Dependency on Smartphones: An Analysis of Structural Equation Modelling

Norazah Mohd Suki[a*], Norbayah Mohd Suki[b]

[a]*Sekolah Perniagaan dan Kewangan Antarabangsa Labuan, Universiti Malaysia Sabah, Malaysia*
[b]*Sekolah Sains Informatik Labuan, Universiti Malaysia Sabah, Malaysia*

*Corresponding author: azahsuki@yahoo.com

Abstract

This study aims to examine the influence of social needs, social influences and convenience of smartphone on students' dependency on smartphones. A total of 200 completed and usable questionnaires were received from the respondents which comprises of students from one of the public higher education institution in Federal Territory of Labuan, Malaysia by utilizing simple random sampling method where every unit in the population have an equal chance to be selected in the sample. Results via the analysis of structural equation modelling (SEM) show that the relationship between social needs, social influences and convenience of smartphone with dependency on smartphone were supported. The first was found to be the strongest effect. A strong relationship also existed between students' dependency on smartphone and their purchase behavior. Based on the findings, the implications are discussed in the paper and directions for future research are also highlighted.

Keywords: Social needs; social influence; dependency; smartphone; purchase behaviour; structural equation modelling

Abstrak

Kajian ini bertujuan untuk mengkaji pengaruh keperluan sosial, pengaruh sosial dan kemudahan telefon pintar terhadap pergantungan pelajar pada telefon pintar. Sebanyak 200 soal selidik yang lengkap telah diterima daripada responden yang terdiri daripada pelajar dari salah satu institusi pengajian tinggi awam di Wilayah Persekutuan Labuan, Malaysia dengan menggunakan kaedah persampelan rawak di mana setiap unit dalam populasi mempunyai peluang yang sama untuk dipilih sebagai sampel. Keputusan melalui analisis yang menggunakan model persamaan struktur (SEM) menunjukkan bahawa hubungan antara keperluan sosial, pengaruh sosial dan kemudahan telefon pintar dengan pergantungan pelajar pada telefon pintar adalah disokong. Keperluan sosial mempunyai kesan yang sangat kuat. Satu hubungan yang kuat juga wujud antara pergantungan kepada pembelian telefon pintar dan tingkah laku pembelian pelajar. Berdasarkan hasil dapatan kajian, implikasi dan cadangan untuk kajian akan datang juga ada dibincangkan.

Kata kunci: Keperluan sosial; pengaruh sosial; pergantungan; telefon pintar; tingkah laku pembelian; model persamaan struktur

■1.0 INTRODUCTION

Smartphone, a programmable mobile phone, offers advanced capabilities and features that help individuals in their daily work and personal life [1]. Smartphone is an information technology tool to perform mobile Internet [2], which capable of accessing Internet at broadband speed ranging from 144 kbps to 2MBps or more [1]. Smartphone sales showed a strong growth in 2012 whereby 154 million unit smartphones sold to end users as of August 2012, with Apple and Samsung contributing to these positive sales [3]. The most universal mobile operating systems (OS) used by modern smartphones including Apple's iOS, Google's Android, Microsoft's Windows Phone, Nokia's Symbian, RIM's and BlackBerry OS. It is noted by Jacob and Isaac [4] that student of university is one of the highest contributors on the increasing number of smartphone demand sales.

Factor that influence the number of acceptance toward the smartphone usage is because the functionality that can help user in their daily life especially for business people and student in the university. This has lead on the research of what factors that shaping the student willingness to purchase the smartphone. As a consequence, this research aims to examine the influence of social needs, social influences and convenience of smartphone on students' dependency on smartphones. It is also important to examine whether students' dependency on smartphones influences their purchase behavior. Results derived from this

study could furnish statistical evidence in terms of research findings to the smartphone provider in meeting customers demanding needs to better create up-to-date smartphone with recent features through holistic strategic marketing management and planning.

The remainder of the paper is organized as follows. In the next section, the literature review and proposed model with hypotheses are discussed. Then, this study described the methodology, the sample and data collection, and the measurements of the constructs. This is followed by a test of a proposed model using structural equation modelling (SEM) where the reliability of the measurement and the results of SEM are shown in this section. Finally, the conclusion and implications about the findings, and future studies are described in section five.

■2.0 LITERATURE REVIEW

Consumer has become highly dependent on smartphones as it is with them when they commute, relax at home, travel overseas and so on [5]. Featuring contains such as instant messaging, downloading application, utilising information services such as WiFi and global positioning system (GPS) and entertainment [1], smartphones have seen an increase in terms of demand due to the popularity and functions offered in the phones [2]. Genova [5] stated that smartphones can be use at anytime and any place. Relative advantage and ease of use of smartphone are the innovation characteristics that frequently being investigated [6]. The influence of social needs, social influences and convenience of smartphone on ones dependency on smartphones is described below.

2.1 Social Needs

Social needs including ones love, affection, belonging and acceptance [7]. Smartphone are significantly varying the way people live on how people shop, buying, searching, playing and connect to the world [8] besides developing and expanding sense of affection among circle of friends and family members. Smartphone devices are programmed with various software tools which allow the users to interact with other users more efficiently and effectively without geographical limitations globally [9]. Smartphone offer larger and higher resolution screen and provide consumers with tremendous array of features, including mobile web browsing, thousands of applications, email, instant messaging, picture messaging, video and audio playback, GPS, games, a video camera, picture and video editing, and much more [8]. In Peterson and Low [10]'s study, almost three quarter of the students stated that they enjoyed with the contract or package provided by the smartphone provider which provides them with unlimited Internet access to their mobile phone or a limited Internet services which is sufficient for their needs. In view of that, the study hypothesizes that:

H1. Social needs significantly affect the students' dependency on smartphones.

2.2 Social Influences

Social influence is related to the way other people affect one's beliefs, feelings and behavior [11]. It is likely that the individual will adopt the particular thought, attitude, feeling and behavior as well [12]. Thus, consumers may be susceptible to social influence by observations, perceptions or anticipations of decisions made by others in engaging to smartphones [13]. Consumers are dependent on their smartphones when they have high continuous usage and reluctant to be part from it [14]. Thus, consumer's expectations for future purchase behavior will be affected by their past experience as they heavily dependent on smartphones because of the underlying motives [15]. Friends and family members are seen as social influences that are perceived to be important to consumers in promoting and encouraging a greater dependency on smartphone [16]. Schiffman *et al*. [7] stated that the influences of social class, culture and subculture although are less tangible are important input factors that are internalized and affect how consumers evaluate and adopt products. According to Smura, Kivi, and Toyli [17], in most developed countries, mobile phone have become an inseparable part of everyday life and a majority of people carry them all the time. Suki and Suki [13] found that heavy mobile phone users possess a higher level of knowledge, have more social participation, maintain extensive interpersonal networks, and have contact with people not only within the social system but also outside it. This is supported by Peterson and Low [10] who stated that student look at websites, check their e-mail and use social networking sites such as Facebook and Twitter most often. An intention to buy a brand is based on a consumer's attitude towards buying the brands as well as the influence of social norms about what other people expect [18]. Therefore, it is hypothesized:

H2. Social influences significantly affect the students' dependency on smartphones.

2.3 Convenience of Smartphone

The smartphone allows users to do thing that never thought could be done without being tethered to a home or office computers, from comparing store prices and searching for restaurant reviews to checking into a hotel and social networking [8] at anytime and anywhere. With smartphone and free software downloaded inside it, users can swipe the barcode of a product in the physical store and then the product information and company information can be generated automatically and promptly in real time. By means of smartphone, consumers can easily and quickly shop for products across multiple channels with substantially greater level of convenience, flexibility, efficiency and personalisation [19]. This showed that advances in mobile technologies do provide promising further benefits [17]. Accordingly, the study hypothesized that:

H3. Convenience of smartphone significantly affects students' dependency on smartphone.

2.4 Dependency on Smartphone

Peterson and Low [10] stated that smartphone ownership and use of the Internet among student is rising. This is supported by Wong [20] stated in his work that the mobile revolution is changing people rapidly from using ordinary mobile phone to smartphone whether in developed and developing countries and people are inseparable from their smartphone and they are more likely to use mobile technologies to access different type of information. Peterson and Low [10] describe that there is a high percentage of student upgrade their mobile phone in the next 12 months to a smartphone, indicating a positive take up. Hence, the following hypothesis is proposed:

H4. Dependency on smartphone significantly affects students' purchase behavior.

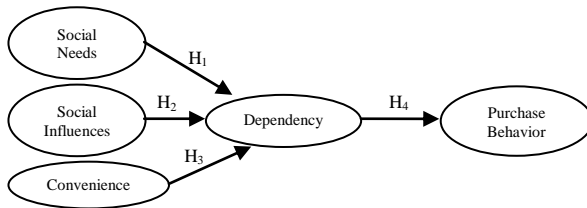This study proposes the research framework as shown in Figure 1.

Figure 1 Theoretical framework

■ **3.0 METHODOLOGY**

A total of 200 completed and usable questionnaires were received from the respondents which comprises of students from one of the public higher education institution in Federal Territory of Labuan, Malaysia by utilizing simple random sampling method where every unit in the population have an equal chance to be selected in the sample. The study sample included respondents who are holding smartphone, known as Generation Y who are considered as members of a digital generation who actively involved in online social networking. Data were collected by conducting survey between January 15 and February 15 of 2012 (about 1 month). Qualitative research design lean towards utilizing small sample sizes [21]. A survey instrument was designed to ask respondents about their experience and perception with smartphone.

Measurements of items were adapted from Ting, Lim, Patanmacia, Low, and Ker [22] and were used to operationalise research constructs in this study. Social needs and social influences were measured using four items each. Convenience and dependency on smartphone were measured by five items. Purchase behavior was measured by four items. Each item was measured on a five-point Likert scale (i.e. 1 = disagree strongly; 5 = agree strongly). The Statistical Package for the Social Sciences (SPSS) computer program version 17.0 was used for statistical analysis and to attain the statistic data for this study. Descriptive statistics was applied to provide the profile of the respondents. The structural equation modelling (SEM) was used to examine the hypothesized relationships among the constructs in this study.

■ **4.0 RESULTS**

Table 1 depicts the descriptive analysis of demographic profile of respondents. 49% of the respondents were male compared to 51% female. A large number of respondents came from the age group of 20 years old and above (97.5%). Students undertaking bachelor degree represented the largest number of respondents with 68%, followed by students holding STPM 19.5% and Diploma with 10%.

4.1 Structural Equation Modelling

SEM using maximum likelihood estimation was utilized to verify the research framework and hypotheses. SEM techniques examine the covariance structure and relationships between and among latent variables. SEM does not assume variables are accurately measured and includes an estimate of measurement error. SEM includes two levels of analysis: the measurement model and the structure model. AMOS 5.0 was the computer software used to examine these models.

Table 1 Demographic profile of respondents

	Frequency	Percentage
Gender		
Male	98	49.0
Female	102	51.0
Age		
< 19 years	5	2.5
20 - 23 years	158	79.0
24 - 27 Years	37	18.5
Education level		
SPM	5	2.5
STPM	39	19.5
Diploma	20	10.0
Degree	136	68.0

4.2 The Measurement Model

The measurement model was estimated to determine whether the intended constructs are measured by the underlying latent variables in the hypothesized model. It is necessary to determine that the measurement model has a satisfactory level of validity and reliability before testing for a significant relationship in the structural model [23]. The psychometric properties of the model in terms of reliability, convergent validity and discriminant validity were evaluated via Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) model.

4.3 Exploratory Factor Analysis

Exploratory factor analysis using principal component analysis is performed to the test the validity of the constructs. The item loadings of the constructs as portrayed in Table 2 are more than 0.50, a cut-off point suggested by Hair, Black, Babin, Anderson, and Tatham [24], thus corroborating that the constructs are unidimensional and factorially distinctive [25]. One item each from social influences and convenience factor i.e. 'I would be open to be persuaded into using a smartphone if I had low self-esteem', and 'Using a smartphone would allow me to accomplish task more quickly' were deleted as it does not load heavily to the factor and due to the small coefficients of absolute value below 0.50. Next, results also itemise that the Cronbach's alpha value of all variables are greater than 0.70, thus confirming that the measurement of this study is acceptable in reliability.

4.4 Construct Reliability

Composite reliability (CR) for the CFA model was used to measure the reliability of a construct in the measurement model. CR offers a more retrospective approach to overall reliability and estimates consistency of the construct itself, including the stability and equivalence of the construct [24]. The reading of CR for all the latent variables was above the threshold value of 0.70 (see Table 3), i.e. greater than the benchmark stated by Hair *et al.* [24], indicating the high internal consistency of scales and the reliability of the latent variables.

Table 2 Exploratory factor item loadings

Items	Factor Loadings
Social Needs (Cronbach's Alpha = 0.860)	
Smartphone allows me to stay connected with those I care about.	.833
I use smartphone to stay connected with friends and family through social networking web sites (Twitter, Facebook, MySpace and etc.).	.801
It is easy for me to observe others' happening by using the smartphone.	.788
I use my smartphone to catch up with friends and relatives.	.767
Social Influence (Cronbach's Alpha = 0.722)	
The pressure from friends and family is likely influence the usage rate of smartphone.	.932
It is important that my friends like the brand of smartphone I'm using.	.868
I would buy a smartphone if it helped me fit in with my social group better.	.847
I would be open to be persuaded into using a smartphone if I had low self-esteem.*	
Convenience (Cronbach's Alpha = 0.896)	
Having a smartphone is like having both a mobile phone and a computer together.	.807
In my work, smartphone saves me time and effort.	.802
I would prefer carrying my smartphone rather than my laptop.	.741
A smartphone enables me to receive learning materials anywhere I go.	.717
Using a smartphone would allow me to accomplish task more quickly.*	
Dependency on Smartphone (Cronbach's Alpha = 0.848)	
I always use my smartphone to deal with my job.	.917
I'm totally depending on my smartphone.	.917
I cannot do anything without the smartphone.	.833
I will feel insecure when my smartphone is not with me.	.801
In my daily life, usage of smartphone is high.	.738
Purchase Behavior (Cronbach's Alpha = 0.809)	
I intend to keep continuing use smartphone in the future.	.883
I intend to have a better purchase of smartphone in the future from my experience.	.822
On the whole, I'm satisfied with the smartphone experience.	.814
Overall, my positive experience outweighs my negative experience with smartphone.	.804

Table 3 Reliability and confirmatory factor item loadings

Constructs	Items	Standardized Loadings	Composite Reliability	Average Variance Extracted
Social Needs	C1	.539	0.802	0.518
	C2	.515		
	C3	.830		
	C4	.909		
Social Influences	D1	.776	0.877	0.708
	D2	.990		
	D3	.735		
Convenience	H2	.690	0.749	0.435
	H3	.596		
	H4	.817		
	H5	.492		
Dependency	F2	.551	0.772	0.549
	F3	.998		
	F4	.589		
Purchase Behavior	G1	.684	0.850	0.590
	G2	.680		
	G3	.895		
	G4	.793		

4.5 Convergent Validity

Convergent validity shows the extent to which indicators of a specific construct converge or have a high proportion of variance in common [24]. This validity measured using standardized factor loadings and average variance extracted (AVE). The factor loadings of latent to observed variable should be above 0.50 [24]. Two items from dependency on smartphone factor (i.e. 'I always use my smartphone to deal with my job', and 'In my daily life,

usage of smartphone is high' were removed as its standardized factor loadings below 0.50. The result of the CFA in Table 3 infers that the standardized factor loadings of all observed variables are adequate ranging from 0.515 to 0.998. This finding indicates that the constructs conform to the convergent validity. Next, all AVE values in Table 3 are above the recommended 0.50 level [24], thus demonstrates convergent validity. This implies that more than one-half of the variances observed in the items were accounted for by their hypothesized factors. Overall, the convergent validity test indicates that the proposed constructs of the model are adequate.

4.6 Discriminant Validity

Discriminant validity shows the extent to which a construct is truly distinct from other constructs [24]. If the items in a construct correlated more highly with each other than with items measuring other constructs, the measure was regarded as having discriminant validity. A commonly used statistical measure of discriminant validity is a comparison of the AVE value with correlation squared [23]. Table 4 shows the correlation matrix for the constructs. The correlation estimates indicate significant two-way correlation between specified variables. All of the correlations between variables were less than 1 and statistically significant at the $p<0.05$ level, confirming a positive correlation among variables. Social needs ($r = 0.862$, $p<0.01$) turned out to have the highest association with students' dependency on smartphone. Students' dependency on smartphone is significantly correlated with purchase behavior ($r = 0.911$, $p<0.01$).

Table 4 Correlations analysis between variables

	1	2	3	4	5
(1) Social Needs	0.720				
(2) Social Influence	0.123	0.841			
(3) Convenience	0.144(*)	0.078	0.660		
(4) Dependency	0.862(**)	0.130(*)	0.089(*)	0.741	
(5) Purchase Behavior	0.866(**)	0.164(*)	0.107	0.911(**)	0.768
Mean	2.633	3.648	3.80	2.629	2.620
Std. Deviation	0.956	0.910	0.633	0.991	0.930
Skewness	0.351	-0.598	-0.849	0.227	0.566
Kurtosis	-0.771	-0.041	1.310	-0.757	-0.234

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

The diagonal elements in the correlation matrix in Table 4 have been replaced by the square roots of the AVE. For discriminant validity to be considered satisfactory, these diagonal elements should be larger than the off-diagonal elements in the related rows and columns. Thus, discriminant validity is justified in this study and appears satisfactory, i.e. multicollinearity is absent. The skewness of all the items ranges from -0.598 to 0.566, below ±2.0. Similarly, the values for kurtosis ranges from -0.041 to 1.310 well below the threshold of ±10. Both the skewness and kurtosis are well below the said threshold, implying that the scores approximate a "normal distribution" or "bell-shaped curve".

4.7 The Structural Model

A structural model was estimated to provide an empirical measure of the hypothesized relationships among the research variables and constructs by performing a simultaneous test. The structural model can be evaluated by two indices. The first one are the path coefficients (β) which show the strength of relations between independent and dependent variables, and the second are the values of R^2 which show the values of variances explained by

independent variables and reflect the predictive power of the model. To assess the model, multiple fit indices were computed (see Table 5).

Table 5 Goodness-of-fit indices for structural model

Fit Indices	Recommended Level of Fit	Model Value
Absolute Fit Measures		
χ^2 (Chi-square)		253.472
df (Degrees of Freedom)		213
Chi-square/df (χ^2/df)	< 3	1.190
GFI (Goodness of Fit Index)	> 0.9	0.931
RMSEA (Root Mean Square Error of Approximation)	< 0.08	0.057
Incremental Fit Measures		
AGFI (Adjusted Goodness of Fit Index)	> 0.80	0.911
NFI (Normed Fit Index)	> 0.90	0. 945
CFI (Comparative Fit Index)	> 0.90	0. 979
IFI (Incremental Fit Index)	> 0.90	0. 928
RFI (Relative Fit Index)	> 0.90	0. 973
Parsimony Fit Measures		
PCFI (Parsimony Comparative of Fit Index)	> 0.50	0. 845
PNFI (Parsimony Normed Fit Index)	> 0.50	0. 831

There are three types in the overall model fit measures: absolute fit measures, incremental fit measures, and parsimonious fit measures. In this study, two model fit measures by each overall model fit type were selected. Of absolute fit measures, GFI ($\geq$0.90 is recommended) and RMSEA ($\leq$0.08 recommended) were selected. In this study, as shown in Table 5, GFI had a value of 0.931 and RMSEA had a value of 0.057 which was acceptable. Of incremental fit measures, IFI ($\geq$0.90 recommended) and NFI ($\geq$0.90 recommended) were selected. Both, IFI = 0.928 and NFI = 0.945 exceeded the recommended levels. And, of parsimonious fit measures, PCIF (0.5> or <0.9 recommended) and PNIF (0.5> or <0.9 recommended) were used. Both, PCIF = 0.845 and PNIF = 0.831 also fell within the recommended levels. Comparison of all the fit indices with their corresponding recommended values provided evidence of a good model fit. Hence, all indices suggest that the hypothesized structural model fits the data reasonably well.

Properties of the causal paths for the structural model (standardized path coefficients (β), standard error, and hypotheses result) are indicated in Table 6. The level of significance (α) was set at 0.05. R^2 values can be utilized to assess the strength of the proposed model. The results of the multivariate test of the structural model show that the social needs, social influences and convenience as a whole explained 66.8% of the variance in students' dependency on smartphone. Next, students' dependency on smartphone explained 71.2% of the variance in the purchase behavior. Figure 2 shows the path diagram with the structural model estimates included on the paths, where the estimate parameters are standardized path coefficients and all path coefficients are significant at the 95% level.
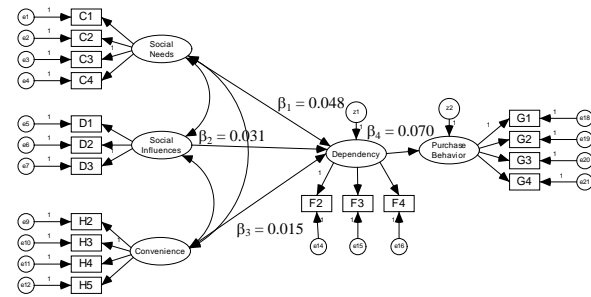

Figure 2 The result of structural model

Table 6 exemplified that the most significant finding was found in relation to the social needs factor (β_1 = 0.048; p<0.05), which was confirmed as the most important predictor of students' dependency on smartphone. Next, there was also support for H2 indicating that social influences do affect students' dependency on smartphone (β_2 = 0.031; p<0.05). H3 was also supported as convenience was the third most significant factor in explaining students' dependency on smartphone (β_3 = 0.015; p<0.05). Furthermore, the data in Table 6 confirmed the importance of students' dependency on smartphone in influencing their purchase behavior (β_4 = 0.070; p<0.05). These results provided support for hypothesis H4.

Table 6 Summary of hypotheses testing results

Path			β	S.E.	C.R.	p	Results
Social Needs	--->	Dependency	0.048	0.036	-0.622	0.045*	Supported
Social Influences	--->	Dependency	0.031	0.032	0.436	0.039*	Supported
Convenience	--->	Dependency	0.015	0.087	0.189	0.034*	Supported
Dependency	--->	Purchase Behavior	0.070	0.145	0.923	0.036*	Supported

Note: β = standardized beta coefficients; S.E. = standard error; C.R. = critical ratio; *p< 0.05

■5.0 DISCUSSION

This study aims to examine the influence of social needs, social influences and convenience of smartphone on students' dependency on smartphones. The estimation of the structural model indicated that all hypotheses were supported and consistent with expectations, because the hypothesized relationship was significant (p<0.05) and in the anticipated direction. Social needs have significant direct effect on students' dependency on smartphone, implying they heavily and actively use smartphone to stay connected with friends and family through social networking web sites such as Twitter, Facebook, MySpace and etc.). In other words, smartphone allow them to stay connected with those they care about. Interestingly, smartphone bring easiness for them to observe what's happenings globally at any time 7 days a week, 24 hours a day, and 367 days a year. This significant result is analogous with Auter [16] and Donahue [26]'s study.

Instead, this research found that social influences play significant role in students' dependency on smartphone. The result demonstrates that social influences such as pressure from friends and family do influence students' usage rate of smartphone. Indeed, they do concern whether their friends like the brand of smartphone they are currently using and would buy a smartphone if it helped them to fit in with their social group. The finding is in coherence with discovery by Park and Chen [2]. Given that the results found that convenience is another important factor in affecting students' dependency on smartphone Having a

smartphone is like having both a mobile phone and a computer together, it enables them to receive learning materials anywhere they go and prefer carrying smartphone rather than laptop. Preceding research by Goldman [8] found comparable finding.

Further investigation of the study regarding the influence of students' dependency on smartphone with purchase behavior divulge consistent results with Nanda, Bos, Kramer, Hay, and Ignacz [27] whereby there is significant relationship between both variables. Results imply that students' are deeply depending on the smartphone which cause them to feel insecure when smartphone is not with them, hence positive experience with smartphone has outweighs their negative experience as their usage of smartphone is high.

◼6.0 CONCLUSION AND RECOMMENDATION

This study examined the influence of social needs, social influences and convenience of smartphone on students' dependency on smartphones. All in all, results through SEM concluded that all hypotheses were supported. Social needs have the strongest effect on the students' dependency on smartphone, followed by social influences and convenience. Next, it is worthy to note that a very strong relationship exists between students' dependency on smartphone and their purchase behavior. Prior research by Woodcock, Middleton, and Nortcliffe [28] indicated that most students have not made strong connections for themselves between their personal smartphone technology, their needs as learners and the way they learn. One of factor that affecting convenience factor is the speed of the Internet connection at the university and the availability of Wi-Fi services which is one of the important thing to use for some of smartphone application. Nevertheless, Woodcock *et al.* [28] suggested that academics and educational developers need to enhance the students' acceptance on the usage of personal technologies such as smartphone and tablet PCs to enlightening their learning process. On the smartphone provider side, they are recommended to continuously increase the smartphone functionality to be of relevant among students.

There are a few limitations that might limit the current research findings, which is the sample was only distributed among 200 students from one of the public higher institution in Federal Territory of Labuan, Malaysia and it have limiting research finding regarding the influence of students' purchased behavior towards smartphone. It is recommended to widen the coverage of sample selection to improve the generalizability of the result and to provide more accurate and holistic results. Future study should be conducted across student regardless university level or secondary level in Malaysia to earn more accurate and holistic results of buying behavior factor and to reflect different cultures among university students. A comparison between different cultural groupings would have will guide on the differences and similarities on how smartphones are perceived and used among students. Furthermore, this research brings implication in terms of it employed qualitative research design which provides insight and in-depth understanding related to the research objective involved. This type of research design has been positively acknowledged by preceding researchers [21; 29-30].

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