Product Innovation, Customer Satisfaction, and Brand Loyalty of Using Smartphones Among University Students : PLS – SEM Approach

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Abstract

This paper examined the impact of product innovation attributes (relative advantage, complexity, compatibility, trialability, and observability) on customer satisfaction and brand loyalty together with gender as a moderator between customer satisfaction and brand loyalty. Based on a sample of 193 university students using partial least square structural equation modeling (PLS-SEM) technique, relative advantage, complexity, compatibility, trialability, and observability were found to positively impact customer satisfaction. The results also demonstrated that product innovation attributes were the key predictors of customer satisfaction. The results revealed that loyal customers utilized the services of specific smartphones as per their preferences consistently. Additionally, the results illustrated that customer satisfaction significantly influenced brand loyalty. Further, the study also found that gender significantly moderated customer satisfaction and brand loyalty. As a practical implication, in the competitive market, the managers need to understand the requirements of the customers and add value to customers by providing innovative products. Innovation in a product improves customer satisfaction and commitment of customers towards a brand. Managers need to understand the requirement of the customers and create value accordingly. As a novelty, the study is a first of its kind to investigate the relationship between product innovation attributes, customer satisfaction, and brand loyalty with gender as a moderator.

Keywords : **product innovation, customer satisfaction, brand loyalty, gender, smartphones**

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In recent years, emphasis on innovation in the mobile phone industry has increased, especially after the smartphone became the standard configuration among different types of mobile devices (Cecere, Corrocher, & Battaglia, 2015). In today's technological world, a smartphone is more convenient and aids students to gather the information that they need to polish their academic products with less effort. No doubt smartphones have improved personal security together with ubiquitous communication tools, however, they have also created distractions and off-task behavior of the users. Engagement towards inappropriate behaviors by the students is a growing concern. Teenagers often fail to consider the consequences and recognize the long-term impact of such

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behaviors. Therefore, increasing the customer's trust would lead to value creation for the organization (Panigrahi, Azizan, & Khan, 2018).

Product innovation, along with the growth of related strategies, has a great impact on the lives of people. One of the biggest impact is the increasing usage of smartphones among students. Product innovation helps the companies to gain a strategic advantage like competitive advantage (Rothaermel, 2016) and revives mature businesses (McLaughlin, 2016). Although product innovation may not directly influence brand loyalty, once the level of satisfaction is changed, the brand loyalty of the customers can be improved. However, the characteristics of product innovation provided by Rogers (2003) have not been considered in relation to customer satisfaction and brand loyalty.

Indeed, many smartphone companies have been focusing on revitalizing their brands through product innovation to increase market shares. There have been ample efforts devoted by researchers to investigate this issue. However, the impact of product innovation, customer satisfaction, and brand loyalty has not been explored extensively. Rogers's diffusion innovation theory identified five key attributes – relative advantage, complexity, compatibility, trialability, and observability. Customers who are willing to adopt innovation would consider definable attributes while making purchase decisions. Thus, it seems to be appropriate that product innovation is crucial for the smartphone industry in the fluctuating business and economic environment. Therefore, the main research questions this paper will address are :

- How the product innovation attributes influence customer satisfaction ; and
- Whether gender moderates between customer satisfaction and brand loyalty.

The smartphone industry is selected as the context as frequency of innovation is high in this industry. The smartphone industry is a very innovative segment due to its extremely dynamic and highly concentrated characteristics (Cecere et al., 2015). The smartphone industry has emerged as the standard fastest-growing market segment. The innovation in smartphones is widely accepted due to its unique design features and specific technology (Cecere et al., 2015). Additionally, personal characteristics like gender are used as a moderator between customer satisfaction and brand loyalty. An understanding of the presence or absence of differences between male and female customers regarding the satisfaction affecting their loyalty is crucial for the smartphone industry. The smartphone industry must determine the gender-differentiated approach.

This paper first presents the theoretical background that conceptualizes product innovation and brand loyalty and then the hypotheses are developed. Next, we explain the research methods and analytical approach. Finally, discussion and research findings are presented.

Literature Review

Brand loyalty was first investigated by introducing the theory of reasoned action (Ajzen & Fishbein, 1980). Loyalty has been a major focus in strategic marketing (Kotler, Saliba, & Wrenn, 1991) for gaining competitive advantage (Choi, Ok, & Hyun, 2017). Product innovation attributes, customer satisfaction, and brand loyalty were considered with the help of the theory of diffusion, and hypotheses were developed based on previous studies and their findings.

Independent Variable : Product Innovation Attributes

Product innovation provides solutions to failure problems and meets customer requirements (Rubera & Kirca, 2017). Product innovation refers to new technology or a combination of technologies that are introduced to

meet customers' requirements and satisfy them (Mahmoud, Hinson, & Anim, 2018). Innovation helps to create a new product, new technique of production, new market, and also a new generation of market (Nemati, Khan, & Iftikhar, 2010) product differentiation (Walter & Peterson, 2016). A strong brand depends on the innovation abilities carried out by a company (Dickinson - Delaporte, Beverland, & Lindgreen, 2010). Thus, product innovation is key to customer satisfaction and brand loyalty.

(1) Compatibility : Compatibility refers to, "the degree to which using innovation is perceived as consistent with the existing socio-cultural values and beliefs, past and present experience, and needs for potential adopters" (Rogers, 2003, p. 240). The significant effect of compatibility on user technology acceptance has been reported by many prior studies including Panigrahi, Zainuddin, and Azizan (2014) ; Venkatesh, Morris, Davis, and Davis ; (2003) ; and Wang, Li, and Chang (2016). However, the influence of compatibility with the aspect of customer satisfaction and brand loyalty has not been explored. Thus, this research provides a comprehensive concept of compatibility, situating it closely along with technology acceptance by smartphone customers. The compatibility of smartphones fits well with the customers' "past investment and lifestyle."

(2) Complexity : Complexity is, "the degree to which the technology is perceived to be difficult to understand and use" (Rogers, 2003, p.16). Furthermore, Oliveira and Martins (2011) stated that complexity is the utilization of internal characteristics in the form of innovativeness to achieve a better understanding of the adoption of technology. The more complex the product is in terms of understanding and usage, the slower the adoption rate (Geissler, 2006).An increase in product complexity leads to an increase in loyalty as many consumers perceive that the trust developed stems from the help of product complexity. As technologies become more complex, the chance of product rejection by the customer increases (Rogers, 2003). Complexity in a smartphone is perceived as more time to learn the operation by the customers. This approach may slow down the smartphone usage and customer satisfaction.

(3) Relative Advantage : Relative advantage is, "the degree to which an innovation is comprehended as being better than the idea it supersedes" (Rogers, 2003, p. 229). Assessment of relative advantage can be of many aspects like satisfaction, convenience, respect, or societal improvement. Firms, in order to be competitive, need to invest their time, resources, and efforts to achieve consistency and convenience in their product innovation keeping in mind customer's aspects. The relative advantage is found to be one of the best predictors of the adoption of an innovation. Researchers consistently found that the relative advantages positively affected users' intention to use the system (Bhattacherjee, Limayem, & Cheung, 2012 ; Choudhury & Karahanna, 2008). For example, a smartphone's advantage consists of ease of availability as well as the product is cheap, safe, and easy to use.

(4) Trialability : Trialability is defined as, "the degree to which an innovation may be tested on a limited basis" (Rogers, 2003, p. 257). The higher the degree of trialability, the greater will be the rate of diffusion. This is because the customers get an opportunity to try the product or service, assess it, and decide to accept or reject it. Consumers could try out the innovative offering, evaluate it, and then decide on a purchase commitment by accepting or rejecting it. Trials leading to purchase can be encouraged through guarantee and warranty schemes. Such trials encourage a product/service to be diffused easily. According to Karatepe (2011), the trialability contributes to achieving comfort among the customers and the users later become more willing to adopt the innovation. Trialability reduces the consumers' perceived risk of purchasing the product. A user wants to try the product before adopting it, even if many people are recommending it (Kebritchi, 2010). Based on previous assertions, it is clear that the trialability attribute of innovation plays an important role in predicting innovation adoption.

(5) Observability : "Observability is the degree to which the results of an innovation are visible to others" (Rogers, 2003, p. 259). The more visible the results of an innovation, the more likely the innovation will be rapidly adopted and implemented (Kebritchi, 2010). The higher the degree of observability, the greater the chances of the innovative offering being accepted by the prospects. Those new product offerings that are : (a) tangible, (b) have social visibility, and (c) whose benefits are readily observed (without much time gap) are more readily diffused than those that are intangible or have no social visibility or whose benefits accumulate over long periods (Scott & Zachariadis, 2010). Visibility stimulates peer discussion of a new idea as friends and neighbours of an adopter often request innovation-evaluation information about it. Therefore, we expect that product innovation attributes influence customer satisfaction and brand loyalty. Moreover, likewise, brand loyalty and innovation are heavily associated with an idea, practice, or object (Rogers, 2010).

Customer Satisfaction

Product innovation not only improves customers selecting the products, but also increases product acceptability, if properly communicated (Szekely & Strebel, 2013). In the past few decades, customer satisfaction has gained high attention in all areas of production (Donavan, Brown, & Mowen, 2004 ; Malik, 2012). Customer satisfaction is often used as a predictor for the future purchase of technology. Customer satisfaction is an effective way to differentiate a firm from its competitors and gain loyalty. Prior studies (Lee, Moon, Kim, & Yi, 2015 ; Ong, Nguyen, & Syed Alwi, 2017 ; Pappu & Quester, 2016 ; So, King, Sparks, & Wang, 2016) found evidence on the relationship between customer satisfaction and brand loyalty. Effect of customer satisfaction was found to have partially mediated the relationship for the benefit and post benefit convenience (Chang & Polonsky, 2012). Similarly, in the study conducted by Han and Ryu (2009), it was found that customer satisfaction partially influenced loyalty.

Brand Loyalty of Smartphones

Brand loyalty is referred to as a deeply held commitment to the repeated purchase of the product consistently in the future (Kumar & Menon, 2017). The organization will achieve high profitability when customers are loyal to products or services (Peppers & Rogers, 2016). From the perspective of customers, brand loyalty is related to the primary choice to purchase (Balakrishnan, Dahnil, & Yi, 2014). Brand loyalty is based on consumers' non-random, behavioral response, expression over time, decision making unit, alternative brands, and psychological functions (Kumar & Narayanan, 2017).

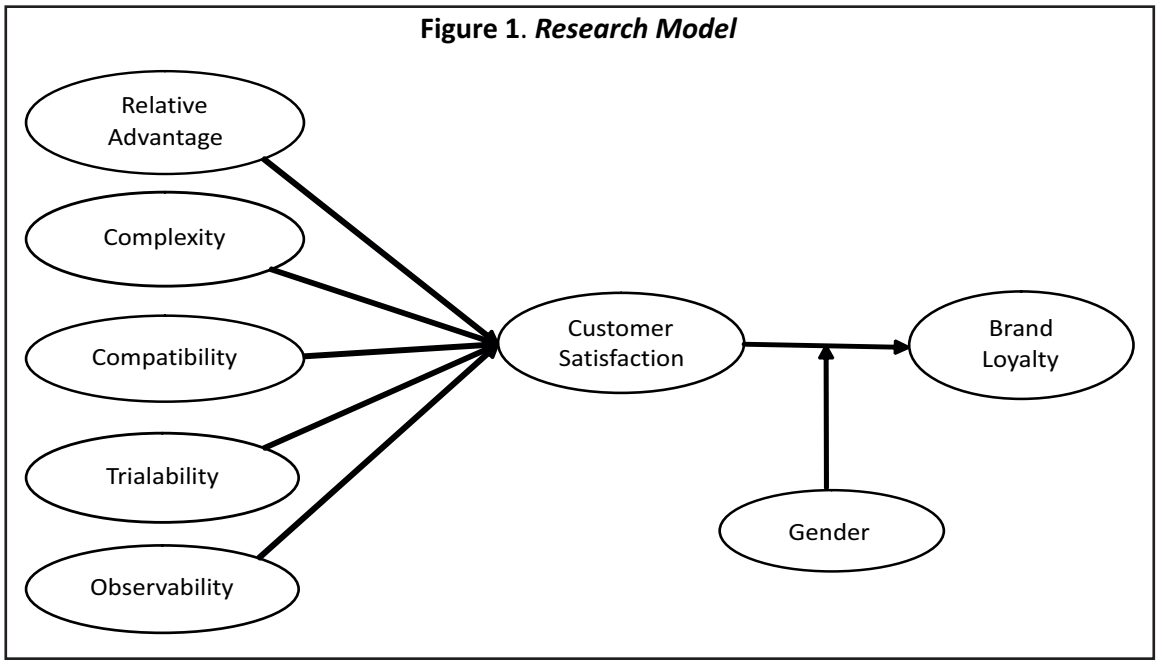
The purpose of this research is to investigate the impact of product innovation attributes on brand loyalty and customer satisfaction. Figure 1 exhibits the research model that depicts the important constructs of the research including product innovation attributes as the independent variables, customer satisfaction as the mediating variable, and brand loyalty as the dependent variable. Brand loyalty is based on the value of consumers and consumer brand identification (Yeh, Wang, & Yieh, 2016).

Based on previous studies on product innovation attributes, all the five dimensions – relative advantage, complexity, compatibility, trialability, and observability are incorporated into the innovation-based satisfaction-loyalty model. Based on the discussed literature above, the study presents the theoretical framework as shown in Figure 1.

The following research hypotheses have been formulated based on in-depth literature study investigations:

- **H1 :** Product innovation attributes positively influence customer satisfaction.
- **H1a :** Relative advantage of product innovation has a positive influence on customer satisfaction.

Figure 1. ***Research Model***



- **H1b :** Compatibility of product innovation has a positive influence on customer satisfaction.
- **H1c :** Complexity of product innovation has a positive influence on customer satisfaction.
- **H1d :** Trialability of product innovation has a positive influence on customer satisfaction.
- **H1e :** Observability of product innovation has a positive influence on customer satisfaction.
- **H2 :** An increase in customer satisfaction of smartphone leads to an increase in brand loyalty.
- **H3 :** Gender moderates the relationship between customer satisfaction and brand loyalty.

The current study contributes to the marketing literature by closely examining the existing literature on product innovation, customer satisfaction, and brand loyalty. In addition, the role of gender as a moderator between customer satisfaction and brand loyalty is also considered. Empirical research studies in marketing (Karatepe, 2011; Ladhari & Leclerc, 2013; Sánchez - Hernández, Martínez - Tur, Peiró, & Moliner, 2010) investigated the gender-differentiated approach to investigate the relationship between service quality and customer satisfaction as well as customer satisfaction and behavioral intention. Thus, it is expected that gender will play a crucial role in the study to investigate product innovation, brand loyalty, and customer satisfaction relationships.

Research Methodology

Sampling

To test the research framework and hypotheses, we considered university students in Oman having a smartphone. The university students were expected to meet the requirements.

The questionnaire used a 5 - point Likert scale adapted by Nemati et al. (2010) and Panigrahi et al. (2014) ranging from 1 as *(strongly disagree)* to 5 as *(strongly agree)*. We considered university students as an appropriate sample, given that the usage of smartphones has rapidly changed the innovativeness of the students. To ensure the

selection of appropriate smartphone brands and their satisfaction level, data were collected in Oman, and participants were recruited online via Google Docs as per the convenience sampling method to collect the primary data. Survey through Google Docs was conducted in April – May 2020, where a total of 300 questionnaires were sent and 205 sets were returned, of which 193 responses were useful for data analysis. The sample size was computed based on G power analysis as recommended by Faul, Erdfelder, Lang, and Buchner (2007). The response rate was 64.3%, which is considered as adequate.

Pretest

Card sorting method, as suggested by Moore and Benbasat (1991), including all the question items in separate index cards, were printed out. The cards were shuffled and presented to two experts from the marketing field and were asked individually to sort the measurement items. This method is also known as the Q - sort method that helps the researchers to assess the reliability and validity of the questionnaire.

Demographic Profile

The demographic profile of the respondents is provided in Table 1. In total, 47.7% (92) were male and 52.3% (101) were female ; 50.25% (97) respondents were under the age of 25 years; 18.65% (36) were in the 25 – 30 years of age ; 26.94% (52) respondents were in the range of 31 – 40 years, and finally, only 4.14% (8) respondents were above the age of 40 years.

Table 1. ***Demographic Profile of the Respondents***

No.	Demographic Profile	Categories	Frequency	%
1	Gender	1. Male	92	47.7
		2. Female	101	52.3
2	Age	1. Less than 25 years	97	50.2
		2. 25 – 30 years	36	18.6
		3. 31 – 40 years	52	26.9
		4. Above 40 years	8	4.14
3	Qualification	1. High School	16	8.29
		2. Bachelor Degree	132	68.3
		3. Master Degree	26	13.4
		4. Doctorate	19	9.84
4	Do you use a smartphone?	1. Yes	193	100.0
		2. No	0	0
5	Facilities used often via smartphone	1. Website	88	45.6
		2. E-Mail	4	2.10
		3. Social Media	96	49.7
		4. Study	5	2.60
6	Smartphone Brand used	Apple	67	34.7
		Samsung	54	28.0
		Oppo	31	16.1
		Huawei	13	6.70
		Others	28	14.5

Note : *N* = 193.

In terms of qualification, we found that 68.39% (132) of the respondents had a bachelor's degree ; 13.47% (26) of the respondents were master's qualified ; 8.29% (16) only had a high school degree, and the remaining respondents (9.84% ; 19 respondents) had a doctorate degree. In this technological era, it is not surprising that all the 193 respondents (100%) were using a smartphone. However, almost 45.6% (96) of the respondents used a smartphone for social media followed by 45.6% (88) of the total respondents using smartphones mostly for web surfing. Only 2.6% (5) used smartphones for study purposes and 2.1% (4) used smartphones for checking their emails. In terms of brand choice, Apple smartphone was the first choice at 34.7% followed by 28% respondents using Samsung brand ; 16.1% were using Oppo ; 6.7% were using Huawei ; and the remaining 14.5% of the respondents used all other smartphone brands.

Empirical Analysis and Results

Data collected through online mode were analyzed using Statistical Package for Social Sciences (SPSS) 21 and SMARTPLS 3.2.8. The analysis was initiated first with the reliability and validity assessment followed by the PLS algorithm and PLS bootstrapping structural equation modeling for identifying significant paths and testing the hypotheses. This study prioritized confirmatory factor analysis (CFA) over exploratory factor analysis (EFA) for hypotheses testing as suggested by Kline (2011) of there being no need to conduct both the analyses. However, the PLS algorithm coefficient model provided in Figure 2 highlights the outer loadings for the measured items.

Reliability and Validity Assessment

To perform reliability and validity assessment, we followed two stage analytical process as suggested by well-known scholars like Anderson and Gerbing (1988) and Hair, Sarstedt, Hopkins, and Kuppelwieser (2014). The first stage of analysis tested reliability and validity ; whereas, in the second stage of analysis, the structural model was examined for testing the hypothesized relationship. To test the significance of the loadings, bootstrapping method with 2000 samples was used (Hair et al., 2014). PLS reliability was measured using Cronbach's alpha (Cronbach, 1951), rho_A (Dijkstra & Henseler, 2015), and composite reliability (Bacon, Sauer, & Young, 1995) ; whereas, the convergent validity of the measurement was examined using average variance extracted (AVE). The PLS reliability and AVE for validity were higher than the threshold value of 0.70 and 0.50 significantly (see Table 2).

Discriminant validity is measured using Fornell and Larcker (1981) criteria and heterotrait - monotrait

Table 2. ***Reliability and Convergent Validity Assessment***

Variables	Number of Items	Cronbach's Alpha	rho_A	Composite Reliability	AVE
Relative Advantage	5	0.852	0.854	0.910	0.772
Complexity	6	0.881	0.882	0.913	0.678
Compatibility	5	0.833	0.834	0.900	0.750
Trialability	4	0.905	0.918	0.924	0.637
Observability	4	0.923	0.923	0.942	0.764
Customer Satisfaction	5	0.915	0.918	0.940	0.796
Brand Loyalty	5	0.907	0.914	0.934	0.781

Note. Cronbach's alpha, rho_A, and composite reliability > 0.7 is significant ; AVE > 0.5 is significant ; AVE – average variance extracted.

(HTMT) value (Kline, 2011). However, the exact threshold value for HTMT is still debatable (Henseler, Ringle, & Sarstedt, 2015). Kline (2011) provided the threshold value of the correlation between the constructs to be 0.85 ; whereas, Teo, Srivastava, and Jiang (2008) provided a threshold value of 0.90. Discussion on the valid criteria for HTMT by Henseler et al. (2015) stated that both the HTMT approaches detect discriminant validity issues reliably. Discriminant validity, as provided in Table 3, indicates that the correlation for each construct is less than the square root of the average variance, indicating satisfactory discriminant validity.

The study also measures discriminant validity using criterion provided by Fornell and Larcker (1981), who suggested to compare the correlations between the constructs and the square root of average variance extracted for such constructs (Table 3).

Table 3. ***Heterotrait – Monotrait (HTMT) and Fornell Test for Validity***

		1	2	3	4	5	6	7
1	Relative Advantage							
2	Complexity	0.700						
3	Compatibility	0.839	0.741					
4	Trialability	0.781	0.656	0.628				
5	Observability	0.759	0.687	0.665	0.828			
6	Customer Satisfaction	0.652	0.654	0.576	0.870	0.847		
7	Brand Loyalty	0.738	0.560	0.564	0.859	0.671	0.732	
Fornell Test for Validity								
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	Relative Advantage	**0.879**						
2	Complexity	0.609	**0.823**					
3	Compatibility	0.71	0.635	**0.866**				
4	Trialability	0.698	0.598	0.561	**0.798**			
5	Observability	0.673	0.619	0.582	0.769	**0.874**		
6	Customer Satisfaction	0.577	0.589	0.506	0.8	0.781	**0.892**	
7	Brand Loyalty	0.651	0.513	0.498	0.791	0.621	0.675	**0.884**

Note. Diagonals highlighted are the square roots of average variance extracted.

The correlation between the constructs is not greater than the diagonals highlighted, indicating that there is no issue of discriminant validity. However, Fornell's discriminant validity criterion faced criticism by Henseler et al. (2015), who mentioned that Fornell's criterion is not reliable to detect the discriminant validity issue and thus proposed HTMT discriminant validity criterion. Assessment of discriminant validity through HTMT can be discussed in two ways. First as a criterion and second by using statistical tests. If the value of HTMT is higher than 0.85 (Kline, 2011) or greater than 0.90 (Gold, Malhotra, & Segars, 2001), there exists an issue of discriminant validity. For the second critical of testing statistically, if the value of HTMT is greater than 1, there exists a lack of discriminant validity. HTMT and Fornell test for validity, as shown in Table 3, indicate that the correlation between the constructs do not exceed the threshold value of 0.90, confirming the discriminant validity to be achieved.

Structural Equation Modeling Using Partial Least Square (PLS)

In order to confirm the structural model, we look at the results of R - square (R^2), beta coefficients (β), factor

loadings, and corresponding *t* - values through the PLS bootstrapping process with a sample of 5,000 observations. First, we look at the five dimensions of Rogers's innovation factors. Relative advantage (β = 0.137, *t* = 3.872, *p* < 0.01), compatibility (β = 0.110, *t* = 3.720, *p* < 0.01), complexity (β = 0.168, *t* = 6.043, *p* < 0.01), trialability (β = 0.419, *t* = 12.155, *p* < 0.01), and observability (β = 0.357, *t* = 9.607, *p* < 0.01) are positively related to customer satisfaction, explaining 0.730 (73%) of variance in customer satisfaction (Table 5). Next, we find that customer satisfaction is having an influence (β = 0.690, *t* = 18.209, *p* < 0.01) towards brand loyalty. Finally, we check the factor loadings and *t* - statistics (Table 4) of the measured items of the constructs that range from 0.750 – 0.942. The loadings of all the items are above the minimum cut off value of 0.50 level (Hair et al., 2014). All the loadings are greater than 0.70 on their respective constructs with the *t*-statistics above 1.96. This result of factor loading provides evidence of convergent validity.

Table 4. ***Factor Loadings for the Scale Items of the Constructs***

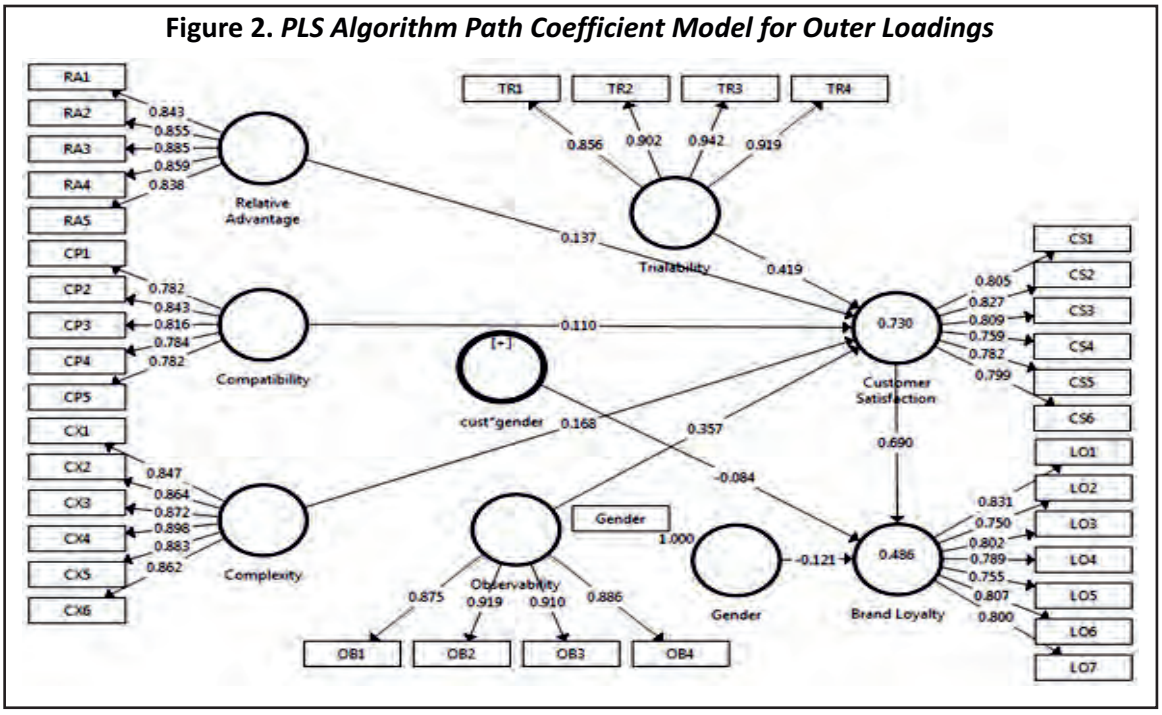
Construct	Code	Items	Factor Loadings	*t* -Statistics
Relative Advantage	*RA1*	A smartphone is convenient for me to manage my daily work.	0.843	38.463
	RA2	A smartphone allows me to manage my work efficiently.	0.855	39.686
	RA3	A smartphone allows me to manage my work effectively.	0.885	65.045
	RA4	A smartphone has good integration of a wide range of functions and services.	0.859	43.324
	RA5	A smartphone is fashionable, stylish, and trendy.	0.838	34.393
Compatibility	*CP1*	A smartphone fits well with the way I like to manage my finances.	0.782	22.81
	CP2	I like to try new technology.	0.843	25.196
	CP3	I like to adopt innovation.	0.816	16.146
	CP4	A smartphone is compatible with my lifestyle.	0.784	13.862
	CP5	Using a smartphone fits into my working style.	0.782	17.285
Complexity	*CX1*	A smartphone requires a lot of mental effort.	0.847	45.322
	CX2	Using a smartphone requires technical skills.	0.864	46.467
	CX3	Using a smartphone can be frustrating.	0.872	48.564
	CX4	A smartphone may be complex to use.	0.896	69.796
	CX5	It may be a bit difficult to understand the internet, gaming, MP3, and functions in a smartphone.	0.883	69.326
	CX6	It would be a hassle for me to choose any other brand of smartphone.	0.862	55.381
Trialability	*TR1*	I want to try a smartphone for at least one month.	0.856	50.688
	TR2	I want to use a smartphone on a trial basis to see what it can do for me.	0.902	54.854
	TR3	It is easier to use smartphones after trying one.	0.942	106.438
	TR4	It took time before accepting to buy a smartphone.	0.919	94.903
Observability	*OB1*	A smartphone can be accessed anytime & anywhere.	0.875	69.391
	OB2	A smartphone is worth its value.	0.919	113.342
	OB3	A smartphone can be accessed when abroad.	0.910	48.091
	OB4	I am satisfied with the results of using a smartphone.	0.886	56.993
Customer Satisfaction	*CS1*	My smartphone is good value for the money that I paid.	0.805	35.153
	CS2	I would recommend my smartphone brand to my friends.	0.827	39.099
	CS3	I am satisfied with the operating functionality or	0.809	35.835

		software system of my smartphone.		
	CS4	I am satisfied with the hardware functionality of my smartphone.	0.759	26.152
	CS5	I have no issues about the price to buy a smartphone.	0.782	33.62
	CS6	Overall, my smartphone is worthy for me.	0.799	28.458
Brand Loyalty	*LO1*	If I could, I would rather change to another company's mobile phone.	0.831	35.026
	LO2	I would choose my current smartphone brand even if the other brands have the same functionality as my current smartphone.	0.750	19.98
	LO3	I consider myself to be loyal to my smartphone brand.	0.802	28.205
	LO4	My brand is my first choice among smartphone brands.	0.789	30.221
	LO5	Quality of the product makes me loyal with a smartphone brand.	0.755	24.374
	LO6	I would encourage my friends and relatives to use my brand of smartphone.	0.807	27.392
	LO7	I intend to engage more with my smartphone.	0.800	24.185

Note : C.R – Composite reliability ; *RA* – Relative advantage ; *CP* – Compatibility; *CX* – Complexity ; *TR* – Trialability ; *OB* – Observability ; *CS* – Customer satisfaction ; *LO* – Brand loyalty ; Factor loadings > 0.7 is significant ; *t* - statistics > 1.96 is significant.

Figure 2 shows the PLS algorithm path coefficient model, which is also known as second-order analysis in PLS. All the paths from the product innovation factors towards customer satisfaction are found to be significant. Factor loadings and their significance is highlighted in Table 4.

Figure 2. ***PLS Algorithm Path Coefficient Model for Outer Loadings***



As depicted in Figure 2, *R* - square (R^2) value for customer satisfaction is 0.730 and for brand loyalty, the R^2 value is 0.486, with adequate explanatory significance. However, only R^2 is not enough for supporting the model (Radović-Marković, Shoaib Farooq, & Marković, 2017). Therefore, *Q* - square (Q^2) test is performed in order to assess the relevance of the structural model.

Figure 3. ***PLS Bootstrapping Model for t - Statistics***

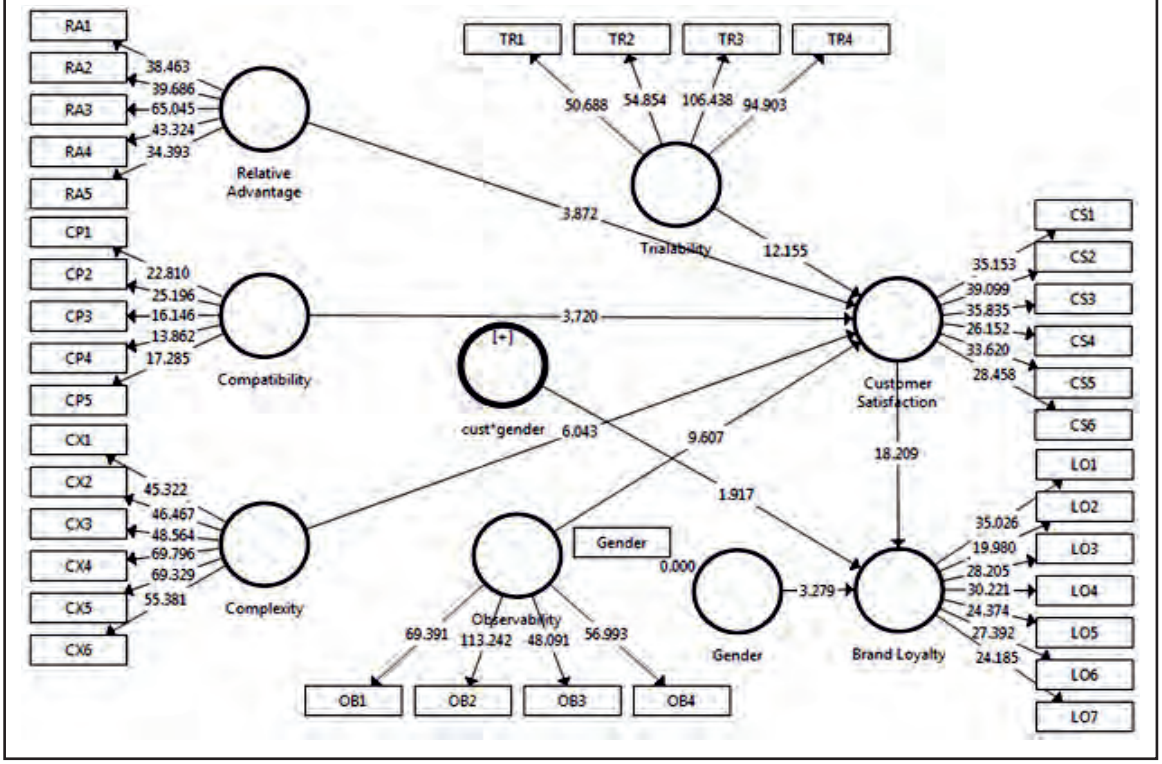


Table 5. ***Standardized Paths for Hypotheses Testing***

Standardized Paths	Coefficient (β)	*SD*	*t* - Statistics	*p* - values
Relative Advantage -> Customer Satisfaction	0.137	0.057	3.872	0.003***
Compatibility -> Customer Satisfaction	0.110	0.058	3.720	0.004***
Complexity -> Customer Satisfaction	0.168	0.057	6.043	0.001***
Trialability -> Customer Satisfaction	0.419	0.056	12.15	0.001***
Observability -> Customer Satisfaction	0.357	0.060	9.607	0.001***
Customer Satisfaction-> Brand Loyalty	0.690	0.059	18.20	0.001***
Gender as Moderator	0.121	0.069	3.279	0.006***

Note. S.D – Standard Deviation ; *$p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

As per the rule of thumb, if the Q^2 value is greater than zero, it suggests us that the exogenous constructs are relevant to the latent endogenous constructs.

Discussion

The main objective of this study is to understand the level of customer satisfaction and brand loyalty that can be achieved through product innovation attributes. The fundamental question articulated from the objective is : (a) How the product innovation attributes influence customer satisfaction ? and (b) Whether gender moderates between customer satisfaction and brand loyalty ? To address these questions, empirical investigations are articulated together with theoretical evidence from previous studies.

Influence of Product Innovation Attributes on Customer Satisfaction

The first objective of the study is to investigate the influence of product innovation attributes on customer satisfaction, which is relation advantage (H1), compatibility (H2), complexity (H3), trialability (H4), and observability (H5). Supporting H1, the findings confirm that product innovation attributes significantly influence customer satisfaction, which is in line with previous studies like Majekodunmi and Oginni (2019), who found that service innovation affected customer satisfaction when the expectations were met. Similarly, Mahmoud et al. (2018) found that satisfaction depended on the employees' innovation activities in terms of product delivery. Furthermore, statistically, the Q^2 value for our structural model is found to be 0.541, which supports the assumption of this research that customer satisfaction is predictively explained by the product innovation factors. Besides, the findings also reveal that there is no multicollinearity issue, confirming that our structural model is fit and predictive relevance is achieved. The study findings indicate that product innovation constructs have a significant and positive influence on customer satisfaction, thus supporting H1.

Customer Satisfaction and Brand Loyalty

The second hypothesis is to investigate the influence of customer satisfaction towards brand loyalty of using a smartphone. The PLS algorithm and bootstrapping results provided in Table 4 and Table 5 indicate that customer satisfaction has an ($\beta = 0.690$, t - value = 18.20) influence on brand loyalty with a significant level of less than 0.05, thereby supporting H2. These empirical results confirm that the smartphone industry needs to seriously focus on building brands in order to compete with their business rivals. Confirming the empirical output of this study, Kumar and Menon (2017) previously mentioned that the industry must ensure the long term growth prioritizing brand building for survival and gain competitive advantage. Furthermore, Yeh et al. (2016) mentioned that customers would remain loyal to the smartphone brand if they feel the product increased perceived value.

Moderating Role of Gender Between Customer Satisfaction and Brand Loyalty

The third hypothesis is to investigate the moderating effect of gender between customer satisfaction and loyalty. To test this hypothesis, the product-indicator approach is used as suggested by Henseler and Fassott (2010). We use gender as an interaction construct and we mean-centered gender and customer satisfaction to reduce the multicollinearity issues. The model, as shown in Figure 3, shows the interaction effect of gender that is significant ($\beta = 0.121$, t - value = 3.279) to customer satisfaction and brand loyalty. There has been a lack of studies performed empirically to investigate gender as moderator, however, from the marketing literature (Amawate & Deb, 2019), gender partially moderates between brand image and patronage intention. Similarly, Tanwar and Prasad (2016) investigated brand dimensions and job satisfaction relationships and found that gender moderated the relationship empirically. Thus, the hypothesis (H3) is accepted. The effect size f^2, as suggested by Cohen (1988), is found to be 0.032, which is significant. This indicates that gender as an interaction has high impact on the satisfaction – loyalty relationship.

Conclusion

The current study investigates an innovation-loyalty model that examines the influence of product innovation factors on customer satisfaction. The statistical results confirm that trialability and observability are the key factors of product innovation that influence customer satisfaction. Based on a sample of 193 university students and using the structural equation modeling approach, the five key product innovation attributes – relative advantage, complexity, compatibility, trialability, and observability are found to have a positive effect on customer

satisfaction (see Table 5). The results demonstrate that product innovation attributes are the key predictors of customer satisfaction. Loyal customers utilize the services of specific smartphone industry as per their preference consistently. Additionally, the results illustrate that customer satisfaction significantly affects brand loyalty.

Managerial Implications

As an implication, in the competitive market, the managers need to understand the requirements of the customers and add value to customers by providing innovative products. Innovation in the products improves customer satisfaction and commitment of customers towards the brand. Managers need to understand the requirement of the customers and create value accordingly. Furthermore, management of the smartphone companies need to create a strong perception amongst customers with improved service quality. With various advertising and strong word of mouth campaigning, efforts will enable the companies to establish and maintain long-term relationships in the market with their customers.

Furthermore, the management needs to ensure that the frontline employees spend enough time with their customers to provide detailed information about the service delivery. Service environment needs to be improved to increase the attachment of customers with more social interactions. On a closing note, the implications mentioned will be successful only when the smartphone industry establishes good - quality products that are compatible, reliable, and less complex. Furthermore, good service quality and product innovation will establish and maintain long - term relationships with their customers.

Limitations of the Study and Scope for Future Research

The main population for the study is the university students studying in the higher learning institutions of Oman. The study sample was collected inside the university premises, which may have restrictions on the usage of smartphones and may have influenced the results. Oman, as it is a less populated country, it may not be possible to increase the sample. Current research enriches the body of knowledge by developing an integrated innovation – satisfaction – loyalty model to better understand the usage of smartphones. There are other areas of investigation, particularly on the loyalty of customers to different brands by applying the proposed integrated model from the study.

Future research could investigate based on the output of the study, the overall organizational performance of the smartphone industry. The implications of the study will benefit the smartphone industry to promote innovation on its products based on the requirement of the customers. This study would encourage the policies of the industry based on the location and the preferences of the customers. This, in turn, will result to gain competitive advantage and an increase in the market share of the smartphone industry in the market. This present study examines gender as a moderating effect among the demographic factors. However, researchers could also examine other demographic factors such as age, gender, experience towards customer satisfaction, and brand loyalty.

Authors' Contribution

Dr. Shrikant Krupasindhu Panigrahi conceived the idea and developed quantitative design to undertake the empirical study. Prof. Noor Azlinna Binti Azizan generated concepts relevant to the research design and extracted relevant research papers from online database. Prof. Azizan conducted proofreading of the paper and further developed the survey questionnaire. Dr. Ibrahim Rashid Al Shamsi verified the analytical methods and supervised the study. The quantitative data were collected by Dr. Ibrahim Rashid Al Shamsi. The numerical computations were done by Dr. Shrikant Krupasindhu Panigrahi using SmartPls 3.0. Dr. Panigrahi and Prof. Azizan wrote the manuscript in consultation with the co-author.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter, or materials discussed in this manuscript.

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