

What impacts the adoption of mCommerce in India? A PLS SEM based study

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Abstract

Introduction: The rapid expansion of mobile commerce (mCommerce) offers opportunities to promote financial and social inclusion among rural populations in India. However, adoption remains influenced by users' perceptions, attitudes, and perceived ability to engage with mobile-based commerce. This study examines the factors influencing mCommerce purchase intention among rural consumers in India by integrating constructs from the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB). The study investigates the effects of perceived ease of use (PEOU) and perceived usefulness (PU) on attitude (ATT), perceived behavioral control (PBC), and purchase intention (PINT).

Method: Data were collected from 280 rural respondents using a five-point Likert-scale questionnaire, and the proposed relationships were examined using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4.

Results: The findings indicate that perceived ease of usage (PEOU) and perceived usefulness (PU) have significant positive effects on several intermediary constructs, including attitude (ATT) and perceived behavioral control (PBC). The findings indicate that PEOU (Perceived ease of usage) has a positive and significant influence on attitude (ATT), perceived behavioral control (PBC), and purchase intention (PINT), while perceived usefulness (PU) significantly influences perceived ease of usage (PEOU), attitude (ATT), and perceived behavioral control (PBC). Attitude (ATT) and perceived behavioral control (PBC) also have significant positive effects on purchase intention (PINT). However, PU does not have a significant direct effect on PINT, suggesting that perceived usefulness alone is insufficient to generate adoption intention. The mediation analysis further demonstrates that PEOU plays a critical role in translating perceived usefulness into purchase/usage intention, while PBC provides an important behavioral pathway. In particular, the serial mediation effect of PU → PEOU → PBC → PINT is significant, highlighting the importance of users' perceived capability and control. The findings extend the TAM-TPB literature by demonstrating that ease of use and perceived behavioral control are central mechanisms through which technology-related perceptions translate into adoption intention. This study provides important insights for policymakers and m-commerce companies.

Key terms: mCommerce, TAM (Technology Acceptance Model), and TPB (Theory of Planned Behavior)

1. Introduction

UN Sustainable Development Vision 2030 emphasizes the need to reduce poverty through social inclusion and promote equitable growth through the use of technology in banking, commerce, and governance. Due to their physical lack of access to opportunities, economically disadvantaged people frequently experience discrimination that impedes their social and financial inclusion. The adoption or implementation of technology is a bottom-up strategy to advance equity, diversity, and social inclusion. The adoption of technology, however, is a complicated process that affects members' mental dispositions and attitudes. The purpose of this paper is to investigate the factors that influence users' adoption of technologies such as mobile commerce. M-commerce, which involves transactions via mobile devices, demonstrates technology's potential to address these goals by providing rural Indians with access to citizen-centric services. Rural India faces significant challenges, including poor physical infrastructure, limited connectivity, low digital literacy, and a reliance on an agrarian economy, despite government efforts to promote digital initiatives. These involve transactions via wireless mobile devices, demonstrating the potential of technology to address these goals by providing rural Indians with access to governance and commerce. Additionally, engaging in mCommerce presents several difficulties for rural women and communities. However, m-commerce can enable people to engage in entrepreneurial activities such as selling agricultural products or handicrafts, helping them achieve economic liberation. Additionally, it has the potential to improve the delivery of government services by improving the effectiveness of direct benefit transfers, pensions, and subsidies to recipients in remote locations. The purpose of this study is to fill gaps in the literature on m-commerce and the variables affecting its uptake in rural India. By using the Technology Acceptance Model (TAM) and the theory of planned behavior to investigate user acceptance of m-commerce in this setting, it aims to close this gap. The study aims to evaluate the influence of user psychological factors on m-commerce adoption in rural India, including perceived ease of use, perceived usefulness, and attitudes. The study analyses the barriers to m-commerce adoption in this particular rural setting using the PLS-SEM method (Herman Wold, 1980). Policymakers, government agencies, and businesses will greatly benefit from the insights this study provides on the acceptance of mobile commerce in rural India as they plan to integrate digital and mobile services for this population. This study aims to analyze the factors that influence the adoption of mobile commerce in India.

2. Literature Review

A substantial 70% of Indian consumers prefer to make purchases on their mobile phones, underscoring the widespread acceptance and convenience of mobile commerce in India. Moreover, m-commerce constitutes approximately 60% of the total e-commerce market in India, reflecting the dominant influence of mobile devices in online transactions (Statista. , 2022). The global number of smartphone subscriptions has surpassed six billion, representing around 80% of the world's population, highlighting the pervasive nature of smartphones in modern society. Although m-commerce is prevalent in developed nations, it remains in its early stages in India and lacks substantial momentum. M-commerce specifically involves conducting transactions using mobile devices like smartphones and tablets (Kim, Mirusmonov, Lee, 2010). Various distinctive definitions of m-commerce are provided in the literature (Khalifa & Shen, 2008). In this study, m-commerce refers to business-to-consumer commerce, emphasizing the use of mobile-optimized websites, apps, and payment systems to facilitate secure and convenient transactions on mobile platforms (Choi, 2018). M-commerce offers benefits such as convenience and an enhanced shopping experience, prompting the increased use of mobile devices for shopping (Gupta, Dhawam, & Gupta, 2018). Additionally, mobile wallets and payment applications linked to m-commerce sites are considered part of the extended dimension of m-commerce. The study primarily aims to explore the main determinants of technology acceptance, specifically m-commerce, by people in rural India. Various factors deter individuals from adopting and integrating m-commerce into their daily lives (Villa, Ruiz, Valencia, & Picón, 2018). The Technology Acceptance Model (TAM) is widely used to ascertain m-commerce acceptance, emphasizing factors such as perceived usefulness and perceived ease of use (Davis, 1989). It emphasizes the critical role of perceived usefulness and perceived ease of use in shaping acceptance behaviors. The study also investigates consumers' acceptance behavior toward m-commerce through the Theory of Planned Behavior (TPB) model (Ajzen, 1988). It indicates that an individual's intention to implement m-commerce is significantly influenced by their attitude and perceived behavioral control (Mishra, 2014). Notably, Liao and Cheung's research delves into the factors influencing the perceived usefulness of a product and service, as well as the willingness to use and security, shedding light on the aspects that impact the perception of usefulness and security related to the utilization of a product or service (Cheung et al., 2002). These insights contribute to a comprehensive understanding of user behavior and the significant factors influencing the acceptance and usage of information systems, particularly in the context of m-commerce in rural India.

Perceived ease of use and intention to use mCommerce

According to Davis (1989), perceived ease of use refers to how user-friendly and simple users perceive a technology, m-commerce application, or website. It emphasizes that people are more likely to interact with technology they believe is simple and easy to use, especially when it comes to business and shopping. On the other hand, because of their perceived difficulty, complex or challenging technologies are less likely to be adopted. Perceived ease of use, according to Thorbjørnsen (2002), is a person's belief that using a particular mobile commerce platform requires little mental effort, reflecting the subjective assessment of practicality and simplicity in m-commerce use. The idea of being free from difficulty and excessive effort when using technology and m-commerce is also included in the concept of perceived ease of use (Davis, 1989). Since excessive cognitive effort can discourage the adoption of m-commerce, this understanding is closely linked to the effective management of cognitive resources. According to the literature, people's inclination to use technology is strongly influenced by perceived ease of use, which in turn is shaped by perceived utility (Phillips, Calantone & Lee, 1994). This boosts confidence in mobile commerce platforms. Research consistently shows that people are more inclined to adopt technology when they believe it is simple to use (Adams et al., 1992), underscoring the motivational value of user-friendly interfaces and experiences.

Perceived usefulness and intention to use mCommerce

Technology adoption is frequently understood as a psychological state impacted by the technology's perceived utility. According to Davis (1989), perceived usefulness refers to a person's conviction that a specific technological system will improve their performance (Agarwal & Karahanna, 2000). For example, Kim & Song (2010) link perceived usefulness to the advantages users gain from using digital banking, including the long-term benefits of using digital banking services (Barkhi, Reza, & Wallace, Linda, 2007; Hamid et al., 2016). Perceived usefulness, which includes benefits such as increased productivity, system effectiveness, and time and cost savings, has a substantial impact on technology adoption, according to the TAM (Davis, 1986). The extrinsic motivation for using technology, in the form of improved performance, is essentially represented by perceived usefulness. The TAM posits that perceived utility and ease of use influence a person's acceptance of technology (Brandon-Jones & Kauppi, 2018). Research shows that the intention to use technology is influenced by perceived usefulness; users will only use the online banking system if they find it useful (Aryani et al., 2018).

Attitude towards mCommerce

An individual's feelings, beliefs, and behavioral tendencies toward a particular person, object, or situation are collectively referred to as attitude (Yang, 2012). It is a

combination of affective states, cognitive functions, and behavioral responses that affect how a person perceives and responds to their surroundings. Adaptability and agility are, in fact, improved by a positive attitude toward technology, including mCommerce. Adopting technology with a positive outlook makes it easier for people and companies to adapt to new procedures, overcome obstacles, and capitalize on the opportunities the digital landscape offers. There is a lack of studies that connect the planned behavior to attitude and intention to use the technology. Perceived utility and ease of use are cognitive factors that influence users' attitudes and feelings toward adopting mCommerce, according to several studies (Zhou, Dai, & Zhang, 2007). Therefore, our research supports the findings of Kulviwat et al. (2007) and Mehrabian & Russell (1974) by demonstrating that PU (Perceived usefulness) and PEOU (Perceived ease of use) further contribute to the formation of attitudes toward the adoption of technology or mCommerce.

Perceived behavioral control

Perceived behavioral control (PBC) is a pivotal construct in the Theory of Planned Behavior (TPB), encapsulating an individual's perception of their ability to perform a specific behavior. This perception is rooted in the belief that one possesses the requisite resources, skills, and opportunities to successfully engage in and execute the behavior in question (Fishbein & Ajzen, 1975). The significance of perceived behavioral control (PBC) in shaping individuals' behavioral intentions and outcomes is indisputable. The concept of PBC, as described by Fishbein & Ajzen (1975), directly influences an individual's self-efficacy for executing a particular behavior, which subsequently affects the behavior's actual outcome. In a similar vein, the study by Pavlou & Fygenon (2006) highlights the complex and diverse aspects of PBC, regarding it as a critical factor influencing purchasing intention in digital transactions, alongside external control beliefs. Elie-Dit-Cosque et al. (2011) provide additional insight into the determinants of perceived behavioral control, noting that social, internal, and external factors influence it. This all-encompassing viewpoint illuminates the complex interaction of personal, ecological, and societal factors that contribute to PBC. In conclusion, the wide array of studies examining PBC highlights its complex characteristics and the numerous factors that contribute to its formation, including internal individual characteristics as well as external environmental and social influences. Gaining insight into the factors that influence perceived behavioral control is of paramount importance, not only for evaluating users' intentions to adopt and trust mobile and digital systems but also for conducting a comprehensive analysis of individuals' behavioral reactions across diverse settings.

Hypothesis to be tested

H1: Perceived Usefulness (PU) positively influences Perceived Ease of Use (PEOU).

H2: Perceived Ease of Use (PEOU) positively influences Attitude (ATT).

H3: Perceived Usefulness (PU) positively influences Attitude (ATT).

H4: Perceived Ease of Use (PEOU) positively influences Perceived Behavioral Control (PBC).

H5: Perceived Usefulness (PU) positively influences Perceived Behavioral Control (PBC).

H6: Perceived Ease of Use (PEOU) positively influences Purchase/Usage Intention (PINT).

H7: Perceived Usefulness (PU) positively influences Purchase/Usage Intention (PINT).

H8: Attitude (ATT) positively influences Purchase/Usage Intention (PINT).

H9: Perceived Behavioral Control (PBC) positively influences Purchase/Usage Intention (PINT).

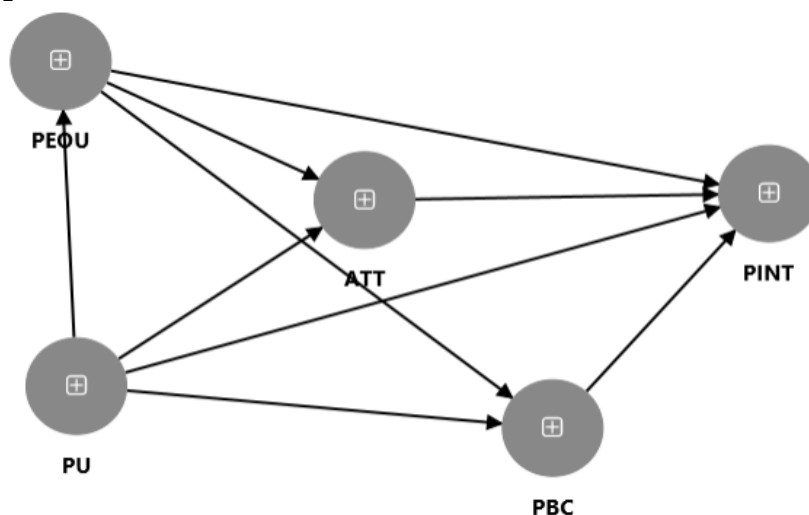
H10: Attitude (ATT) significantly mediates the relationship between Perceived Ease of Use (PEOU) and Purchase Intention (PINT).

H11: Attitude (ATT) significantly mediates the relationship between Perceived Usefulness (PU) and Purchase Intention (PINT).

H12: Perceived Behavioral Control (PBC) significantly mediates the relationship between Perceived Ease of Use (PEOU) and Purchase Intention (PINT).

H13: Perceived Behavioral Control (PBC) significantly mediates the relationship between Perceived Usefulness (PU) and Purchase Intention (PINT).

Conceptual Model



(PEOU: Perceived ease of usage, PU: Perceived usefulness, PBC: Perceived behavioral control, ATT: Attitude, and PINT: Purchase intention)

Figure 1: PLS SEM Model (Source: Author's own work)

The conceptual model adopted for this study is grounded in the Theory of Planned Behavior and is presented in Figure 1. The proposed framework integrates the Theory of Planned Behavior and the Technology Acceptance Model to explain the consumer purchase intention through mobile commerce. The technology acceptance model explains the use of m-commerce based on cognitive evaluations. The Theory of Planned Behavior explains the use of m-commerce in terms of affective factors such as attitude and behavioral control. Within the Technology Acceptance Model framework, individuals are more likely to use m-commerce if they perceive the technology as easy to use and useful. In this framework, perceived ease of use and perceived usage are both cognitive evaluations. The hypotheses being tested within this framework are perceived ease of use and perceived usage lead to purchase intention.

The theory of planned behavior proposes that attitude and perceived behavioral control impact purchase intention. TPB posits that attitude and perceived behavioral control influence purchase intention to use mCommerce in rural India. The attitude refers to the individual's emotional dispositions and beliefs regarding the use of m-commerce in rural India. Perceived behavioral control refers to an individual's perception that they have the resources, ability, knowledge, and control required to use the technology.

The proposed framework integrates the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) to explain users' intention to adopt/use the focal technology. Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), derived from TAM, represent the technological determinants of acceptance. These perceptions are expected to influence users' Attitude (ATT) and Perceived Behavioral Control (PBC), which are derived from TPB. In addition, PU and PEOU are hypothesized to exert direct effects on Purchase/Usage Intention (PINT). Consistent with TPB, ATT and PBC are expected to influence PINT positively. The framework, therefore, captures both direct and indirect mechanisms through which technology-related perceptions influence behavioral intention, with ATT and PBC potentially mediating the relationships between TAM constructs and intention.

4. Methodology

A Likert scale from 1 to 5 was used in the study's questionnaire, which was based on previously published research. Five constructs were included in the questionnaire: attitude, intention to use, perceived usefulness, and perceived ease of use. The concept of perceived usefulness and ease of use was taken from Davis (1989). Indicators of attitude have been modified from those of Kim et al. (2014) and Yang (2012). Each construct has been carefully selected from a range of academic publications, thereby strengthening the questionnaire's validity. The indicators from the questionnaire are detailed in Table 1 of the paper. The study tested the hypotheses of the Technology

Acceptance Model (TAM) using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method, developed by Wold (1985). In line with the objective of the PLS-SEM as stated by Claudia et al. (2014), this method seeks to maximize the explained variance of the endogenous constructs/indicators while minimizing the overall term. As demonstrated by Babin & Boles (1998), who emphasized PLS-SEM's high regard among scholars, it has gained considerable recognition in academia. Sarstedt et al. (2017a) and Hair et al. (2019) highlight its suitability for non-normal data, particularly when mediation is included in the model. Additionally, as demonstrated by Hair et al. (201), Claudia et al. (2014), and Agithaputri (1998), PLS-SEM is preferred over covariance-based structural modeling and ordinary least squares (OLS) regression, especially in situations of non-normality and small sample sizes. The model is crucial for comprehending the connections in the structural model (Hair et al., 2019; Benitez et al., 2010). The measurement and structural model are calculated using SmartPLS V4 software.

5. Data Collection & Analysis

5.1 Normality test

With 280 members, the sample's demographic profile, as shown in Table 2, primarily reflects the 18–55 age range. (Zhang & Yuan, 2018) suggested a web-based calculator test for assessing multivariate normality in the data to ensure accurate model prediction. The evaluation shows signs of non-normality in the multivariate distribution, but the univariate data remain normal, as indicated by skewness and kurtosis values between -2 and +2. Mardia's multivariate skewness ($\beta = 3.22$; $p > 0.00$) and multivariate kurtosis ($\beta = 56.35$; $p < 0.00$) serve as examples of this (George, D., & Mallery, 2003; Field, A., 2009). The use of Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis is supported by the data's non-normality and the lack of distributional assumptions. According to Hair et al. (2011), Nitzl (2016), and Efron (1987), this method is preferred for its greater robustness in abnormal situations.

5.2 Common method bias

Common method bias may occur when data is sourced from a single origin, raising concerns about data validity (Avolio et al., 1991; Podsakoff et al., 2012). To mitigate this, the study applied both procedural techniques and statistical tests (Reio, 2010). The questionnaire was carefully designed to be precise and targeted to the relevant demographic. The variance inflation factor (VIF) was used to assess collinearity and maintain statistical rigor (Kock, 2015; Podsakoff et al., 2012; Burton-Jones, 2009; Viswanathan & Kayande, 2012). A pilot study with 30 participants was conducted to validate the response accuracy (Hulland, 1999). VIF values for all latent constructs ranged from 1.73 to 3.73, staying below the conservative threshold of 5 and slightly

above 3.3, suggesting that common method bias is not a significant concern in this research.

5.3 Assessment of reflective constructs

Following the research protocol, an analysis of the outer loadings of indicators was conducted, with all five construct indicators exceeding the 0.7 threshold recommended by Hair et al. (2010). External model evaluation, the first step in assessing the PLS-SEM model, involves examining the relationships between indicators and their constructs. The study assessed the model's internal consistency reliability, discriminant validity, convergent validity, and indicator validity (Bernstein and Nunnally, 2017). Cronbach's Alpha, ranging from 0 to 1, was used to evaluate reliability. Values above 0.60 are acceptable for early-stage research; values above 0.70 and 0.80 indicate increasing reliability, while values over 0.90 may imply redundancy or excessively high correlations among indicators. This metric measures only the correlation between variables. Composite reliability and Rho values were also calculated to assess reliability. Composite reliability offers a more liberal estimate of internal consistency, whereas Cronbach's Alpha is more conservative. The Rho value reflects the correlation between these two measures. Indicator reliability was deemed satisfactory, as all outer loadings of reflective indicators were above 0.708. Constructs showed adequate internal consistency and reliability, with Cronbach's Alpha values ranging from 0.708 to 0.90. Composite reliability (CR) and Rho values also fell within this range. Convergent validity was evaluated using the Average Variance Extracted (AVE) criterion. All AVE values, calculated following Hair et al. (2017), exceeded the 0.50 benchmark. The measurement model results are presented in Table I.

TABLE I: MEASUREMENT MODEL

Construct	Item	Scale	Loading	AVE	Composite reliability (rho_a)	Cronbach alpha	Composite reliability (rho_c)
Attitude	ATT1	REF	0.902***	0.712	0.882	0.865	0.908
	ATT2		0.791***				
	ATT3		0.834***				
	ATT4		0.845***				
	PEOU1		0.876***				
PEOU	PEOU2		0.755***	0.647	0.871	0.863	0.901
	PEOU3		0.804***				
	PEOU4		0.789***				
	PEOU5		0.793***				
PBC	PBC1	REF	0.944***	0.781	0.900	0.860	0.914

	PBC2		0.867***				
	PBC3		0.837***				
PU	PU1	REF	0.893***	0.709	0.886	0.863	0.906
	PU2		0.855***				
	PU3		0.761***				
	PU4		0.852***				
PINT	PINT1	REF	0.920***	0.751	0.871	0.834	0.900
	PINT2		0.861***				
	PINT3		0.816***				

(Source: Author's own source); Note:*** ($p < 0.05$) for testing significance level
ATT refers to Attitude; PEOU refers to perceived ease of usage; PBC refers to perceived behavioral control; PU refers to perceived usefulness & PINT refers to perceived intention

5.4 Discriminant Validity

According to Fornell and Larcker (1981), discriminant validity means that the latent variables explain a larger portion of the variance in the indicator variables than what is shared with other constructs (Campbell and Fiske, 1959). This approach focuses on evaluating the Average Variance Extracted (AVE) in relation to the squared correlations with other constructs in the model. Discriminant validity was examined using both the Heterotrait-Monotrait Ratio (HTMT) and the Fornell and Larcker criterion (Fornell and Larcker, 1981). According to Fornell and Larcker's criterion, the square root of the AVE for each construct must exceed its correlation with any other construct, ensuring discriminant validity within the data. Furthermore, all HTMT values (Henseler et al., 2015) fall below the 0.85 threshold, confirming the absence of discriminant validity issues. The detailed results of this analysis are provided in Tables II and III.

TABLE II: DISCRIMINANT VALIDITY - HTMT RATIO

	ATT	PBC	PEOU	PINT	PU
ATT					
PBC	0.376				
PEOU	0.409	0.552			
PINT	0.356	0.437	0.519		
PU	0.349	0.392	0.420	0.308	

ATT refers to Attitude; PEOU refers to perceived ease of usage; PBC refers to perceived behavioral control; PU refers to perceived usefulness & PINT refers to perceived intention; (Source: Author's own work)

TABLE III: FORNELL LARCKER CRITERION

	ATT	PBC	PEOU	PINT	PU
ATT	0.844				
PBC	0.336	0.884			
PEOU	0.361	0.489	0.804		
PINT	0.312	0.376	0.447	0.867	
PU	0.314	0.349	0.37	0.27	0.842

ATT refers to Attitude; PEOU refers to perceived ease of usage; PBC refers to perceived behavioral control; PU refers to perceived usefulness & PINT refers to perceived intention ; (Source : Author's own work)

5.5. Assessment of structural model

After testing the reliability and validity of the measurement model, the next step is to analyze the structural model to validate the hypotheses (Hair et al., 2017). Furthermore, the Variance Inflation Factor (VIF) was calculated to assess multicollinearity in the model. The results show that all the tolerance values are below the threshold value of 5.

TABLE IV: STRUCTURAL MODEL

	Original sample	Std Error	T statistics	P values
ATT -> PINT	0.130***	0.064	2.027	0.043
PBC -> PINT	0.166***	0.063	2.657	0.008
PEOU -> ATT	0.284***	0.065	4.338	0.000
PEOU -> PBC	0.416***	0.059	7.108	0.000
PEOU -> PINT	0.296***	0.064	4.597	0.000
PU -> ATT	0.209***	0.065	3.204	0.001
PU -> PBC	0.195***	0.059	3.325	0.001
PU -> PEOU	0.37***	0.056	6.558	0.000
PU -> PINT	0.061	0.064	0.952	0.341
PU -> PEOU -> ATT	0.105***	0.03	3.495	0.000
PU -> PEOU -> PBC	0.154***	0.031	5.027	0.000
PEOU -> PBC -> PINT	0.069***	0.029	2.413	0.016
PEOU -> ATT -> PINT	0.037	0.021	1.785	0.074
PU -> PEOU -> PINT	0.11***	0.031	3.484	0.000
PU -> PBC -> PINT	0.033	0.018	1.853	0.064
PU -> ATT -> PINT	0.027	0.017	1.569	0.117
PU -> PEOU -> ATT -> PINT	0.014	0.008	1.731	0.084
PU -> PEOU -> PBC -> PINT	0.026***	0.011	2.229	0.026

ATT refers to Attitude; PEOU refers to perceived ease of usage; PBC refers to perceived behavioral control; PU refers to perceived usefulness & PINT refers to perceived intention ; (Source : Author's own work); Note:*** ($p < 0.05$) for testing significance level

Results for the hypothesis testing for the direct effect

The structural model results support the assertions of the integrated framework of the theory of planned behavior and the technology acceptance model. The findings indicate that cognitive factors, attitudes, and perceived behavioral control regarding the use of m-commerce and technology positively influence purchase intention. The results support the theory of planned behavior as the attitude has a positive and significant impact on purchase intention ($\beta = 0.130$, $t = 2.027$, $p = 0.043$). Thus, the results of the study support the proposition that attitude positively influences purchase intention through the use of m-commerce in rural India. Secondly, the Perceived Behavioral Control (PBC) positively and significantly influences PINT ($\beta = 0.166$, $t = 2.657$, $p = 0.008$). Thus, individuals who perceive they have greater ability, knowledge, and resources tend to use technology and m-commerce to make purchases much more frequently. The findings also support the technology acceptance model. Perceived Ease of Use (PEOU) has a positive and significant effect on ATT ($\beta = 0.284$, $t = 4.338$, $p < 0.001$), indicating that when users perceive the technology as easy to understand and operate, they are more likely to develop a favorable attitude toward it. PEOU also has a substantial positive effect on PBC ($\beta = 0.416$, $t = 7.108$, $p < 0.001$), suggesting that ease of use enhances users' confidence in their ability to use the technology. Importantly, PEOU also has a direct and significant effect on PINT ($\beta = 0.296$, $t = 4.597$, $p < 0.001$). This is the strongest direct predictor of PINT among the reported relationships, demonstrating that simplicity and ease of interaction are particularly important in shaping users' intentions. Similarly, perceived usefulness (PU) has a positive and significant impact on the attitude ($\beta = 0.209$, $t = 3.204$, $p = 0.001$) and **PBC** ($\beta = 0.195$, $t = 3.325$, $p = 0.001$). This implies that users who perceive greater benefits from using m-commerce are more likely to evaluate it positively and feel capable of using it. Furthermore, PU has a significant positive effect on **PEOU** ($\beta = 0.370$, $t = 6.558$, $p < 0.001$). This finding indicates a strong association between usefulness and perceived ease of use in the proposed framework. However, the direct relationship between PU and PINT is not statistically significant ($\beta = 0.061$, $t = 0.952$, $p = 0.341$). This is an important finding: perceived usefulness does not directly translate into purchase intention. Instead, the influence of PU appears to operate primarily through other constructs, particularly PEOU, attitude, and PBC.

Mediation

The mediation results provide further insight into how perceptions of technology are translated into behavioral intention. The indirect effect of $PU \rightarrow PEOU \rightarrow ATT$ is positive and significant ($\beta = 0.105$, $t = 3.495$, $p < 0.001$), indicating that PU contributes to a favorable attitude partly through its association with ease of use. Similarly, the

indirect effect of **PU** → **PEOU** → **PBC** is significant ($\beta = 0.154, t = 5.027, p < 0.001$), demonstrating that PU strengthens perceived behavioral control through PEOU. The pathway **PEOU** → **PBC** → **PINT** is also positive and significant ($\beta = 0.069, t = 2.413, p = 0.016$). This confirms that PBC serves as an important mediator between ease of use and intention. In other words, an easy-to-use technology not only directly encourages intention but also increases intention by enhancing users' perception that they have the ability and control necessary to use the technology. In contrast, **PEOU** → **ATT** → **PINT** is not significant ($\beta = 0.037, t = 1.785, p = 0.074$). Although PEOU significantly improves attitude, the resulting indirect effect on intention through attitude alone is insufficient to reach the 5% significance level. This suggests that attitude is a weaker mediating mechanism than perceived behavioral control in explaining the relationship between PEOU and PINT. The indirect pathway **PU** → **PEOU** → **PINT** is positive and significant ($\beta = 0.110, t = 3.484, p < 0.001$), despite the absence of a significant direct **PU** → **PINT** relationship. This is a particularly important result. It suggests that the effect of usefulness on intention is transmitted through perceived ease of use rather than occurring directly. Users may recognize a technology's usefulness, but this perception translates into intention, particularly when the technology is also perceived as easy to use.

TABLE V - R-SQUARE

	R-square	R-square adjusted
ATT	0.168	0.162
PBC	0.272	0.266
PEOU	0.137	0.134
PINT	0.252	0.242

ATT refers to Attitude; PEOU refers to perceived ease of usage; PBC refers to perceived behavioral control; PU refers to perceived usefulness & PINT refers to perceived intention (Source : Author's own work)

The R-square (R^2) values indicate the proportion of variance in each endogenous construct that is explained by its predictor variables in the proposed PLS-SEM model. The results show that ATT has an R^2 of 0.168, **indicating that** PEOU and PU explain 16.8% of the variance in ATT. This implies that perceived ease of usage and perceived usefulness explain a significant amount of variance in attitude. Further, PBC has an R^2 of 0.272, **meaning that** PEOU and PU explain 27.2% of the variance in Perceived Behavioral Control. The adjusted R^2 of 0.266 confirms that the model provides a reasonably stable explanation of PBC. Further, PEOU, the R^2 value is 0.137, **indicating that** PU explains 13.7% of its variance. **Finally**, PINT has an R^2 of 0.252, **meaning that** ATT, PBC, PEOU, and PU explain 25.2% of the variance in Purchase/Usage Intention. **The adjusted R^2 of 0.242** indicates that the model retains approximately 24.2% explanatory power after adjustment for the predictors.

6. Conclusion

The findings of the study have far-reaching implications for digital service providers and mCommerce firms seeking to increase technology adoption in rural India. According to the structural model, perceived ease of use is the single most important predictor of intention to use ($\beta = 0.296, p < 0.001$) and also significantly influences both Attitude and Perceived Behavioral Control. Therefore, policymakers should encourage the development of simple, intuitive, and user-friendly digital mCommerce platforms. Policymakers can design regulations to create mCommerce platforms that are easy to use and navigate in terms of design, language, features, and accessible authentication procedures. Further reducing the complexity of digital platforms can lower barriers to adoption, particularly among users with limited experience. Second, the significant relationship between PEOU and PBC ($\beta = 0.416, p < 0.001$) and the significant mediation of PBC between PEOU and PINT indicate that users' confidence and perceived ability to use technology are critical for adoption. The policymakers and service providers should therefore invest in digital literacy and user training programs. The use of online awareness campaigns, digital programs, and assisted digital service centers can help users develop the skills and confidence required to use digital platforms independently. Third, Perceived Usefulness (PU) significantly influences PEOU, ATT, and PBC, although its direct effect on PINT is insignificant ($\beta = 0.061, p = 0.341$). This suggests that simply communicating the benefits of a technology may not be sufficient to generate the intention to adopt it. The mCommerce providers and policymakers should invest significantly in promoting the functionality and benefits of mobile commerce apps in rural India. Fourth, the significant effect of ATT on PINT ($\beta = 0.130, p = 0.043$) indicates that creating a positive user perception remains important. Service providers should therefore improve users' overall experience by ensuring **reliability, transparency, security, responsiveness, and service quality**. Policymakers can support this process through consumer-protection regulations, grievance-redressal mechanisms, transparency requirements, and standards for digital-service quality. Positive experiences with technology can contribute to more favorable attitudes and, in turn, strengthen adoption intention. Fifth, PBC has a significant positive effect on PINT ($\beta = 0.166, p = 0.008$), and the pathway $PU \rightarrow PEOU \rightarrow PBC \rightarrow PINT$ is also significant. This indicates that policy interventions should focus not only on providing access to technology but also on ensuring that users have the resources, skills, infrastructure, and confidence necessary to exercise control over its use. Accordingly, initiatives aimed at expanding digital infrastructure, improving internet connectivity, ensuring affordable access to devices and services, and providing technical assistance can contribute to higher adoption. Finally, the non-significant direct effect of PU on PINT and the significant indirect effect $PU \rightarrow PEOU \rightarrow PINT$ ($\beta = 0.110, p < 0.001$) suggest an important policy lesson: usefulness alone does not guarantee adoption. Users may

recognize the benefits of a technology but still be reluctant to adopt it if the technology is difficult to operate.

7. Scope for future research

This study looks at the impact of perceived ease of use, perceived usage, attitude and perceived behavioral control on m Commerce usage in India. The context of this study is rural India, which is impacted by various social and subjective factors such as traditions, language, beliefs and customs. In future, more research can be undertaken to test the impact of the subjective norms and social factors on the adoption of mCommerce in rural India.

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