“Examining antecedents affecting Indian consumers’ adoption of mobile apps”

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EXAMINING ANTECEDENTS AFFECTING INDIAN CONSUMERS' ADOPTION OF MOBILE APPS

Abstract

This research aims to integrate the functional, social, security, and personal dimensions to study mobile app usage antecedents in the Northern Capital Region of India. Convenience sampling was used, and an online survey resulted in 407 valid responses. The measurement and structural models were estimated using PLS-SEM. Perceived usefulness and social influence had no significant impact on usage, implying that contemporary consumers are much more discerning and do not get swayed by the benefits offered or the influence of those around them. The findings show that perceived ease of use had a significant impact on perceived usefulness and attitude formation. Since security is the most important factor determining usage and trust, the industry should have stringent standards to maintain security protocols in every interaction with the user. Also, security concerns need to be allayed, and grievances need to be resolved immediately to gain customer satisfaction and loyalty. Personal innovativeness and lifestyle compatibility are important determinants of attitude and usage. Firms should target mobile apps to students and the active working population who possess innovativeness and for whom mobile apps are compatible with their lifestyle. These users can act as influencers and help in improving their adoption.

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INTRODUCTION

With the increased usage of smartphones, there has also been an exponential rise in the use of mobile apps with a record of 194 billion downloads worldwide in 2018, which shows a 35% increase from 2016 (App Annie, 2019). Mobile minutes comprise a majority chunk of online minutes across the world, with the US recording 77%, Canada 72%, India 91%, Indonesia 91%, and Brazil 85% (Comscore, 2019).

The mobile app adoption curve can be categorized into three phases. Emerging markets such as India and Indonesia are in the experimentation phase and show many downloads driven by new mobile device owners discovering and experimenting with apps. India recorded a 165% growth in the number of downloads in 2018 compared to 2016. As mobile habits begin to form among consumers, engagement increases and marks the adoption phase. The final is the ubiquity phase characterized by increased engagement and consumer spending in mature markets. App Store consumer spending (paid downloads, in-app purchases, and in-app subscriptions) in 2018 compared to 2016 has shown 140%, 70%, and 55% increase in China, the US, and the UK, respectively (App Annie, 2019).

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While some of the apps are used in desktop/mobile mode, some apps are skewed towards only mobile usage. As of June 2019, in the US, a major chunk of mobile minutes as a share of total online minutes is consumed by certain categories of apps such as games (94%), social media (92%), entertainment (83%), retail (77%), travel (72%), and news/information (70%) (Comscore, 2019).

Many mobile apps such as those for travel, retail, entertainment, wallets, and banking apps involve commercial transactions and share similar challenges to websites in terms of perceived risk, security, and trust, affecting their adoption. Studies concerning the adoption of technology in general and mobile apps, in particular, have used the Technology Adoption Model (TAM) (Davis, 1989) as a basis for their framework with perceived ease of use and perceived usefulness being the prominent beliefs driving usage. Though the TAM has been a robust model, which has been validated in various contexts, it has also been criticized for being over-simplistic and deterministic (Bagozzi, 2007). The current study was undertaken with primarily two objectives – to test the relevance of the TAM relationships with changing times and overcome its limitation by identifying other constructs, which may affect the adoption.

1. LITERATURE REVIEW

The constructs of the TAM and their linkages have been validated in many research studies. The TAM proposed the effect of the technological product's functional characteristics perceived usefulness and perceived ease of use on attitude, a mediator of behavioral intention. The effect of attitude on the intention to use has been empirically validated across various research studies in the context of adopting e-services (Belanche, Casal, & Flavian, 2012) or adoption of mobile apps (Carter & Yeo, 2016; Hu & Zhang, 2016). In studies on e-government services adoption (Belanche et al., 2012), Chinese students' usage of an m-library app (Hu et al., 2016) and Malaysian students' usage of mobile apps (Carter et al., 2016), the attitude was found a significant determinant of intention. The study of mobile banking adoption in the UAE also revealed that attitude had a significant positive impact on adoption (Aboelmaged & Gebba, 2013).

A study by Wu, Kang, and Yang (2005) on the adoption of m-commerce applications found that perceived ease of use did not directly affect intention, but had an indirect effect on perceived usefulness. It was found that perceived ease of use had a significant effect on perceived usefulness in a study on the adoption of mobile services (Nicolas, Castillo, & Bouwman, 2008). The study on the adoption of taxi-hailing apps in India (Roy, 2017) revealed that perceived ease of use had a significant path coefficient to attitude. A study on the adoption of e-government services in Spain revealed that perceived ease of use had a very small effect on attitude but had a large effect on perceived usefulness (Belanche et al., 2012).

Perceived usefulness was found to have a significant positive impact on attitude in studies on mobile banking adoption in Lebanon (Audi, Wahbi, Abdallah, Kassem, & Makkawi, 2016) and users' purchase of paid mobile apps (Wu et al., 2015). A study assessing the intention to shop online showed that perceived usefulness was a significant determinant of attitude (Vijayasarathy, 2004). Perceived usefulness turned out to be the most important factor affecting attitude directly and intention (directly and indirectly) in the adoption of e-government services (Belanche et al., 2012).

The TAM has been subject to expansion by the formulation of the TAM2 (Venkatesh & Davis, 2000) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, G. Davis, & F. Davis, 2003) to include social influence as an antecedent. However, many more dimensions need to be explored in adopting online services and are explained hereafter.

Continued usage and transactions in the online environment are largely determined by the perceptions of security and trust in the minds of the users (Riquelme & Roman, 2014; Miyazaki & Fernandez, 2001; Jarvenpaa, Tractinsky, & Vitale, 2000; Belanche et al., 2012). In an online environment, trust has been identified as a key determinant of adoption due to its ability to reduce uncertainty and risk of vulnerability (Gefen, Karahanna,

& Straub, 2003). It assumes much more importance than in an offline environment due to the virtual nature of the transaction.

It has also been observed that different individuals adopt technological tools at unique rates in the backdrop of similar culture. Individual personality differences such as personal innovativeness have been thought to affect consumer decisions and might explain differences in the adoption of technology from person to person (Amoroso & Lim, 2014; Pandey & Chawla, 2018).

The process of consumption of online services and online transactions has been happening since the advent of the Internet. The transaction medium has shifted largely from desktop to mobile, as is evident from the trends outlined above. Alongside, there have also been changes on the social front with the millennials' coming, their beliefs, and lifestyle. A few studies have explored effects such as lifestyle compatibility (Pandey et al., 2018; Chawla & Joshi, 2017) on adopting online services.

The TAM has investigated the effects of antecedents on intention, whereas many factors can intervene in the time gap between intention and the actual behavior, causing the non-occurrence of that behavior (Bagozzi, 2007). Fazio and Olson (2014) also pointed out that intention could be a mediator between attitude and behavior only in the case of deliberate behavior instead of spontaneous behavior. Hence, to understand customer behavior, the effect of antecedents will be studied on adoption/usage and not on intention for the purpose of the current study.

2. AIMS OF THE STUDY

Through literature review, it has been identified that the existing theoretical frameworks such as TAM, TAM2, and UTAUT have gaps that need to be addressed and a multiplicity of dimensions that need to be explored to provide a holistic framework explaining the adoption of mobile apps. The current study will integrate the functional, social, security, and personal dimensions in explaining the adoption. It will investigate the effects of personal innovativeness and lifestyle compatibility on the adoption of mobile apps. It will study the effect of security and trust, which have a huge impact in online transactions compared to offline mode. Given the dynamic social scenario, the study will also validate the earlier frameworks' linkages to establish their reliability with changing times.

3. RESEARCH MODEL AND HYPOTHESES

Based on the constructs identified from TAM and the discussion provided in the literature review section, the hypotheses linking perceived ease of use, perceived usefulness, attitude, and usage are as follows:

H1: Attitude will have a significant positive impact on usage.

H2: Perceived ease of use will have a significant positive impact on mobile apps' perceived usefulness.

H3: Perceived ease of use will have a significant positive impact on attitude towards mobile apps.

H4: Perceived usefulness will have a significant positive impact on attitude towards mobile apps.

The additional constructs outside of TAM gleaned from a literature review of research studies in technology adoption are presented further with a detailed discussion.

3.1. Security

Lack of security has been defined as the user's anxiety and discomfort regarding payment failure and non-performance in terms of the vendor (Riqueleme et al., 2014). Security concerns also include general misrepresentation or fraud, non-delivery of product/service promised, and unauthorized third-party access to personal and credit card information. Though these concerns inhibit online shopping behavior, a higher level of experience in transacting on the Internet reduces the level of perceived security risk and increases online shopping behavior (Miyazaki et al., 2001).

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Perceived security is a significant determinant of trust (Riqueleme et al., 2014). Security concerns have been found to have a negative impact on mobile banking adoption behavior in India (Shankar, 2016). While investigating consumer attitudes towards online and mobile banking, Laforet and Li (2005) found that confidentiality and security were two prime concerns affecting mobile banking adoption. Security was found to have a significant positive impact on attitude in a study on the adoption of online shopping (Vijayasarathy, 2004).

Based on the above discussion, the relationship between perceived security, trust, and mobile apps adoption must be investigated further and empirically validated. The following relations are hypothesized:

H5: Perceived security positively affects trust.

H6: Perceived security positively affects the usage of the app.

3.2. Trust

Empirical evidence suggests that in e-commerce situations, trust requires familiarity with the website and vendor. Familiarity requires multiple interactions, and hence trust is built over a long period (Gefen et al., 2003). In this way, trust can be differentiated from security as a macro level construct and built when security features are complied with during multiple instances.

A study on e-commerce adoption revealed that trust is an important antecedent of intention directly or mediated through attitude (Jarvenpaa et al., 2000). In the study on e-government services adoption, it was found that trust was a significant antecedent of attitude (Belanche et al., 2012). Thus, it is hypothesized that,

H7: Trust positively influences attitude towards mobile apps.

3.3. Social influence

Several research studies have empirically tested the importance of social influence and found it to be a significant factor on the intention to adopt mobile wallets (Madan & Yadav, 2016), mobile banking (Yu, 2012), e-banking services (Ghalandari, 2012), and online shopping (Limayem, Khalifa, & Frini, 2000). Social influence was found to have a direct positive effect on the adoption of mobile banking in Singapore (Riquelme et al., 2014). Hence, the following hypothesis was framed:

H8: Social influence positively affects the usage of mobile apps.

3.4. Personal innovativeness

Numerous researchers have studied the effect of personal innovativeness on attitude and intention in m-commerce, online shopping, and mobile technology adoption studies and found both path coefficients to be significant (Limayem et al., 2000; Agarwal & Prasad, 1998). Agarwal and Prasad (1998) found that early adopters of technology had more personal innovativeness (PI) trait than late adopters. PI was found to have a significant direct and indirect effect on the adoption of m-commerce, and individuals who displayed innovativeness found m-commerce more useful, convenient, and enjoyable (Pandey et al., 2018). Personal innovativeness has been found to have a significant positive impact on attitude and intention to adopt mobile technology in the Philippines (Amoroso et al., 2014). Hence, it is hypothesized that:

H9: Personal innovativeness positively influences attitude towards mobile apps.

H10: Personal innovativeness positively influences the usage of mobile apps.

3.5. Lifestyle compatibility

In a study by Wu and Wang (2005) on the adoption of m-commerce applications, it was found that compatibility had the most important effect on the intention to use and the second most important effect on actual use. In a study on English consumers (Koenig-Lewis, Palmer, & Moll, 2010) and consumers in Iran (Mohammadi, 2015), it was found that users found mobile banking more useful, easy to use, and credible if mobile banking fitted with their beliefs, values, and lifestyle. A study on m-banking adoption in India found that compatibility played an important role in adopting the service, and users adopted the service on-

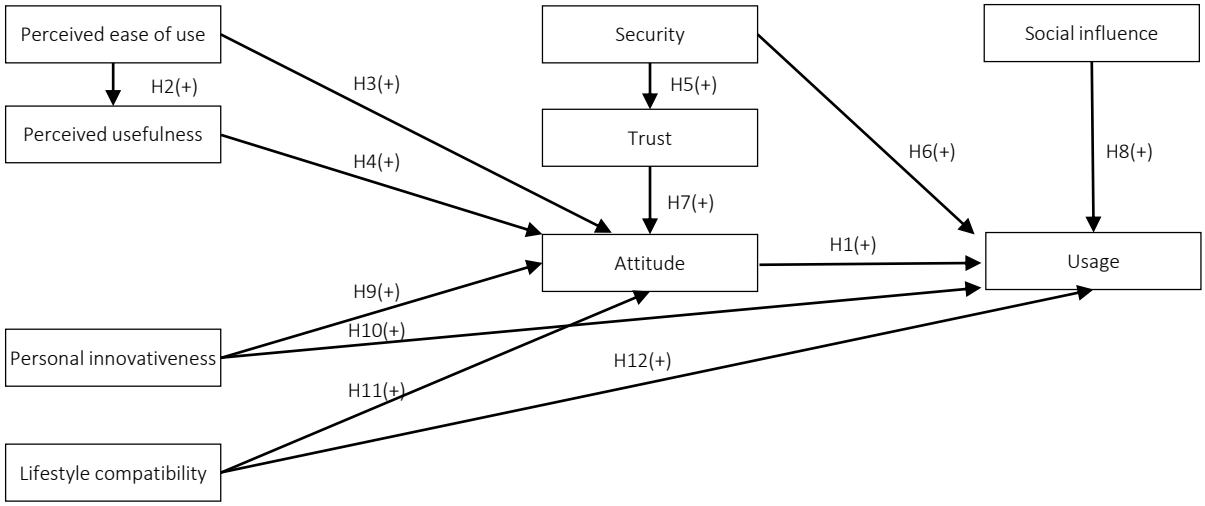

Figure 1. Research model framework

ly if they found it compatible with their lifestyle (Shankar, 2016). In another study, perceived lifestyle compatibility was the most important factor affecting attitude and intention to adopt mobile banking in India (Chawla et al., 2017). Hence, it is hypothesized that:

H11: Lifestyle compatibility positively influences attitude towards mobile apps.

H12: Lifestyle compatibility positively influences the usage of mobile apps.

The research framework for the current study is presented in Figure 1.

4. METHODOLOGY

This section deals with the research instrument and the data collection method. Data processing is carried out in terms of data, and variable reduction is explained. Also, the demographic profile of the valid responses is detailed.

4.1. Research instrument and data collection

Pre-validated items pertaining to the various constructs were picked from earlier research studies. A few items were added based on the findings of the qualitative research study, which was done before the current study (Arora, Malik, & Chawla, 2020). A final list of items for the constructs is shown in Appendix A. The items were measured on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). To reduce unengaged responses, a few negative items were added, which were subsequently reverse coded. Apart from these items, questions on usage patterns and demographics were also included in the research instrument.

The authors used convenience sampling, and the instrument was distributed online through Google Forms. The research instrument was sent to residents of the Northern Capital Region who were more than 18 years old and possessed a mobile phone. The sample was not limited to those using mobile apps as the usage or non-usage was ascertained through the instrument. The respondents belonged to a diverse set of professions, such as salaried professionals, self-employed, students, home-makers, and retired persons. Care was taken to see that diversity was maintained in terms of marital status, gender, and age to get a truly representative sample. Educational qualifications varied to include respondents with undergraduate, post-graduate, and doctoral degrees. The sample consisted of respondents with varied educational backgrounds such as arts, science, commerce, engineering, and management. A total of 710 responses were received.

4.2. Data processing

To improve the reliability of the results, the process of data reduction was carried out. Responses

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for which the items of a construct showed a standard deviation of less than 0.07 were removed, and 407 responses remained. The next step was to carry out a variable reduction. There were 56 items under the constructs: perceived ease of use, perceived usefulness, security, trust, social influence, personal innovativeness, attitude, and usage. The correlation coefficient of each item's total score was computed with a total score of 56 items and arranged in descending order of magnitude. Any statement having a correlation coefficient of 0.34 or below was removed from the analysis. Using this criterion, the items PU9, PEOU3, PEOU5, SEC2, SEC3, SEC5, SEC8, TR2, SI1, SI3, SI5, SI7, INN3 were deleted, and 43 items remained. A similar procedure was followed for the 14 items under lifestyle compatibility, and LIF5 was deleted.

4.3. Respondents' profile

Among the 407 respondents, there were 248 (60.9%) males and 159 (39.1%) females; 118 (29%) were married, and 289 (71%) were single; 191 (46.9%) were graduates while 196(48.2%) had post-graduate degrees and above; 165 (40.5%) were salaried professionals, and 201(49.4%) were students; 179 (34%) had annual family income greater than 15 lakhs. More detailed information on demographics is given in Table 1.

Eighty-six percent of the respondents used mobile apps for grocery shopping. In contrast, more than 90% of the respondents used mobile apps for chatting/messaging, checking mail, booking apps (travel, hotels, movies, cabs), getting information(news, weather, sports), navigation, paying utility bills, accessing social media and for entertainment. For the usage of mobile apps of the above functionalities, family and friends were the biggest sources of influence, followed by professional contacts and colleagues. 58.5% of the respondents revealed that App Store was their source of information, 68.3% for the peer group, and 43.5% for mass media. The total percentages exceed 100%, as the respondents would have more than one source of information.

Regarding the usage, 91.9% revealed that they had been using mobile apps for more than two years. 16.2% used mobile apps for less than 1 hour per day, 50.4% for between 1 and 3 hours, and 33.5% used it for more than 3 hours. 16% of the respondents used about 1 to 3 apps per month; 44.2% used around 4-8 apps, whereas 39.8% used more than eight apps.

Only 22.4% of the respondents used paid mobile apps. Out of these, 23.3% were willing to spend more than 400 Rs per month on mobile apps, while 33.3% were willing to spend less than 100 Rs in a month.

Table 1. Demographic profile of respondents

Categories	Number	Percentage
Age category		
Gen Z (1996 and later)	69	17
Gen Y (1980 – 1995)	267	65.6
Gen X (1965- 1979)	51	12.5
Baby boomers (1946–1964)	20	4.9
Educational qualification		
10 + 2 or below	20	4.9
Graduates	191	46.9
Post-graduates	183	45
Doctorate	13	3.2
Educational background		
Arts and allied	37	9.3
Commerce	46	22.6
Science	92	11.3
Management	122	30
Engineering	110	27
Occupational background		
Salaried professionals	165	40.5
Self-employed	29	7.1
Students	201	49.4
Homemaker and retired	12	2.9
Work experience		
No work experience	15	3.7
Less than a year	127	31.2
1 year – less than 3 years	119	29.2
3 years – less than 5 years	35	8.6
5 years – less than 7 years	20	4.9
Above 7 years	91	22.4
Annual family income		
Less than 5 lakhs	55	13.5
5 lakhs – less than 10 lakhs	92	22.6
10 lakhs – less than 15 lakhs	81	19.9
15 lakhs – less than 20 lakhs	59	14.5
More than 20 lakhs	120	29.5

5. DATA ANALYSIS AND RESULTS

The measurement and structural models were estimated using partial least squares structural equation modeling using SmartPLS 3.2.1. The

prerequisite for running the PLS algorithm is that the sample size should be at least ten times, the largest number of structural paths directed at a construct in the structural model (Chin, 1998). In the existing framework, the highest number of structural paths directed towards the usage construct is five, which requires a minimum sample of 50. With valid responses totaling 407, the sample size requirements for using PLS-SEM were adequately met.

5.1. Measurement model assessment

The first step is to run the PLS algorithm and construct a measurement model that shows the relation between a construct and its items. Items with outer loadings below 0.6 are unacceptable (Hair, Black, Babin, & Anderson, 2016). The items, LIF1, LIF2, LIF7, LIF9, LIF11, LIF12, PU5, PU8, SI2, USA4, USA9 were deleted.

The measurement model is assessed by the Cronbach Alpha, composite reliability (CR), and average variance extracted (AVE) figures. The internal consistency is measured though Cronbach alpha for which a minimum value of 0.7 is recommended (Nunnally & Bernstein, 1994). It is also suggested that items with lower loadings be removed to improve the Cronbach Alpha and reliability values (Hair et al., 2016). The construct social influence had a Cronbach Alpha of 0.4, so the item with the lowest outer loading SI6 was deleted. Cronbach Alpha, CR, and AVE figures after the items' deletion are given in Table 2. It is observed that the Cronbach Alpha figures are higher than 0.704, except for trust where it is 0.695, which is close to 0.7, indicating the internal consistency of the constructs.

Convergent validity of the construct is indicated by composite reliability (CR) figures being greater than 0.7 (Garson, 2016) and average variance extracted (AVE) figures being greater than 0.5 (Chin, 1998). Items with the least outer loadings PU2, USA3, and USA6 were deleted to improve the respective constructs' CR and AVE figures. After deletion, it was observed (Table 2) that the CR and AVE figures are above 0.825 and 0.5, respectively, indicating the convergent validity of the constructs. Discriminant validity of the constructs is established through the Fornell-Larcker criterion, where the diagonal elements represent the square root of the AVE figures and are higher than the correlations with other constructs, as can be seen from Table 3.

Table 2. Reliability measures

Constructs	Cronbach Alpha	Composite reliability	Average Variance Extracted (AVE)
ATT	0.895	0.918	0.615
INN	0.704	0.834	0.628
LIF	0.862	0.895	0.549
PEOU	0.807	0.867	0.568
PU	0.802	0.858	0.504
SEC	0.787	0.864	0.616
SI	1.000	1.000	1.000
TR	0.695	0.825	0.612
USA	0.790	0.856	0.543

Table 3. Fornell – Larcker criterion for discriminant validity

Constructs	ATT	INN	LIF	PEOU	PU	SEC	SI	TR	USA
ATT	0.784	–	–	–	–	–	–	–	–
INN	0.381	0.792	–	–	–	–	–	–	–
LIF	0.512	0.340	0.741	–	–	–	–	–	–
PEOU	0.463	0.349	0.366	0.753	–	–	–	–	–
PU	0.491	0.397	0.536	0.641	0.710	–	–	–	–
SEC	0.439	0.406	0.493	0.380	0.428	0.785	–	–	–
SI	0.391	0.188	0.293	0.348	0.338	0.168	1.000	–	–
TR	0.348	0.317	0.376	0.330	0.349	0.702	0.120	0.783	–
USA	0.447	0.407	0.462	0.323	0.424	0.535	0.242	0.476	0.737

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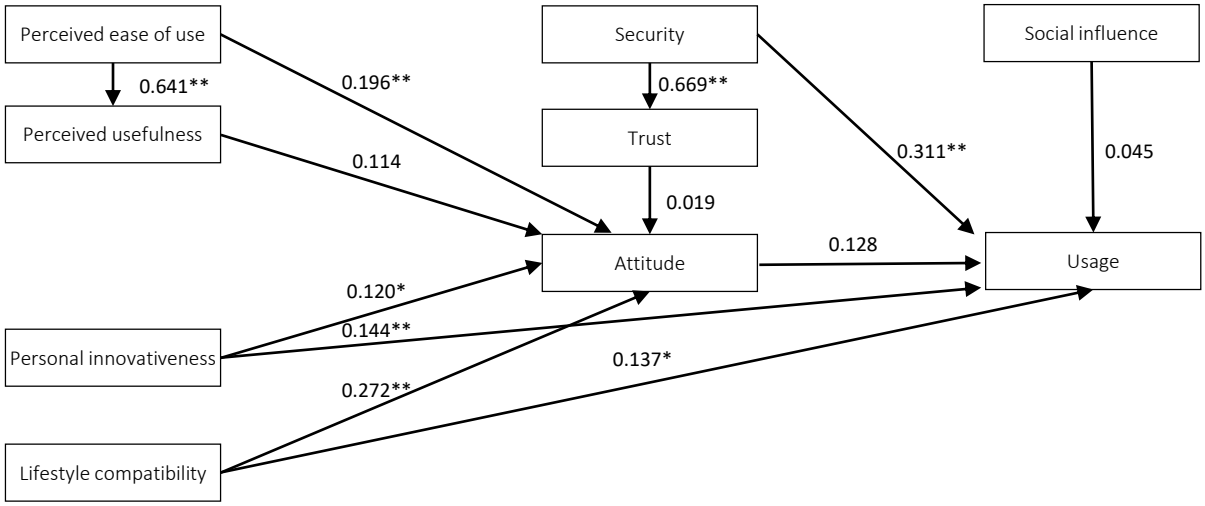
Indicator reliability is given as the square of the measurement model's outer loading, and an outer loading of 0.7 and above indicates around 50% reliability (Henseler, Ringle, & Sarstedt, 2016). The outer loadings of the items of the measurement model are given in Table 4. It can be seen that seven items for attitude, three out of six items for perceived usefulness, four out of five items for perceived ease of use, three out of four items for security, three items for trust, three items for innovativeness, six out of seven items for lifestyle compatibility, one item for social influence and five items for usage have an outer loading of at least 0.7, indicating good reliability.

5.2. Estimation of the structural model

Having established the measurement model's internal consistency and validity, the collinearity among the constructs is ascertained before estimating the structural model. A variance inflation factor (VIF) above 3.3 or tolerance coefficient (reciprocal of VIF) below 0.30 indicates multicollinearity among the constructs. However, the VIF values were found to be between 1 and 2.3; hence, there was no multicollinearity issue between the constructs.

Table 4. Outer loadings table

Items	ATT	INN	LIF	PEOU	PU	SEC	SI	TR	USA
ATT1	0.779	–	–	–	–	–	–	–	–
ATT2	0.819	–	–	–	–	–	–	–	–
ATT3	0.732	–	–	–	–	–	–	–	–
ATT4	0.769	–	–	–	–	–	–	–	–
ATT5	0.817	–	–	–	–	–	–	–	–
ATT6	0.830	–	–	–	–	–	–	–	–
ATT7	0.738	–	–	–	–	–	–	–	–
INN1	–	0.829	–	–	–	–	–	–	–
INN2	–	0.834	–	–	–	–	–	–	–
INN4	–	0.707	–	–	–	–	–	–	–
LIF10	–	–	0.653	–	–	–	–	–	–
LIF13	–	–	0.742	–	–	–	–	–	–
LIF14	–	–	0.719	–	–	–	–	–	–
LIF3	–	–	0.769	–	–	–	–	–	–
LIF4	–	–	0.757	–	–	–	–	–	–
LIF6	–	–	0.788	–	–	–	–	–	–
LIF8	–	–	0.750	–	–	–	–	–	–
PEOU1	–	–	–	0.803	–	–	–	–	–
PEOU2	–	–	–	0.756	–	–	–	–	–
PEOU4	–	–	–	0.663	–	–	–	–	–
PEOU6	–	–	–	0.715	–	–	–	–	–
PEOU7	–	–	–	0.820	–	–	–	–	–
PU1	–	–	–	–	0.625	–	–	–	–
PU10	–	–	–	–	0.698	–	–	–	–
PU3	–	–	–	–	0.710	–	–	–	–
PU4	–	–	–	–	0.679	–	–	–	–
PU6	–	–	–	–	0.746	–	–	–	–
PU7	–	–	–	–	0.789	–	–	–	–
SEC1	–	–	–	–	–	0.635	–	–	–
SEC4	–	–	–	–	–	0.762	–	–	–
SEC6	–	–	–	–	–	0.839	–	–	–
SEC7	–	–	–	–	–	0.882	–	–	–
SI4	–	–	–	–	–	–	1.000	–	–
TR1	–	–	–	–	–	–	–	0.845	–
TR3	–	–	–	–	–	–	–	0.750	–
TR4	–	–	–	–	–	–	–	0.749	–
USA1	–	–	–	–	–	–	–	–	0.730
USA2	–	–	–	–	–	–	–	–	0.717
USA5	–	–	–	–	–	–	–	–	0.771
USA7	–	–	–	–	–	–	–	–	0.758
USA8	–	–	–	–	–	–	–	–	0.707



Note: * significant at 0.05 level, ** significant at 0.01 level, *** significant at 0.001 level.

Figure 2. Structural model

The various linkages hypotheses are tested by looking at the path coefficients and their significance in the structural model using the bootstrapping algorithm with 5000 sub-samples and 407 cases. The standardized regression coefficients are depicted in Figure 2.

Attitude ($\beta = 0.128$, $p > 0.05$) and social influence ($\beta = 0.045$, $p > 0.05$) were found to be insignificant determinants of usage. Perceived usefulness ($\beta = 0.114$, $p > 0.05$) and trust ($\beta = 0.019$, $p > 0.05$) were found to be insignificant in their influence on attitude. Perceived ease of use was significantly related to perceived usefulness ($\beta = 0.641$, $p < 0.001$) and attitude ($\beta = 0.196$, $p < 0.01$). Security had a significant effect on trust ($\beta = 0.669$, $p < 0.001$) and usage ($\beta = 0.311$, $p < 0.001$). Personal innovativeness was a significant determinant of attitude ($\beta = 0.120$, $p < 0.05$) and usage ($\beta = 0.144$, $p < 0.01$). Lifestyle compatibility had a significant relation with attitude ($\beta = 0.272$, $p < 0.001$) and usage ($\beta = 0.137$, $p < 0.05$). To summarize, *H2*, *H3*, *H5*, *H6*, *H9*, *H10*, *H11*, and *H12* were supported, while *H1*, *H4*, *H7*, and *H8* were not supported. Scanning for the highest standardized regression co-efficient, it is found that security is the most important factor affecting usage followed by personal innovativeness and lifestyle compatibility. Lifestyle compatibility is also the most significant factor determining attitude formation towards mobile apps.

The coefficient of determination (R^2) is a measure of the model's predictive power and is calculated as the squared correlation between the predicted and actual values of the endogenous constructs. The R^2 values of the endogenous constructs are attitude (0.391), perceived usefulness (0.411), trust (0.498), and usage (0.391). Since R^2 values of 0.2 are considered high in consumer behavior studies (Hair, Hult, Ringle, & Sarstedt, 2017), the estimated model was found to be high in its predictive power.

The Stone-Geisser Q^2 values for the endogenous constructs were found using the blindfolding technique, and values greater than 0 indicate predictive relevance for those constructs. The endogenous constructs – attitude, perceived usefulness, trust, and usage had Q^2 values of 0.217, 0.192, 0.274, and 0.194, respectively, indicating that the model has predictive relevance for these endogenous constructs.

6. DISCUSSION

The current study attempted to find antecedents for the endogenous constructs – perceived usefulness, trust, attitude, and usage. The above analysis found that perceived ease of use had a significant positive impact on perceived usefulness and attitude. The ease of use for a mobile app is characterized by navigation features, user interface, and learnability. The easier it is to learn using an app, the more useful it is perceived to be in the consumer's minds, and the more favorable is the attitude towards the app. These results align with previous research studies (Nicolas et al., 2008; Belanche et al., 2012).

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The current study showed that perceived usefulness did not have a significant impact on attitude formation. A possible explanation for this deviation of findings from earlier studies could be that with a plethora of apps in the market, each of them offering their own set of benefits, the customer has become intelligent not to be swayed over just by the bouquet of benefits being offered. Instead, he evaluates many other factors before forming a favorable attitude towards the mobile app.

It was found that social influence did not significantly impact the usage of mobile apps, whereas earlier research has shown that it was a significant determinant of usage (Madan et al., 2016; Yu, 2012; Ghalandari, 2012). A potential explanation could be that others' opinions do not easily sway the consumer. Today's consumer is discerning in that he does his own research and takes a rational decision on whether to use or not use a mobile app.

Security features are the most important consideration in the usage of mobile apps, as is shown from a comparison of the standardized regression coefficients, and they also have a significant impact on trust. These results align with earlier studies (Riqueleme et al., 2014; Laforet & Li, 2005). This implies that security features fulfilled at the atomic transaction level help build trust at a macro-level over a long period and affect usage of the mobile apps.

Personal innovativeness was found to have a significant positive impact on mobile apps' attitude and usage, as has been seen in earlier research studies (Limayem et al., 2000; Agarwal & Prasad, 1998). From an earlier research study in India (Arora et al., 2020), it was found that respondents below 40 years of age (students and young working professionals) expressed a sense of competition amongst themselves to download and try new mobile apps from the App Store, displaying personal innovativeness. Another study among undergraduate and graduate students of Turkey showed that they possessed a higher degree of innovativeness and had more willingness to new experiences (Unal, Temizel, & Eren, 2017).

Lifestyle compatibility has also been found to have a significant positive impact on attitude and usage. This aligns with earlier research studies (Shankar, 2016; Chawla et al., 2017). Earlier research has shown that the principal reasons for using mobile apps are convenience, time-saving, cost-saving, and 'on-the-go' usage (Arora et al., 2020). The study also revealed that respondents below 40 years of age claimed that they could not survive without mobile apps. Therefore, 'time-starved' customers have very hectic lifestyles and straddle many responsibilities and have a high probability of adopting mobile apps. This segment includes students and the active working population who delicately balance the personal and professional dimensions of their life.

CONCLUSION

There are tectonic shifts in consumer perceptions and behavior with changing social dynamics, and existing frameworks are no longer sufficient to explain technology adoption. This study's academic contribution is that it has validated the constructs of the existing models in the context of the changing times and expanded the framework by integrating functional, social, security, and personal dimensions in the adoption of mobile apps. The existing models' functional characteristics – perceived usefulness and perceived ease of use were examined as antecedents for adoption. Personal characteristics- personal innovativeness and lifestyle compatibility are significant determinants of attitude formation and usage. The security dimension emerged as the most important antecedent affecting usage. Further research studies in this domain should include these four dimensions to obtain a holistic framework for the study.

With most companies using mobile apps as an innovative marketing tool for interacting with the customer, the current study has practical implications, detailed hereafter. To ensure the adoption of mobile apps and provide a better consumer experience, it is important to note that mobile apps have a user interface that is easy to learn and use. Poorly designed interfaces, cluttered pages, missing links, tedious navigation, and frequent upgrades will only dissuade the consumer from using

the app. In case of upgrades or addition of more features to the app, it is recommended that the overall 'look and feel' of the mobile app should not change drastically, so that the customer's confidence in navigating through the app is retained and he continues using the app.

For the consumer, security is the most important attribute that builds trust and propels usage. Trust is a key driver for continued transactions between the consumer and the vendor and lays the basis for a long-term relationship between the two parties. This implies that app publishers should focus on the security features and alleviate the security concerns in consumers' minds. App designers need to draw up a detailed blueprint to predict loopholes, failed transactions, and transaction rollbacks by the customer at different levels and provide mechanisms to safeguard consumer interest. Therefore, managers must ensure that processes and controls are strong and indestructible at every transactional level to build trust in the minds of the consumers and drive usage. Also, security grievances should be resolved immediately to gain customer satisfaction and loyalty.

The study results show greater usage and a more favorable attitude towards the mobile app, if the consumer feels that usage of mobile apps fits in with his lifestyle and with individuals with a higher degree of personal innovativeness. The greater a mobile app is shown to fit in individuals' lifestyle, the greater will be the likelihood of its adoption. A recommendation to practicing managers is that mobile apps should be targeted to the age group between 18 and 40 years, representing the students and active working population. This segment possesses a high degree of personal innovativeness, and mobile apps are also in sync with their lifestyle. These individuals can further act as influencers to help in the diffusion and adoption of mobile apps in society.

LIMITATIONS OF THE STUDY

The current study is also subject to certain limitations; therefore, the results should be interpreted with caution. The study is a one-time snapshot of consumer perceptions and patterns of mobile app usage. As digital media preferences and consumptions keep changing over time, it would be of interest to conduct a longitudinal study among consumers and note their changes.

Another limitation of the current study is in the area of sampling. The responses were collected only from a homogenous group residing in a specific region, namely the Northern Capital Region of India, probably lacking diversity if the sample was collected from the whole country.

The third limitation of the current study was to have studied security as a construct while ignoring privacy concerns. For future research studies in this domain, security and privacy could be investigated separately as antecedents of usage. Future research studies could also examine the effect of gender and age on mobile apps' attitude and usage.

AUTHOR CONTRIBUTIONS

Conceptualization: Neerja Arora.
Data curation: Garima Malik.
Formal analysis: Neerja Arora.
Methodology: Neerja Arora.
Supervision: Garima Malik.
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Writing – review & editing: Neerja Arora, Garima Malik.

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APPENDIX A

Table A1. Examining antecedents affecting Indian consumers' adoption of mobile apps

Perceived usefulness	
Using mobile apps allows me to accomplish more work than otherwise would be possible	PU1
Mobile apps support critical aspects of my life	PU2
Through mobile apps, I can complete tasks 24*7	PU3
Using mobile apps keeps me socially connected	PU4
I save time by using mobile apps	PU5
Mobile apps keep me updated with the latest trends	PU6
Life becomes convenient by using mobile apps	PU7
I save money by using mobile apps	PU8
The usage of mobile apps gives me more free time with family	PU9
Mobile apps keep me professionally connected	PU10
Perceived ease of use	
Learning to operate mobile apps is easy for me	PEOU1
It is easy for me to remember how to perform tasks using mobile apps	PEOU2
Interaction with mobile apps requires lot of mental effort (R)	PEOU3
I believe that it is easy to get a mobile app to do what I want it to do	PEOU4
I think I need others help in using mobile apps (R)	PEOU5
Step by step navigation of mobile apps is easy to understand	PEOU6
Overall, I believe that mobile apps are easy to use	PEOU7
Security	
The usage of mobile apps makes me feel secure	SEC1
I do not consider it safe to do any kind of financial business through mobile apps (R)	SEC2
I prefer to conduct high value monetary transactions through a laptop/desktop rather than through mobile apps because of security reasons (R)	SEC3
I am confident of making payments through mobile apps	SEC4
I would be worried about what would happen to the balance stored in the mobile app in case of loss or theft of my smartphone (R)	SEC5
I believe technology used in mobile apps is very secure	SEC6
I believe that transactions conducted through mobile apps are secure	SEC7
Mobile apps make it too easy for governments and companies to spy on people (R)	SEC8
Trust	
I trust the transactions happening through mobile apps	TR1
I believe that business providers of mobile apps will not share any of my information with a third party	TR2
I trust that mobile app providers give high priority to the customers' interest	TR3
I believe that in the case of any problems, the mobile app provider will assist me	TR4
Social influence	
Before downloading apps, I consult my family/friends	SI1
Using mobile apps improves my image amongst my peer group	SI2
People who influence my behavior think I should use mobile apps	SI3
Almost all my friends use mobile apps	SI4
People around me who use mobile apps have more prestige than those who do not	SI5
Before downloading apps, I consult the online ratings and review at the App Store	SI6
The online ratings and review of the app are more important than the review of my family and friends before downloading	SI7
Personal innovativeness	
If I hear about a new information technology, I would look for ways to experiment with it	INN1
Among my peers, I am usually the first to explore new technologies	INN2
In general, I am hesitant to experiment with new technologies (R)	INN3
I find new technologies to be mentally stimulating	INN4
Attitude	
I feel using mobile apps is a good idea	ATT1
I feel mobile apps are useful	ATT2
The use of mobile apps is exciting	ATT3

Table A1 (cont.). Examining antecedents affecting Indian consumers' adoption of mobile apps

Perceived usefulness	
The use of mobile apps is relevant in today's world	ATT4
The use of mobile apps is beneficial	ATT5
I value the benefits of mobile apps	ATT6
I find it interesting to use mobile apps	ATT7
Usage	
Most of my utility bills are paid through mobile apps	USA1
Most of the time, I book (travel, hotel, cab, restaurant, movie, theatre) tickets through mobile apps	USA2
I use mobile apps for navigation (maps)	USA3
Most of the time, I use mobile apps for searching information (news, sports, weather)	USA4
I use mobile apps for transferring money to and from banks/to other people	USA5
There is hardly a day when I have not used mobile apps	USA6
I shop through mobile apps	USA7
Most of the time I receive cash back/discount coupons on mobile devices	USA8
I use mobile apps when I am lonely/bored	USA9
Lifestyle compatibility	
I order food online on mobile apps	LIF1
I prefer to shop online than physically go to the stores	LIF2
Life will be very boring/dull without mobile apps	LIF3
The usage of mobile apps is a necessity in today's world	LIF4
The overuse of mobile apps has led to a decline in face-to-face human interaction (R)	LIF5
I cannot imagine my life without mobile apps	LIF6
I like to possess the latest mobile phone	LIF7
Using mobile apps empowers me	LIF8
Mobile apps can facilitate human togetherness and give an individual a sense of belonging	LIF9
Shopping through mobile apps helps save money	LIF10
Mobile apps are a good way to communicate and encourage human interaction	LIF11
Digitalization has reduced illegal transactions	LIF12
I cannot survive without mobile apps	LIF13
Mobile apps are an important source of information and entertainment for me	LIF14

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