.089				
	3	0.722	0.868	-0.28				
Risk	1	0.697	0.615	-0.719	0.857	0.668	0.856	0.867
	2	0.855	0.742	-0.716				
	3	0.887	0.709	-0.629				
Utility	1	0.713	-0.877	-0.267	0.825	0.541	0.824	0.827
	2	0.791	-0.591	-0.791				
	3	0.704	-0.817	-0.376				
	4	0.732	-0.41	-0.804				
App Installation	1	0.878	-0.385	-0.723	0.913	0.725	0.913	0.914
	2	0.833	-0.467	-0.738				
	3	0.821	-0.674	-0.508				
	4	0.874	-0.528	-0.645				

Table 4 Total Effect

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Cost -> App Installation	-0.216	-0.214	0.039	5.488	0.000
Risk -> App Installation	-0.159	-0.162	0.051	3.115	0.002
Utility -> App Installation	0.705	0.704	0.062	11.450	0.000
Utility -> Cost	-0.047	-0.047	0.059	0.793	0.428
Utility -> Risk	-0.124	-0.125	0.058	2.163	0.031

Table 5 Construct Reliability and Validity

	Cronbach's Alpha	Rho A	Composite Reliability	Average Variance Extracted (AVE)
App Installation	0.913	0.914	0.913	0.725
Cost	0.865	0.875	0.866	0.685
Risk	0.856	0.867	0.857	0.668
Utility	0.824	0.827	0.825	0.541

Table 6a Outer Lodgings (Composite)

	App Installation	Cost	Risk	Utility
Cost1		0.892		
Cost2		0.859		
Cost3		0.722		
INT1	0.878			
INT2	0.833			
INT3	0.821			
INT4	0.874			
RISK1			0.697	
RISK2			0.855	
RISK3			0.887	
Ut1				0.713
Ut2				0.791
Ut3				0.704
Ut4				0.732

Table 6b Outer Lodgings (Android)

	App Installation	Cost	Risk	Utility
Cost1		**0.871**		
Cost2		**0.843**		
Cost3		**0.759**		
INT1	**0.910**			
INT2	**0.852**			
INT3	**0.846**			
INT4	**0.900**			
RISK1			**0.703**	
RISK2			**0.864**	
RISK3			**0.904**	
Ut1				**0.739**
Ut2				**0.797**
Ut3				**0.744**
Ut4				**0.749**

Table 6c Outer Lodgings (iOS)

	App Installation	Cost	Risk	Utility
Cost1		**0.919**		
Cost2		**0.873**		
Cost3		**0.678**		
INT1	**0.851**			
INT2	**0.816**			
INT3	**0.799**			
INT4	**0.855**			
RISK1			**0.691**	
RISK2			**0.849**	
RISK3			**0.873**	
Ut1				**0.694**
Ut2				**0.788**
Ut3				**0.670**
Ut4				**0.723**

Figure 4a: Composite reliability calculated for all constructs.

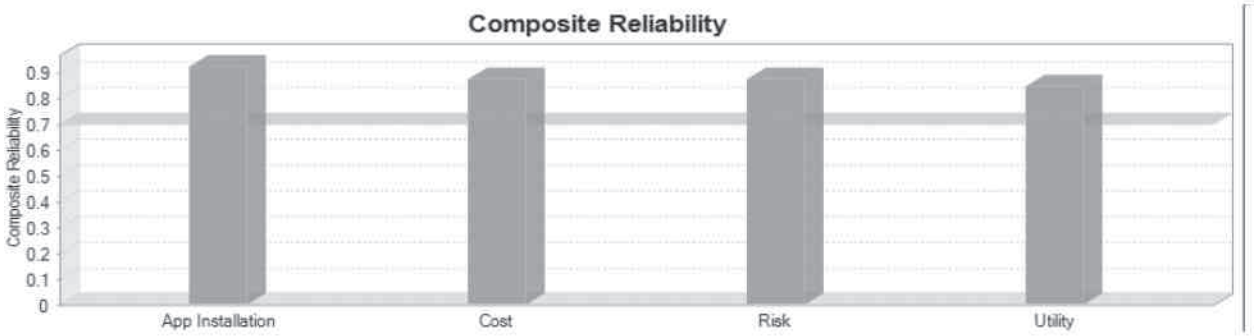
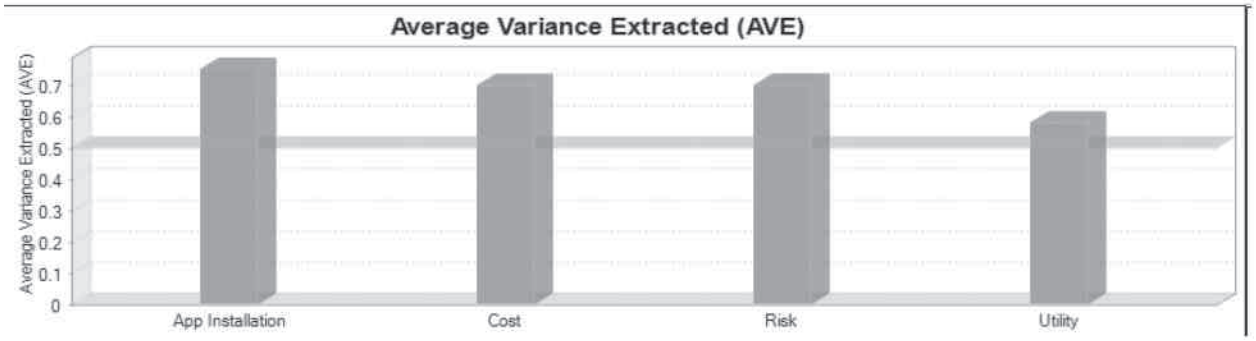
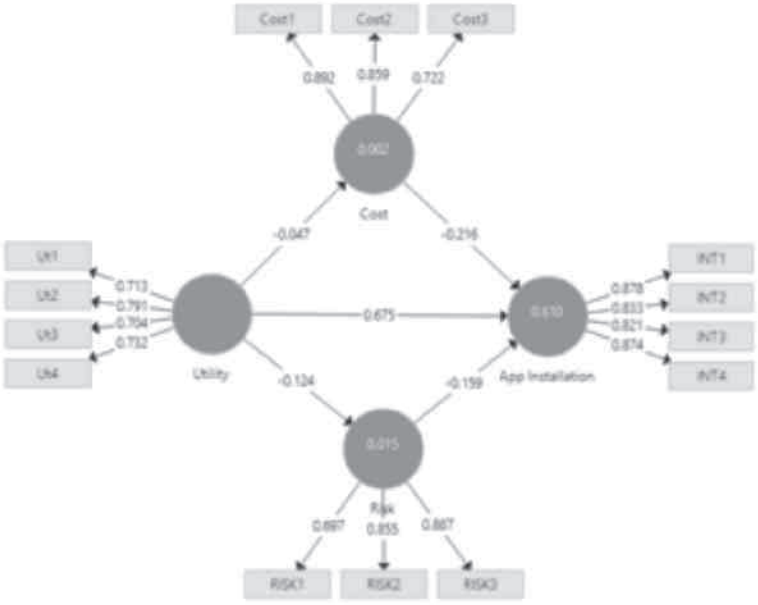


Figure 4b: AVE values for all constructs



As the model is reflective in nature, the outer loadings were recorded. Table 1 shows the beta values, indicating the correlation between the indicator variables and the latent construct. The composite outer loadings for iOS and Android indicators are almost near to the acceptable range of 0.7.

Figure 5a: PLS Path Model after applying PLS Algorithm Calculation



The values obtained for Rho, Cronbach Alpha and Composite reliability see Table 5 (Figure4.a) were more than 0.7, whereas Average Variance Extracted (Figure4.b) was more than 0.5 which meant that all the measures of all the constructs in the model had a high level of convergent validity in the model (Figure5a). The individual item reliability (Table 1) showed the constructs and their items followed by the loadings. The skewness and kurtosis values corresponded to the items of the scale. The average variance extracted (AVE), the Cronbach α values for latent constructs ranged from 0.824 to 0.913 and the corresponding Composite Reliability ranged from 0.825 to 0.913. All the 14 items of the questionnaire had a loading of more than 0.70 both for iOS and Android (Table 6a) and individually for Android (Table 6b) and iOS (Table 6c).

Table10 Discriminant Validity (Fornell-Larcker criterion)

	App Installation	Cost	Risk	Utility
App Installation	0.852			
Cost	-0.346	0.828		
Risk	-0.377	0.619	0.817	
Utility	0.705	-0.047	-0.124	0.736

Table 11 Discriminant Validity Heterotrait-Monotrait Ratio (HTMT)

	App Installation	Cost	Risk
App Installation			
Cost	0.347		
Risk	0.376	0.625	
Utility	0.704	0.061	0.149

According to the studies of Henseler et al., (2009) and Hair et al., (2011), the Fornell-Larcker criterion and the cross-loadings were checked for discriminant validity (Table 10). The diagonal elements show the square root of the average variance extracted. The off-diagonal elements show the correlations between the constructs. For this model, cross-loadings were checked, it was measured that the values of AVE should be greater than MSV and finally, the Heterotrait-Monotrait Ratio (HTMT) was calculated, (see Table 11). All values for the construct were greater than its vertical and horizontal values. The HTMT values were less than 0.85 (Henseler et al., 2014);hence discriminant validity was present in the model.

Table12 VIF Values for constructs

	VIF
Cost1	2.149
Cost2	2.577
Cost3	2.147
INT1	3.160
INT2	2.587
INT3	3.377
INT4	3.509
RISK1	2.013
RISK2	2.259
RISK3	2.149
Ut1	1.885
Ut2	1.986
Ut3	1.390
Ut4	2.358

Collinearity was checked for the constructs by validating VIF values, which should be less than 5. All the VIF values of the constructs are shown in Table 12. All the VIF values were found to be less than 5. Therefore it was concluded that the collinearity issue does not exist between the constructs. Hence, the independent constructs are not correlated.

Table 2 Path Coefficients

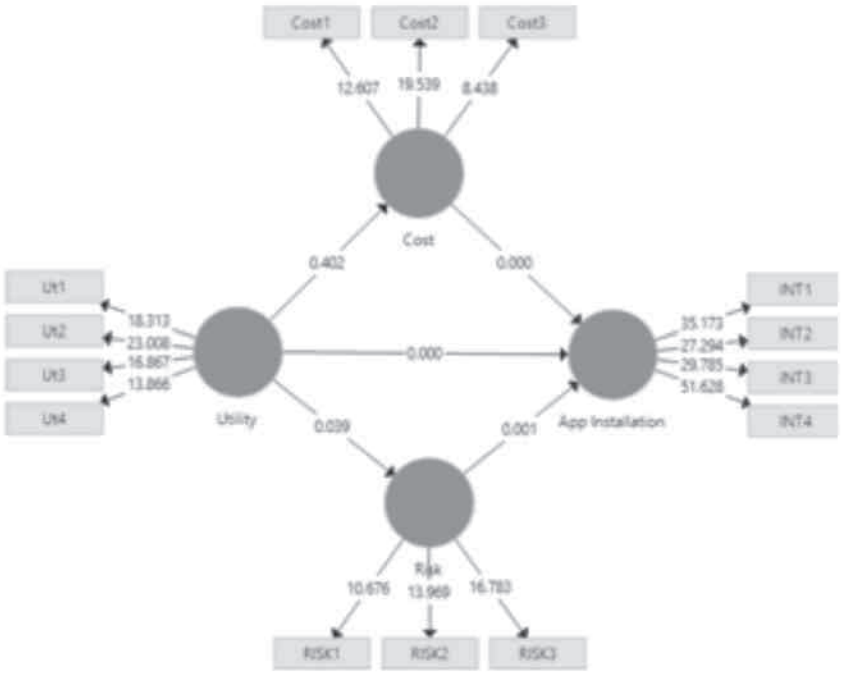
	Composite for Android and iOS		Android		iOS	
	Original Sample (O)	P Values	Original Sample (O)	P Values	Original Sample (O)	P Value
Cost -> App Installation	-0.216	0.000	-0.184	0.029	-0.233	0.000
Risk -> App Installation	-0.159	0.002	-0.196	0.064	-0.142	0.015
Utility -> App Installation	0.675	0.000	0.626	0.000	0.718	0.000

Table 3 Specific Indirect Effect

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Utility -> Cost -> App Installation	0.010	0.010	0.013	0.780	**0.436**
Utility -> Risk -> App Installation	0.020	0.020	0.010	1.917	**0.056**

The Bootstrapping procedure reports the significance of the path coefficient values. The result showed the p-value as significant for all three relations (Table 2). It was found that in the combined sample of Android and iOS, both Cost (-0.216) and Risk (-0.159) negatively impacted the App Installation, whereas Utility (0.675) positively impact the App Installation (Table 2). It is observed that the specific indirect effect of cost and risk on app installation is insignificant (Table 3), but this indirect effect becomes significant on App installation when total effect is calculated (Table 4). Further,it was observed that all the relations of cost-App Installation, Risk-App Installation and Utility-App Installation were significant (Table 2). Forandroid, Cost (-0.184) and Risk (-0.196) negatively impact the App Installation whereas Utility (0.626) positively impacts the App Installation (Table 2). For iOS, Cost (-0.233) and Risk (-0.142) also negatively impact the App Installation whereas Utility (0.718) positively impacts the App Installation (Table 2).

Figure 5b: PLS Path Model after applying Boot Strapping



The t-values of items of the constructs are very high which means that they all are significant and contribute in the respective constructs (Figure 5b Bootstrapping).

Table 7 R square

	R Square	R Square Adjusted	R Square	R Square Adjusted	R Square	R Square Adjusted
	Combined for Android and iOS		Android		iOS	
App Installation	0.610	0.607	0.575	0.568	0.645	0.641
Cost	0.002	0.000	0.017	0.011	0.000	-0.004
Risk	0.015	0.013	0.016	0.010	0.014	0.010

Table 8 F Square (Effect Size)

	Combined for App Installation	Android	iOS
Cost	0.074	0.040	0.104
Risk	0.039	0.046	0.038
Utility	1.149	0.905	1.417

Further, the R-square value combined for Android and iOS was 0.610 for App Installation, 0.002 for Cost, and 0.015 for Risk (Table 7). Further, when calculated for Android, the R-square for App Installation was 0.575, 0.017 for Cost and 0.016 for Risk. Lastly, for iOS, the R-square for App Installation was 0.645, 0 for Costand 0.014 for Risk. Table 8 shows f-square (effect size) where two constructs (Cost and Risk) have a common effect whereas Utility has a high effect (combined as well as individually for Android and iOS).

Table 9 Blindfolding (Predictive relevance)

	SSO	SSE	Q^2 (=1-SSE/SSO)
App Installation	1,664.000	659.746	0.604
Cost	1,248.000	603.210	0.517
Risk	1,248.000	626.928	0.498
Utility	1,664.000	967.903	0.418

Table 13 Measures of Model fit Collinearity

	Recommended value	Saturated Model	Estimated Model
SRMR	?0.1	0.063	0.143
d_ULS		0.423	2.134
d_G		0.373	0.465

Figure 5c: Blindfolding results

The results of the blindfolding procedure with omission Distance (D) value =7, the Q2 values obtained are more significant than zero as shown in Table 9 which indicated that the path model's predictive relevance is high. The highest predictive relevance was for App Installation (0.604), followed by Cost (0.517), Risk (0.498) and lastly for Utility (0.418), see Figure5c. Moreover, in this model, the value of SRMR is 0.065 which was considered as a good fit (Table 13).

Table14PLS MGA

	Path Coefficients-diff (| GROUP_OS(1.0) - GROUP_OS(2.0) |)	p-Value(GROUP_OS(1.0) vs GROUP_OS(2.0))
Cost -> App Installation	0.019	**0.600**
Risk -> App Installation	0.037	**0.338**
Utility -> App Installation	0.056	**0.302**

PLS-MGA (Partial Least Square-Multi Group Analysis) was adapted to make two groups and do the analysis related to the differences in these groups (Android and iOS). It was observed that in (Table 14),the first column shows the relationships among the constructs. The second column shows the difference in their relationships and in the third column the significant level is shown. The difference between the Android and iOS groups for Utility is 0.056, Cost is 0.019 and for Risk is 0.037. All the corresponding p-values are 0.302, 0.600 and 0.338; therefore, these differences in the Android and iOS groups are insignificant.

Mediation effect

To find the mediation effect, first, the impact of utility on App Installation was calculated without the incorporation of cost and risk as to the mediators (Figure6a) for Android (Figure6b) and for iOS (Figure6c), followed by the incorporation of the mediators. The analysis was performed for a complete sample (Android and iOS) and then separately for Android as well as for iOS. By running the Bootstrapping, it was found that this impact is highly significant for both combined and individual Android and iOS device samples (Table 15). The approach of (Kim et al., 2008b; Preacher & Hayes, 2004, 2008) and bootstrapping was performed using SmartPLS3. After the evaluation of the corresponding path coefficients' relevance and significance without the mediator in the model, it was observed that there is a very high (0.705) impact of Utility on the App Installation. The results of the bootstrapping show that this impact is the high significance (0.000).

Table15Impact of Utility on App Installation

	App Installation					
	Complete	**P-Value**	**Android**	**P-Value**	**iOS**	**P-Value**
Without Mediator	0.705	0.000	0.675	0.000	0.731	0.000
Cost as Mediator	0.689	0.000	0.632	0.000	0.736	0.000
Risk as Mediator	0.670	0.000	0.635	0.000	0.699	0.000
Cost and Risk as Mediator	0.675	0.000	0.626	0.000	0.718	0.000

Figure 6a: Impact of Utility on App installation without mediator combined for Android and iOS consumers

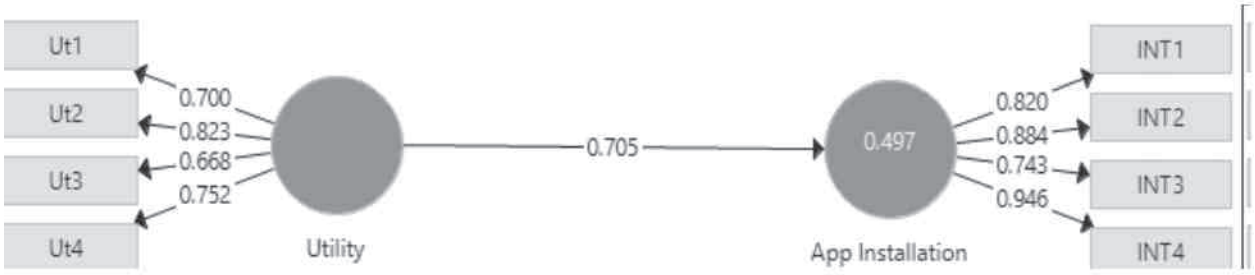


Figure 6b: Impact of Utility on App installation without mediator for only Android consumers

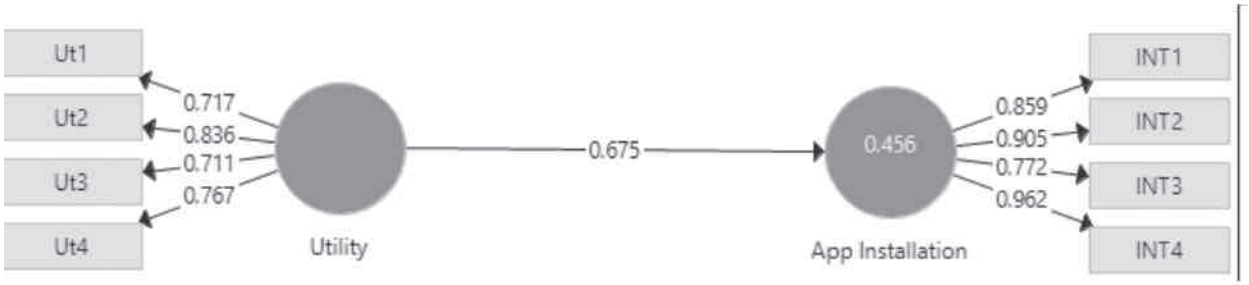


Figure 6c: Impact of Utility on App installation without mediator only for iOS consumers

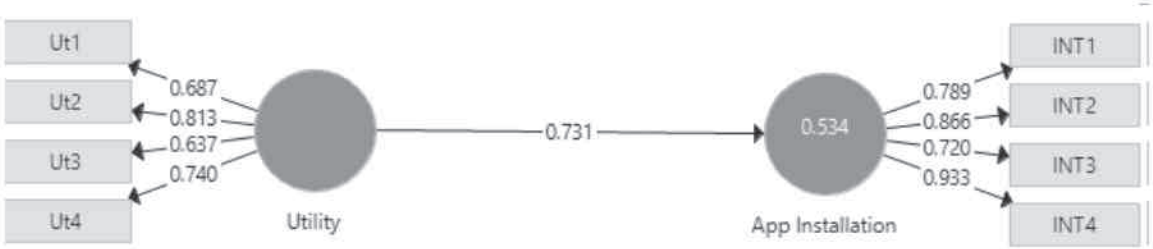


Figure 7a: PLS Algorithm results for Cost factor as a Mediator combined for Android and iOS consumers.

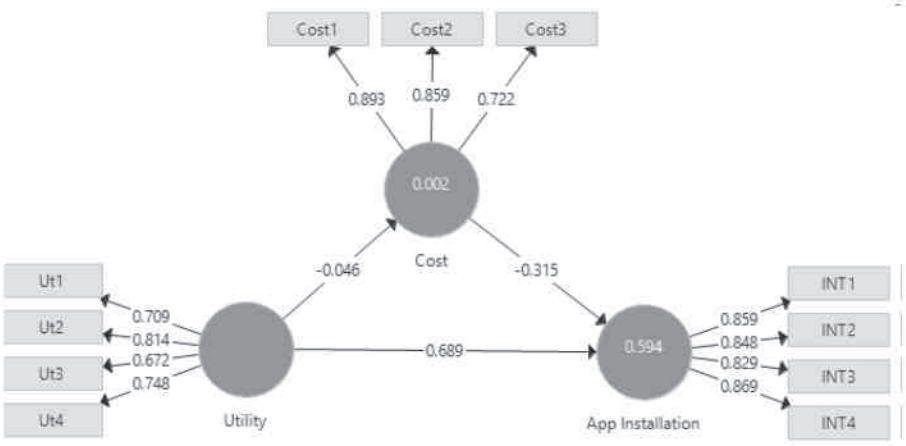


Figure 7b: PLS Algorithm results for Cost factor as a Mediator only for Android consumers.

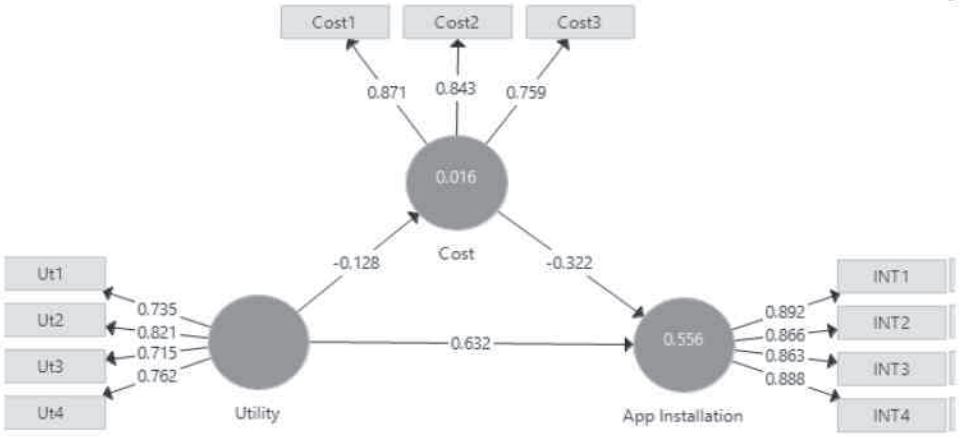
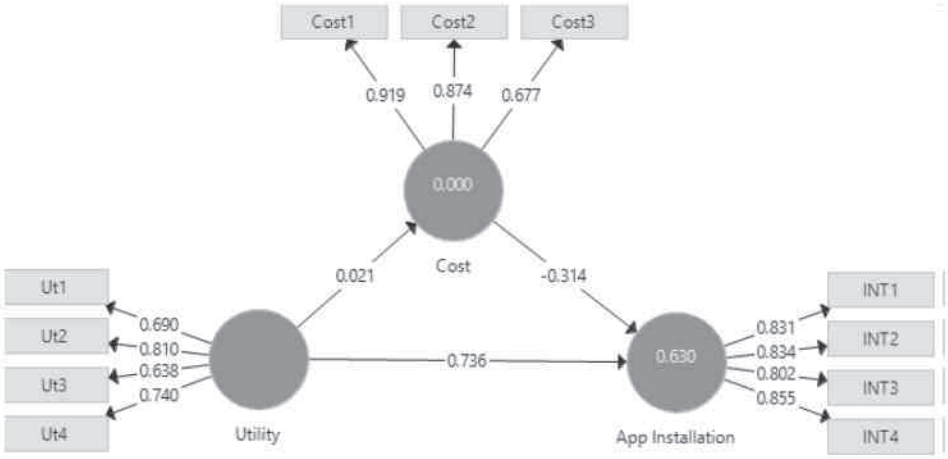


Figure 7c: PLS Algorithm results for Cost factor as a Mediator only for iOS consumers.



The individual mediator effect for Cost and Risk was calculated. After the incorporation of the first mediator (Cost), again, the path coefficients' were evaluated for relevance and significance values. First, the Cost as the mediator was inserted and found that the impact of Utility on App Installation reduces (compare Figure 6a, Figure6b, Figure6c with Figure7a, Figure7b and Figure 7c) from 0.705 to 0.689 for combined, from 0.675 to 0.632 for Android and 0.731 to 0.736 for iOS. The results of the bootstrapping after the incorporation of the mediator also shows a very high significance. Therefore it is clear that there is some mediation exists. Hence it can be said that the hypothesis H7a (Cost does not mediate between Utility and App Installation for Android) and H7b (Cost does not mediate between Utility and App Installation for iOS) is rejected.

Figure 8a PLS Algorithm results for risk factor as a Mediator combined for Android and iOS consumers.

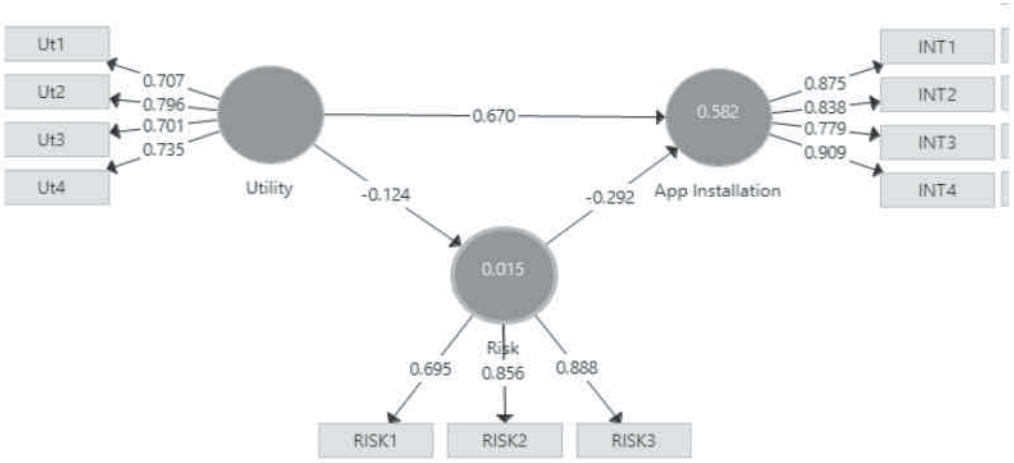


Figure 8b: PLS Algorithm results for Risk factor as a Mediator for only Android consumers.

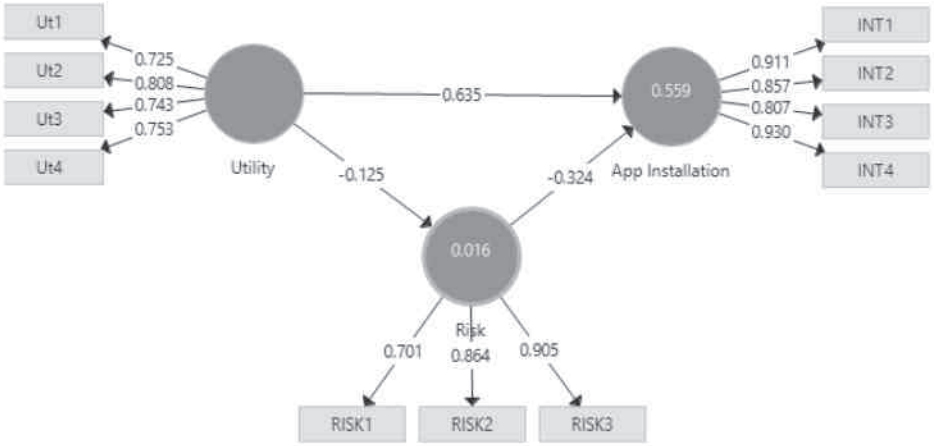
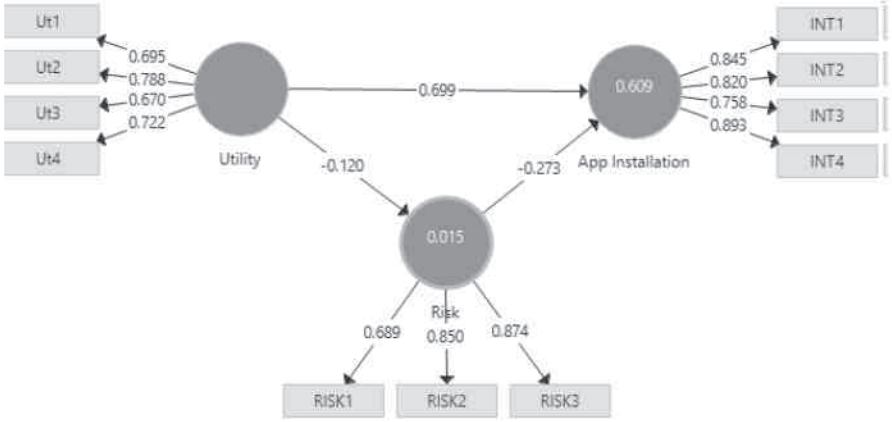


Figure 8c. PLS Algorithm results for Risk factor as a Mediator only for iOS consumers.



After the incorporation of the second mediator (Risk), again, the path coefficients' were evaluated for relevance and significance values. Similar tests were performed to test the Risk as the mediator (Figure 8a, Figure 8b and Figure 8c) and in this case, as well as the impact of Utility on App Installation changed. The impact reduced from 0.705 to 0.670 for combined, from 0.675 to 0.635 for Android and 0.731 to 0.699 for iOS (Table 15). The results of the bootstrapping after the incorporation of the mediator also show a very high significance. Therefore it is clear that there is some mediation exists but this median effect of 0.005 is so low to be considered. Hence it can be said that the hypothesis H8a (Risk does not mediate between Utility and App Installation for Android) and H8b (Risk does not mediate between Utility and App Installation for iOS) is rejected.

Figure 9a: PLS Algorithm results for Cost and Risk as mediator combined for Android and iOS consumers.

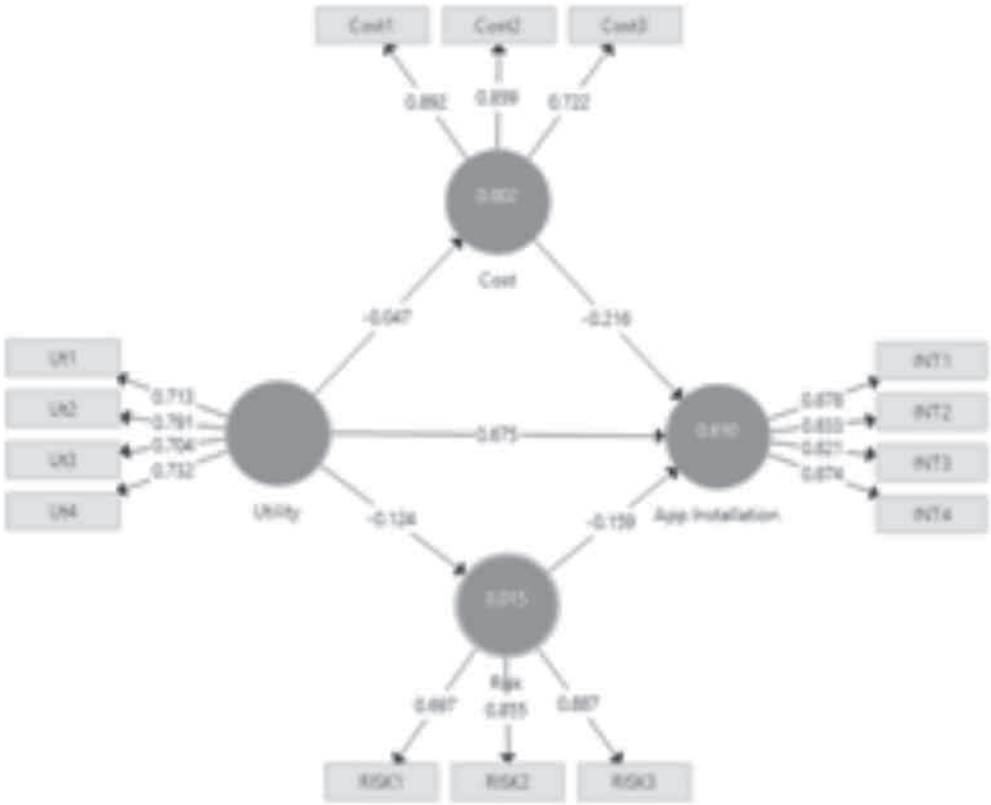


Figure 9b: PLS Algorithm results for Cost and Risk as mediator for only Android consumers.

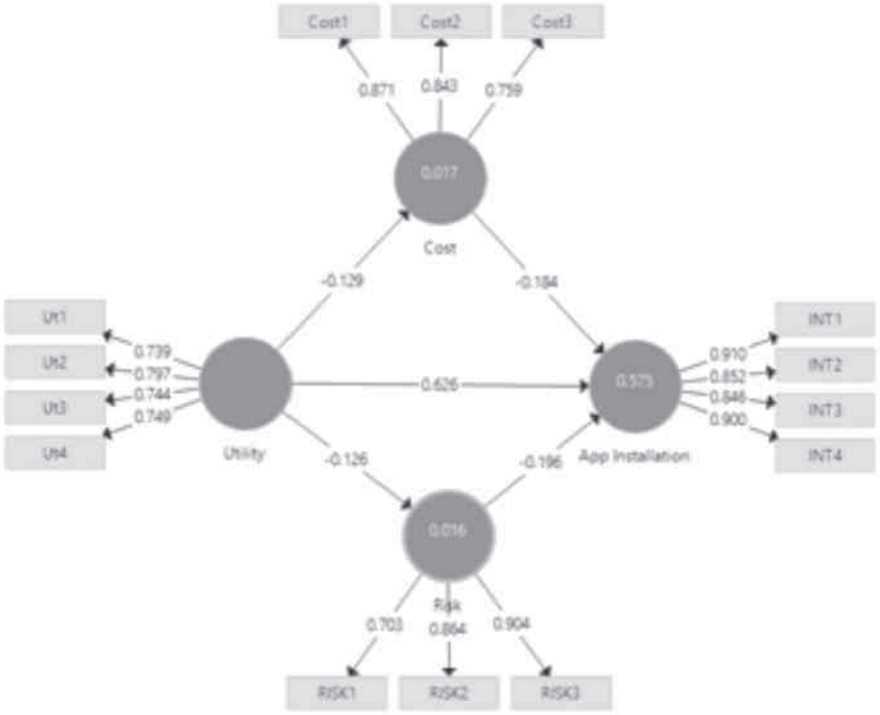
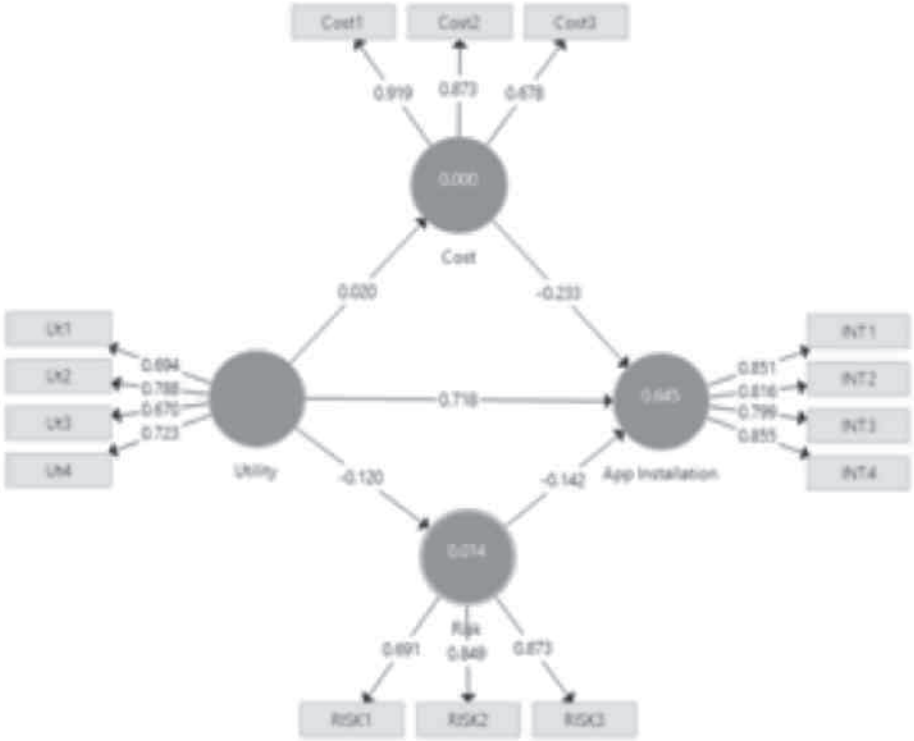


Figure 9c: PLS Algorithm results for Cost and Risk as mediator for only iOS consumers.



When both the mediators were introduced simultaneously, the impact is significantly reduced. The impact reduced from 0.705 to 0.675 for combined (Figure 9a), from 0.675 to 0.626 for Android (Figure 9b)and 0.731 to 0.718 for iOS (Figure 9c; Table 15). The results of bootstrapping shows that this indirect effect of Utility on App Installation is insignificant. So, in a nutshell, it can be said that both the mediator effect does exist on App Installation.

Discussions

The present study contributes to the understanding concerning the Saudi Arabian young population's app download intent. While making a theoretical contribution by extending and modifying the trust-based decision-making model proposed by (Kim et al., 2008b), the proposed research model identified the impact of utility, risk, and cost individually with regard to Android and iOS app stores. Moreover, the researcher also explored the mediator effect of Risk and Cost on App Installation for iOS and Android operating systems. In this study, all the factors were investigated at three levels. First, without the mediator, second by incorporating each mediator one by one and lastly by incorporating both the mediator simultaneously.

It was observed that the impact of Utility on App installation changed as the Cost factor was introduced, indicating it'smediator effect.The impact reduced for a combined user base from 0.705 to 0.689 and from 0.675 to 0.632 for Android while increasing from 0.731 to 0.736 for iOS. This increase of the impact is an indication that the consumers associate the cost factor as the surety for the security of an App. As in iOS,a higher number of Apps are paid as compared to the Android platform. Therefore consumers consider the iOS platform as more secure for App installation (Shahriar, Weldemariam, Zulkernine, & Lutellier, 2014; Virvilis, Mylonas, Tsalis, & Gritzalis, 2015). Upon introduction of Risk factor, a similar pattern of reduction in the impact of Utilityas in the case of Cost factor was observed. The impact of utility reduced from 0.705 to 0.670 for combined, from 0.675 to 0.635 for Android and 0.731 to 0.699 for iOS. The risk factor results in a more significant reduction of Utility impact as compared to Cost. Thus, it could be understood that Risk is the main factor which derives the Utility. As the risk increases, the utility reduces. In this case, also it is proved that there exists a mediator effect of Risk for the Utility and App installation. Additionally, while observing the mediation effect of both the Cost and Risk factors the impact of Utility was significantly reduced. The impact reduced from 0.705 to 0.675 for combined, from 0.675 to 0.626 for Android and 0.731 to 0.718 for iOS (Table 15). Therefore, it was seen that Cost and Risk exert mediator effect both as individually one by one and simultaneously as well.

As discussed earlier majority of apps are free to download on both Android and iOS app download platforms, therefore consumers are not much bothered about the cost of an app. Also, whenever there is any cost attached to the App Installation, the Utility of that app diminishes (Kim, 2011b). However, the present findings do not corroborate with such findings of previous research which indicate no significant impact of cost on the App Installation. These findings prove to be highly significant, which shows that Saudi Arabian consumers' behavior cannot be ignored. In their practical life, consumers are not exposed to the Cost of downloading and installing an App; therefore, this construct becomes more important for marketers. Although iOS has developed a customer base who are willing to pay for the App but that proportion is approx. 5% (Statista, 2019). Yet, the findings suggest that marketers should not charge consumers for App Installation.

Similarly, none of the App platforms can claim to be completelyRisk-free (Alepis & Patsakis, 2019; Barrera et al., 2012) and it is also evident from the results of this study as well as the past studies that Risk has negative impact on App Installation (Abdel-salam et al., 2019; Aghekyan-Simonian, Forsythe, Suk Kwon, & Chattaraman, 2012; Chuang, 2019; Forsythe & Shi, 2003; Kim et al., 2008b; Shen, 2015). In this study, the researcher has statically proved that there exists a mediator role of Risk on the App installation. Further, no distinction in terms of Android and iOS operating systems security was observed and the impact of utility gets similar reduction statically as was observed by similar researches (Ahmad, Musa, Nadarajah, Hassan, & Othman, 2013b; Wukkadada, Nambiar, & Nair, 2015).

For iOS, Cost, Risk, and Utility are the significant factors for the App installation. Cost and Risk are negative whereas Utility has a positive impact on App installation (Table 2). This result shows that even for the iOS, Cost has a significant impact on App installation as in the case of Android users. Cost and Risk have negative but Utility has a significantly positive impact on both iOS and Android platforms. Risk being adverse in both iOS and Android platforms, but it is insignificant in Android whereas significant in iOS. This means that the Android users are less conscious about the risk factors as compared to the iOS users as they considered it to be safe (Ahmad et al., 2013b). As the results suggest that although it is negative in both the cases, it is significant for iOS and insignificant for Android (Table 2).

Table 16 Hypothesis testing

Hypothesis	Path coefficients	P-Values	
H1a: There is no significant impact of Utility on App Installation for Android smart devices.	0.626	0.000	Rejected
H1b: There is no significant impact of Utility on App Installation for iOS smart devices.	0.718	0.000	Rejected
H2: There is no difference in Utility of an App among Android and iOS.	0.056	0.302	Rejected
H3a: There is no significant impact of Cost on the App Installation for Android OS.	-0.184	0.029	Rejected
H3b: There is no significant impact of Cost on the App Installation for iOS.	-0.233	0.000	Rejected
H4: There is no difference in cost of an App Installation among Android and iOS.	0.019	0.600	Rejected
H5a: There is no significant impact of Risk on the App Installation for Android OS.	-0.196	0.064	Accepted
H5b: There is no significant impact of Risk on the App Installation for iOS.	-0.142	0.015	Rejected
H6: There is no difference in Risk of an App Installation among Android and iOS.	0.037	0.338	Rejected
H7a: Cost does not mediate between Utility and App Installation for Android OS.	0.632	0.000	Rejected
H7b: Cost does not mediate between Utility and App Installation for iOS.	0.736	0.000	Rejected
H8a: Risk does not mediate between Utility and App Installation for Android OS.	0.635	0.000	Rejected
H8b: Risk does not mediate between Utility and App Installation for iOS.	0.699	0.000	Rejected

The R-square value is a statistical measure that represents the proportion of the variance for a dependent variable (App Installation) that's explained by an independent variable (Cost, Risk, and Utility). In this case, the R2 value for Cost is zero which means that this construct is not contributing to the decision to install an App. The proposed model was utilized to investigate eight hypotheses to predict the dependent construct (App Installation). While the hypothesis H5a was accepted, all the rest of the hypotheses were rejected (Table 16).

Conclusions

The results of this study have significant implications for app developers and app market business in Saudi Arabia. As Saudi Arabia is poised as an emerging intelligent market with rapidly increasing consumers of smart technology, the companies are providing apps with higher capacity, usability, and quality. Thus, to align the consumers' intent with app installation, it is essential to understand the associated antecedents. As both Cost and Risk are almost equally reducing the App Installation amongst consumers in Saudi Arabia, the businesses have to think ways to skip the cost aspect while installing an App and device a risk-free webspace so as to encourage the App Installation but as Harris et al., (2015) says that there cannot be any webspace without the risk. Therefore, risk can only be reduced and cannot be eliminated fully (Al-Qershi, Al-Qurishi, Md Mizanur Rahman, & Al-Amri, 2014).

The simplified and reduced model utilized in the present research helped understand and compare the behaviors of Android and iOS users separately in a precise manner. By comparing the impact of Cost and Risk on Utility of the app, it was understood that both the factors influence the app download intent of iOS and Android users. However, iOS users show higher aversion to risk and higher adoption of paid apps as compared to android users. Among the two mediators, Risk has a higher impact on reducing the utility for app Installation as compared to the Cost. However, Harris et al., (2015b) have found risk in every App install; it may be low to high depending upon the source of App Installation. This can be understood in a way that the consumers are willing to pay for an app and Install it rather than encounter the Risk (Wukkadada et al., 2015) or in other words. It can be concluded that consumers are willing to pay the cost of an App in order to avoid the risk factors associated with the App Installation. This novel insight into the cost of app installation related to the intent to download the app in the Saudi Arabian population is an important finding. Earlier research shows the role of attitude, perceived behavior control, trust, subjective norms, security, privacy (Alatawy, 2018; Alkhalid, 2016); however cost factor remains elusive.

Limitations and Future research directions

Unlike any research, this study also has some limitations and market implications. First of all, as the sample size of this study is 416, although this sample size is sufficient for the SmartPLS statistical software and techniques used in for this study, in future, researches could conduct this study employing a larger sample size which may strengthen some of the insignificant relationships of the constructs. Furthermore, a sample can be a more diverse sample and collected from different universities, as well. Similar studies are possible for diverse demographic groups like gender, age, education and others. Another limitation could be the introduction of new items of the questionnaires. These items may have resulted in the weak loadings in the constructs.

For future researches on App Installation, it is suggested to include more constructs that lead to App Installation. With the advent of new Apps and new challenges are evolving in this dynamic environment. Another suggestion can be the use of a seven, nine, or ten-point Likert scale instead of a five-point Likert scale employed in the present study although Preston & Colman (2000) suggest that seven, nine, and ten-point scales are preferable for such studies but not employed in this study. A final suggestion for future research is to establish the Cost and Risk interconnected model to show the relationship among all constructs of the model.

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Appendix A: questions to measure the App Installation

Constructs	Items of the questionnaire	Mean	Standard Deviation	Loadings	Adapted From
Cost	The price that I pay for the App is acceptable for me.	1.485	0.594	0.885	New
	I like the price paid for this App	1.464	0.643	0.917	New
	I am ready to install this app for this price	1.505	0.628	0.879	New
Risk	Installing an app from this app market involves more no risk as compared to other markets	1.629	0.678	0.875	(Shen, 2015)
	The decision to install an app from this market is not risky	1.608	0.712	0.905	(Chopdar, Korfiatis, Sivakumar, & Lytras, 2018)
	I believe installing an app from this market cannot be harmful	1.598	0.684	0.9	(Ozturk, Nusair, Okumus, & Hua, 2016; Rauschnabel, Rossmann, & tom Dieck, 2017)
Utility	I think using this Website is convenient.	4.515	0.611	0.842	(Davis, 1989; Swaminathan, Lepkowska-White, & Rao, 1999)
	Using this Website increases my productivity in shopping (e.g., make purchase decisions or find product information within the shortest time frame)	4.546	0.538	0.848	(Davis, 1989)
	I can save money by using this Website	4.485	0.628	0.735	Kim, D., Ferrin, D., & Rao, R. (2008)
	Using this Website enables me to accomplish a shopping task more quickly than using traditional stores	4.474	0.558	0.883	Kim, D., Ferrin, D., & Rao, R. (2008)
App Installation	I am ready to install this app from the App Market	4.412	0.588	0.901	New
	I will continue downloading App from App Market	4.434	0.656	0.875	(Gong, Liu, Zheng, & Wu, 2018)
	Apps are fun to download	4.485	0.594	0.908	New
	I always download new Apps whenever available	4.439	0.635	0.924	New