International Journal of Accounting and Economics Studies, 12 (7) (2025) 566-574

International Journal of Accounting and Economics Studies

Website: www.sciencepubco.com/index.php/IJAES
https://doi.org/10.14419/a4z4df13
Research paper

Digital Literacy and Online Shopping Behavior: Evidence from Rural Vietnam

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Received: September 3, 2025, Accepted: October 26, 2025, Published: November 19, 2025

Abstract

With the current strong digital transformation in Vietnam, this study aims to explore the role of digital literacy (DL) in shaping the perception and online shopping behavior of consumers in rural areas, a market that businesses have not yet exploited well. The study was conducted in two phases: phase 1 was to adjust the scale to adapt the scale to the research context; phase 2 was to survey 501 rural users who had their first access to e-commerce to test the conceptual model. Based on the extended technology acceptance model (eTAM) to establish the proposed research model, the SEM analysis results showed that DL has a positive impact on both perceived ease of use (PEOU) and perceived usefulness (PU), thereby indirectly affecting attitudes towards online shopping (ATOS) and purchase intention (PI). This finding confirms the fundamental role of DL in promoting digital consumer behavior in areas with many limitations in technological infrastructure and digital skills of consumers. The study not only contributes to the eTAM in a new context but also provides important practical implications for businesses and policy makers in developing e-commerce in rural areas of Vietnam.

Keywords: *Extended TAM Model; Digital Literacy; Rural Consumers; Online Shopping.*

1. Introduction

The rapid development of the technology and communication era has brought about significant changes in the socio-economy, most notably in global consumer behavior, including a strong shift from traditional shopping to online one. Vietnam is also a country dominated by such a context, especially in the post-COVID-19 pandemic context, and the policy of promoting national digital transformation, and e-commerce has become an indispensable part of human life. According to https://thitruongtaichinhtiente.vn/, in 2024, the size of Vietnam's e-commerce market will soon exceed the 25 billion USD mark, an increase of 20% compared to 2023, accounting for about 9% of the total retail sales of goods and consumer service revenue nationwide.

The impetus for this development comes from many sides, such as an increasingly complete technology infrastructure, a high rate of internet users of over 78% of the population accessing this service, and especially Decision 1813/QD-TTg in 2021 of the Government on non-cash payment policy. However, one of the biggest challenges today is the imbalance between urban and rural areas in the ability to access and benefit from e-commerce. While urban consumers are familiar with online shopping platforms such as Shopee, Lazada, Tiki, or TikTok Shop, in rural areas, where the majority of the country's population is located, the level of e-commerce penetration is still very limited (https://www.worldbank.org/en/country/vietnam). A common barrier for rural consumers is often low technology literacy, lack of trust in online transactions, limited digital skills, and difficulties in payment and delivery of goods (World Bank, 2020). Therefore, this research topic is an issue of high theoretical and practical significance.

Therefore, in the context of this study, the technology acceptance behavior of rural customers in the context of direct shopping is the core factor in the analysis. The Technology Acceptance Model (TAM) proposed by Davis (1989), in which two core factors are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), is considered the main factor influencing attitude and behavioral intention. This model has been effectively applied in explaining behavior in many studies related to e-commerce, information systems in digital environments (Venkatesh & Davis, 2000).

However, for rural consumers, access to and use of technology is not only dependent on the usefulness and ease of use of the platform but is also linked to the individual's digital competence, also known as digital literacy (DL). Digital literacy is defined as "the set of skills, understanding and attitudes needed to effectively use digital technologies in personal, educational and working life" (Ng, 2012). Eshet-Alkalai's (2004) study suggests that DL is a prerequisite for any consumer who wants to participate effectively in the digital environment. Recently, many studies have extended the TAM model by integrating the DL factor, showing that DL has a significant impact on PEOU and PU (Hargittai, 2010). The study by Al-Okaily et al. (2020) shows that digital skills have a positive impact on the use of mobile payment applications among rural users. This suggests that, to promote online shopping behavior, it is necessary to enhance DL as a premise of raising technology awareness. Therefore, the objective of the study is to determine the role of digital skills (DL) in technology awareness of rural consumers, and at the same time, test the relationships in the extended TAM model in the context of online shopping behavior in

rural areas of Vietnam. Finally, it proposes managerial implications to help businesses and authorities increase support for faster penetration of e-commerce in rural areas.

2. Literature Review

2.1. Theoretical background

The Technology Acceptance Model (TAM) is used as a background theory to explain the relationships between variables in the research model. In addition, the model is extended with the digital literacy factor to suit the goals and context of rural consumers in Vietnam.

The Theory of Reasoned Action (TRA) was developed by Ajzen and Fishbein in 1967 and then revised and perfected in 1975 (Ajzen & Fishbein, 1975). Ajzen & Fishbein (1975) argued that behavioral tendencies are predictors of actual behavior, in which behavioral intentions are a function of two variables that contribute to behavioral tendencies: attitudes and subjective norms. After TRA, two other variations appeared based on TRA: the TPB and the TAM. TRA was developed in the field of science and technology to form a new model, TAM. In this field, a product cannot be considered a good product if it does not do what consumers need. For example, products, software, websites, and applications need to be both easy to use and useful for people to "accept" them. That is the idea behind the technology acceptance model TAM.

The TAM model was developed by Davis (1986) to explain the factors that influence users' acceptance and use of information technology systems. Unlike TRA, TAM simplifies TRA by focusing on two key cognitive factors: (1) perceived usefulness (PU), which is a person's subjective belief that using a particular system will enhance their work performance, and (2) perceived ease of use (PEOU), which is a person's belief that using a system requires little effort because of the simplicity of the system (Davis, 1989).

TAM suggests that PEOU directly influences PU, and both influence attitudes toward technology use, which in turn influence intentions to use. Some scholars use an extended TAM, in which attitudes are sometimes removed, in which PU and PEOU are directly related to intentions (Venkatesh & Davis, 2000). However, most studies still consider attitude as an important mediator in the formation of consumer behavior, especially in the context of users who have little experience with technology (Zhou et al., 2007).

TAM has been applied in many fields such as information systems, financial services, online education, and especially e-commerce (Gefen et al., 2003; Pavlou, 2003). In e-commerce, PU is often related to the benefits of online shopping, such as saving time, cost, the ability to quickly search and compare products; while PEOU reflects how convenient and easy it is to access, search, operate, and complete transactions.

Although TAM has a fairly clear analytical framework, the original model did not take into account the fundamental factors, such as digital literacy (DL), which is essential in the current digital transformation context. According to Ng (2012), DL includes three components: technical skills, cognitive skills, and social-emotional aspects. This shows that DL is not only a technical ability, but also includes the cognitive ability to evaluate information, avoid risks, and use technology responsibly.

The application of TAM in this study has a clear academic and practical basis. In theory, TAM has been confirmed to be effective in predicting consumer behavior when approaching new technology platforms (Gefen et al., 2003; Pavlou, 2003). In practice, rural consumers in Vietnam are a group of customers with many limitations in digital capabilities. With these limitations, the assessment of ease of use and positive usefulness will determine their attitudes and behaviors towards online shopping. In addition, the study also extends the TAM model by integrating DL into the model as a prerequisite factor contributing to explaining the differences in technology awareness between population groups.

2.2. Concepts

Digital Literacy (DL)

Digital literacy is a concept that has been extended from traditional reading comprehension to the digital environment because they have similar connotations. DL refers to the ability to use digital tools to evaluate, use, and create information. According to Ng (2012), DL is a second-order construct with three components: technical skills, cognitive skills, and social-emotional skills.

In the context of e-commerce, DL is considered an important input factor that helps consumers understand and use digital platforms effectively for commercial activities. Users often appreciate the ease of use and usefulness of the system, thereby forming positive attitudes and usage behavior (Venkatesh et al., 2012). Especially for consumers in rural areas, DL plays an essential role as a prerequisite, supporting them in making decisions to access and use technology more effectively (van Deursen & van Dijk, 2014; Zhou et al., 2007; Lin, 2007).

Perceived Ease of Use (PEOU)

PEOU is defined by Davis (1989) as the simplicity of a system, or the degree to which a person believes that operating the system requires little effort. In e-commerce, PEOU reflects the ease with which a website or app can be used to search, place an order, track an order, and make a payment. PEOU is one of the two core components of TAM and often directly influences PU and indirectly influences PI through attitude (Venkatesh & Davis, 2000). Many experiments have shown that an easy-to-use interface and simple operations make consumers feel more comfortable, thereby increasing the likelihood of making online purchases (Zhou et al., 2007; Lin, 2007).

Perceived Usefulness (PU)

PU is the second important component, also defined by Davis (1989) as the extent to which a person believes that using the system will help them improve their job performance or make their life more positive. In the context of this study, PU is expressed by consumers' perception that e-commerce helps them save money, time, and facilitates transactions with a variety of different options. PU is one of the strongest factors influencing intention to use in many studies on this topic (Gefen et al., 2003; Pavlou, 2003).

Attitude Toward Online Shopping (ATOS)

Attitude is measured by a person's belief in a certain object or phenomenon. For commerce, belief in the product or service they intend to use is an emotional state that is expressed in human behavior (Edwin Cheng et al., 2006). In addition, attitude is a psychological tendency expressed by evaluating a specific object with some degree of support or disfavor (Eagly & Chaiken, 1993). In this study, attitude toward online shopping (ATOS) is the degree of positive or negative evaluation of consumers towards online shopping behavior. According to Ajzen & Fishbein (1980), attitude is an important mediator influencing behavioral intention.

Purchase Intention (PI)

Intended behavior is defined as the tendency to exert effort that people try to perform that behavior (Ajzen, 1991). According to TPB, behavior is the result of attitude, which determines behavior (Ajzen, 1991). It is influenced by two basic factors: objective factors and subjective factors. Objective factors here can be: living, working, learning, and educating environment, etc., while the subjective factor is

cognitive ability (attitude, trust). In the context of online shopping, intended behavior is strongly influenced by subjective cognitive ability, which is the premise that forms their attitude, including the perception of usefulness and ease of use of the service (Davis, 1989).
Purchase intention is the consumer's intention to perform a purchase behavior in the future. This is an important dependent variable reflecting the consumer's willingness to accept a form of purchase. PI is often influenced by attitudes, perceptions, and social factors such as trust, security, and user experience (Pavlou, 2003; Gefen et al., 2003). In this study, PI is understood as the level of willingness and desire of rural consumers to perform a purchase form change in the future.

2.3. Linkage among concepts

Digital literacy (DL) is the ability to access, use, and create digital information effectively, which is the foundation for determining consumer behavior and attitudes towards technology acceptance in the digital age. According to Ng (2012), in the context of e-commerce, DL plays a particularly important role because accessing e-commerce systems, such as interacting with the shopping interface and payment process, requires consumers to have a minimum level of digital competency. When users possess a high level of DL, they feel confident when operating on digital online platforms, thereby making it easier to form a perception of the system's Perceived Ease of Use - PEOU.
This conclusion is consistent with the study of Eshet-Alkalai (2004), who emphasized that digital literacy is not simply the skill of using software, but the comprehensive ability that helps users "adapt flexibly to technological changes", thereby perceiving the system as friendly and easy to use. The study of Venkatesh et al. (2003) on technology acceptance, in which PEOU is an important factor influencing the use of technology. This study suggests that when users feel that the technology is easy to use, they will tend to use the system. This proves that digital literacy plays an important role in promoting users' PEOU.
From the theoretical and empirical evidence, it can be seen that DL is a fundamental factor in forming the perception of the ease of use of the system. From that, the following hypothesis is proposed:
H1+: DL has a positive effect on PEOU.
In the digital age, digital literacy is not only a foundational skill that helps consumers interact effectively in online environments, but also a key factor in shaping the perception of the practical value that technology brings. People with high digital literacy not only know how to use digital tools, but also know how to integrate other tools to improve personal effectiveness (Ng, 2012). Moving to the online consumption context, it means that consumers with high digital literacy will easily recognize the benefits that e-commerce brings, thereby forming a positive perception of the usefulness of digital platforms.
Several empirical studies have confirmed the positive relationship between DL and PU. In the study by Hung et al. (2013), the authors found that DL acts as a strong underlying factor that influences PU. Users with good DL knowledge tend to rate digital services as more useful. Another study, which studied small and medium enterprises (SMEs) in Nigeria, found that managers with good DL knowledge were more likely to accurately assess the benefits of information technology on firm performance (Awa et al., 2015).
From the above evidence, it can be seen that DL not only facilitates technology usage behavior but also helps determine whether users perceive the technology as “useful” or not. Therefore, the following hypothesis is proposed.
H2: DL has a positive effect on PU.
According to TAM, PEOU is defined as how easy it is to operate the system. Meanwhile, PU reflects the extent to which users believe that the system is effective (Davis, 1989). These two variables do not exist independently; in fact, one of the strongest and most consistent relationships in TAM is the impact of PEOU on PU. That is, when consumers feel that a system is easy to use, they tend to rate it as more useful. Davis (1989), in his seminal work on TAM, came to this conclusion about the relationship and found that PEOU not only directly affects PU but also acts as a mediator to help users overcome psychological barriers during the adoption phase of technology. This argument is further reinforced in the study of Venkatesh & Davis (2000).
The PEOU-PU relationship is further confirmed by Ha & Stoel (2009) in the context of fashion e-commerce, as users perceive the shopping process as smooth and effortless. This is consistent with Lin’s (2007) argument that a smooth and simple user experience is one of the determinants of the perception of long-term benefits of technology.
In the context of this study, for rural consumers who are not familiar with online platforms, a friendly and easy-to-navigate interface not only reduces psychological pressure and fear but also helps them realize that online shopping platforms can actually bring more useful value. From there, the following hypothesis is proposed:
H3: PEOU has a positive effect on PU.
In Davis's TAM model (1989), PEOU is not only considered a factor influencing PU, but also contributes to shaping consumers' attitudes towards using technology. In the e-commerce environment, where interactions are mainly carried out through digital interfaces. Therefore, consumers' perception of ease of operation related to the interaction process is a prerequisite for them to form a positive attitude towards this form of shopping (Attitude Toward Online Shopping - ATOS).
Theoretically, when users feel that using a system is easy, they tend to reduce the anxiety that is often experienced when using new technology. According to Ajzen (1991), attitudes are driven by positive beliefs; among them, ease of use is considered a key belief in digital environments.
Empirical evidence has provided support for this relationship. Lin (2007) showed that PEOU strongly influences ATOS through psychological well-being in the shopping experience. Similarly, Chong (2013) also showed that PEOU is an important factor shaping users’ attitudes towards applications, especially among people with limited digital literacy. In the same vein, for travel consumers, it is found that the easier a user finds a platform to use, the more positive their attitudes are (Martín & Herrero, 2012; Amaro & Duarte, 2015).
Particularly in the online shopping environment in rural areas, the lack of technological experience is still common; convenience is the key factor for consumers to overcome the initial barrier and develop a positive attitude towards the decision to consume e-commerce services. From the above reasons, the study proposes the hypothesis:
H4: PEOU has a positive influence on ATOS.
In the framework of the TAM Model, PU is defined as the extent to which an individual believes that using a system will enhance their performance in their activities (Davis, 1989). PU can be understood as the extent to which consumers perceive that online shopping will help them save time, optimize costs, and facilitate transactions. It is this positive perception that plays an important role in shaping consumer attitudes.
Ajzen's (1991) TPB also suggests that attitudes stem from favorable beliefs about the outcomes of behavior. In this case, if consumers believe that the system is useful, they will have a more positive attitude toward this form of shopping. This is why many studies have consistently confirmed that PU is one of the most important factors influencing attitudes toward the acceptance of new technology. For example, in the original study by Davis (1989), PU was found to be the most powerful factor influencing user attitudes in an office technology environment, which is similar to Pavlou's (2003) study in the context of e-commerce. Similarly, Al-Gahtani et al.'s (2007) study

in Saudi Arabia confirmed PU as an important predictor of attitudes and intentions, even in a culturally conservative environment toward new technology.

From the above evidence, it can be affirmed that when consumers are aware of the practical benefits that e-commerce brings, they will form a positive attitude towards this shopping behavior. Therefore, the study proposes the following hypothesis:

H5: PU has a positive influence on ATOS.

Theoretically, Ajzen's TPB (1991) or Davis' TAM (1989) clearly identify that attitude is the most important predictor of behavioral intention. This is evidenced in studies using these models, which have also been replicated in many studies in many technological contexts (San Martín & Herrero, 2012; Ha & Stoel, 2009; Awa et al., 2015). In the context of e-commerce, attitude towards online shopping (ATOS) represents the degree of positive or negative feelings that consumers have about using shopping platforms. When consumers believe that this form is useful and easy to use, they will develop a more positive attitude, which will motivate them to perform future shopping behavior (Purchase Intention – PI).

There is a considerable amount of empirical evidence supporting the relationship between ATOS and PI. For example, Pavlou (2003) identified a new relationship between technological beliefs and actual behavior, San Martín & Herrero (2012) in the field of online tourism, and Akman & Mishra (2017) studied online purchasing behavior in developing country markets.

In the context of the current study, Vietnamese rural consumers ' attitudes play an even more decisive role. Since this group of consumers often has little experience with digital platforms, when they have formed a positive attitude (through perceived ease of use, usefulness, and trust), the likelihood of them converting to actual purchase behavior will be higher. This is especially meaningful in expanding the market to unexplored areas. Based on the above theoretical and empirical bases, the study proposes the following hypothesis:

H6: ATOS has a positive effect on PI.

Recent studies have further refined the understanding of digital literacy in online commerce contexts. Nguyen et al. (2024) found that DL not only improves users' perceptions of usefulness and ease of use but also strengthens online security behaviors, which in turn encourage e-payment adoption. Linh et al. (2024) highlighted that neighborhood effects in rural and mountainous regions can either discourage or indirectly facilitate digital payment adoption, indicating that social context mediates how DL translates into actual transactional behavior. In addition, Yin et al. (2025) showed that AI-driven recommendation systems enhance users' technology acceptance by increasing perceived usefulness and ease of use, although strong privacy concerns may weaken these effects. Together, these findings underscore that DL increasingly interacts with both social and technological factors to shape online shopping behavior.

2.4. Conceptual models

To broaden the economic perspective, the study integrates the TAM framework with key economic theories. According to consumer choice theory, digital capabilities (DL) reduce search and transaction costs, supporting rural consumers in making more efficient online decisions. The "digital divide" framework (van Deursen & van Dijk, 2014) shows that the gap in access and skills between urban and rural areas is narrowed as DL increases, expanding the possibilities for market participation. The conceptual model, therefore, considers DL as both a factor influencing PEOU and PU and a driver of market growth and cost savings, thereby linking individual digital capabilities to macroeconomic impacts. Based on the issues presented in Section 2.3, the research model proposed is outlined as follows (Figure 1).

Figure 1 presents the conceptual framework of the study, which builds on the Technology Acceptance Model (TAM) by incorporating digital literacy (DL) as a key antecedent. DL is proposed to affect both perceived ease of use (PEOU) and perceived usefulness (PU), which subsequently influence attitudes toward online shopping (ATOS) and purchase intention (PI). The model emphasizes the pivotal role of DL in shaping rural consumers' perceptions and behavioral intentions in e-commerce environments.

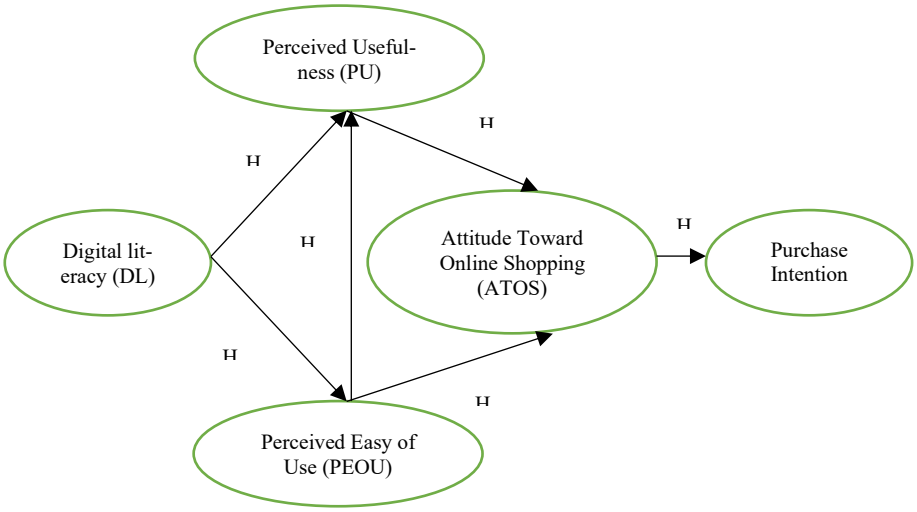

Fig. 1: Schematic Presentation of the Conceptual Model.

Authors' Own Research.

3. Methodology

3.1. Research process

This study used a mixed method (a combination of qualitative and quantitative methods). In the qualitative phase, focus group discussions were conducted with 6 experts, who are people living in rural areas, far from urban areas in Vietnam. The main purpose of this discussion was to refine the scale to adapt it to the research context of e-commerce purchasing behavior. A panel of experts reviewed each item to assess its clarity of language, cultural suitability, and contextual fit. Following their suggestions, several statements were revised to better

represent the technological context of rural consumers, and an additional item has been included in each CD, SD, and ATOS construct. This expert review process helped establish content validity before finalizing the survey instrument. After the scale was adjusted, the scale was used to collect quantitative data with a structured questionnaire. The "snowball" sampling method was used to approach a total of 501 respondents (valid questionnaires) who had their first steps in e-commerce.

3.2. Measurements

All measurement variables for the research concepts were adjusted (focus group) to fit the specific research context, except for DL all the remaining concepts are first-order constructs. Specifically, PU and PEOU both have four items referenced from Davis (1989); ATOS is measured with three items borrowed from Hee-dong & Youngjin (2004); and finally, PI is measured with three indicators adapted from Venkatesh et al. (2003). DL is measured by three components: (1) technical dimension with six items; cognitive dimension with two items; and social-emotional dimension with two indicators, all of which are borrowed from Ng (2012).
All items are rated using a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). All referenced scales were written in English and then translated into Vietnamese for the survey. This was necessary because most of the respondents were not good at English. As a result of the focus group discussion, the items were adjusted in terms of sentence structure and wording to better suit the context of this study, the context of e-commerce in rural areas. As a result of the focus group discussion, based on the context, the experts agreed to add one indicator to ATOS.
Participants were recruited using three main eligibility conditions: they had to have lived in rural communities for at least three years, possess basic internet or smartphone access, and have limited prior engagement with online shopping. While convenience sampling was employed, sampling bias was minimized by selecting respondents from various rural provinces and excluding individuals who were already frequent e-commerce users. The deliberate focus on rural populations aimed to capture a consumer group that remains relatively under-studied, thereby aligning with the research goal of examining digital inclusion and technology adoption in emerging market contexts.

4. Results and Discussion

4.1. Measure refinement

Cronbach's Alpha reliability analysis and Exploratory Factor Analysis assessed the internal consistency and construct validity of the scales. The results showed that all the coefficients of the constructs met the requirements of internal consistency, with Cronbach's Alpha coefficients of 0.846 for TD, 0.871 for CD, 0.868 for PU, 0.888 for PEOU, 0.818 for ATOS, and 0.853 for PI, respectively. A single variable in the TD scale was eliminated because the adjusted item-total correlation coefficient was below the acceptable threshold of 0.3 (Nunnally & Bernstein, 1994), while all the remaining variables exceeded this criterion and were therefore retained. Principal Component Analysis (PCA) with Varimax rotation was then conducted to examine the underlying factor structure. The analysis revealed seven distinct factors with eigenvalues greater than 1, accounting for 69.15% of the total explained variance (minimum eigenvalue = 1.215), thus indicating a satisfactory level of construct validity. Overall, the empirical findings confirmed that the measurement model met the required standards of reliability and validity, which provided the basis for including this model in a critical CFA, as detailed in Table 1.

Table 1: Analysis of Rotated Component Matrix

	Component						
	1	2	3	4	5	6	7
PEOU1			0.735				
PEOU2			0.815				
PEOU3			0.803				
PEOU4			0.776				
PU1				0.745			
PU2				0.732			
PU3				0.823			
PU4				0.826			
ATOS1		0.875					
TAOS2		0.814					
ATOS3		0.807					
ATOS4		0.910					
PI1							0.723
PI2							0.763
PI3							0.831
TD1	0.831						
TD2	0.753						
TD3	0.793						
TD4	0.810						
TD5	0.807						
CD1						0.760	
CD2						0.809	
CD3					0.212	0.803	
SD1					0.864		
SD2					0.748		
SD3					0.803		

4.2. Measurement validation

In this study, the saturated CFA model was used to assess the goodness of fit of the measurement model and the adequacy of the underlying constructs. The model consisting of five concepts with seven latent variables, as introduced above, was reused in this analysis. The overall model showed a good fit to the empirical data, as evidenced by the following fit indices: χ^2 (df = 278) = 503.480, $p < 0.001$; Cmin/df was 1.811, lower than the acceptable threshold of 3.0, as recommended by Carmines & McIver (1981). Alternative fit indices also indicated

the adequacy of the model, with the Goodness-of-Fit Index (GFI = 0.926), Comparative Fit Index (CFI = 0.960), and Tucker-Lewis Index (TLI = 0.953) all exceeding the conventional threshold of 0.90, indicating a good model fit. The root mean square error of approximation (RMSEA) was 0.040, which was still well below the upper limit of 0.08, thus confirming an acceptable level of approximation error (Figure 2). In addition, all items exhibited significant and statistically significant standardized factor loadings ($\lambda \geq 0.500$, $p < 0.001$), confirming that convergent validity was satisfied (Gerbing & Anderson, 1988). Furthermore, these constructs also met the conditions for composite reliability (CR) and average variance extracted (AVE), with all CR and AVE values exceeding the recommended threshold of 0.50. Importantly, discriminant validity was also established, as the AVE of each construct was greater than the corresponding Maximum Shared Variance (MSV), in line with the criteria proposed by Nguyen & Nguyen (2011), see Table 2.

Table 2: Measurement and Analysis of Model Validity

	CR	AVE	MSV	MaxR(H)	PU	PEOU	ATOS	PI	TD	CD	SD
PU	0.819	0.533	0.167	0.832	0.730						
PEOU	0.833	0.557	0.303	0.842	0.362***	0.746					
ATOS	0.900	0.697	0.150	0.938	0.264***	0.356***	0.835				
PI	0.777	0.538	0.303	0.784	0.408***	0.551***	0.387***	0.733			
TD	0.868	0.570	0.129	0.872	0.121*	0.048	0.056	0.007	0.755		
CD	0.765	0.522	0.213	0.773	0.081	0.113*	0.081	0.033	0.360***	0.722	
SD	0.779	0.542	0.213	0.787	0.132*	0.112*	0.070	0.079	0.274***	0.461***	0.736

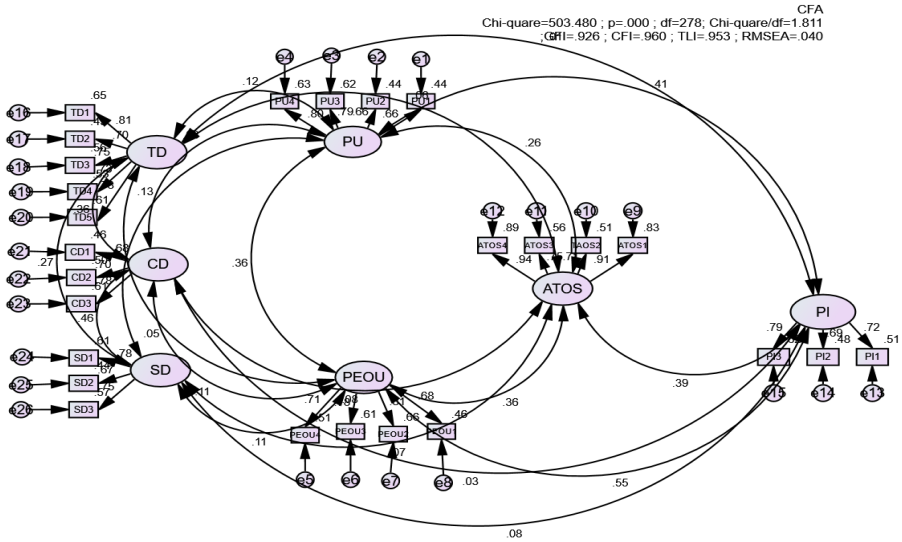

Fig. 2: The Saturated CFA Model.

Authors' own research

Figure 2 depicts the measurement framework, outlining how the observed indicators load onto their corresponding latent constructs. This representation clarifies the underlying structure of digital literacy (DL), perceived ease of use (PEOU), perceived usefulness (PU), attitudes toward online shopping (ATOS), and purchase intention (PI). It serves as the foundation for assessing construct reliability and validity before testing the structural relationships.

4.3. Structural results

As mentioned above, SEM was used to empirically test the conceptual framework and assess the hypothesized relationships among the core constructs proposed in the research model (see Figure 2 and Table 3). The results obtained from the standardized SEM analysis showed that all five hypothesized paths were statistically significant at the 0.05 level ($p < 0.05$), thus providing strong evidence for the fit of the theoretical model and the market data.

Specifically, the findings confirmed that, in the context of e-commerce, rural customers' PI is positively affected by ATOS, and ATOS in turn is positively affected by PEOU and PU. In addition, the internal relationship between PEOU and PU also shows a causal relationship. Finally, with the participation of the extended variable DL, the results show that DL has a positive impact on both PEOU and PU.

The results show that digital literacy, including the ability to access and use digital devices and basic operations with e-commerce platforms, plays a fundamental role in promoting positive perceptions of this form of shopping. In the rural context, where the digital literacy of the general population is still limited due to educational conditions and technological infrastructure, improving digital skills not only helps people overcome technological barriers but also triggers positive attitudes towards the acceptance and positive evaluation of this form of shopping.

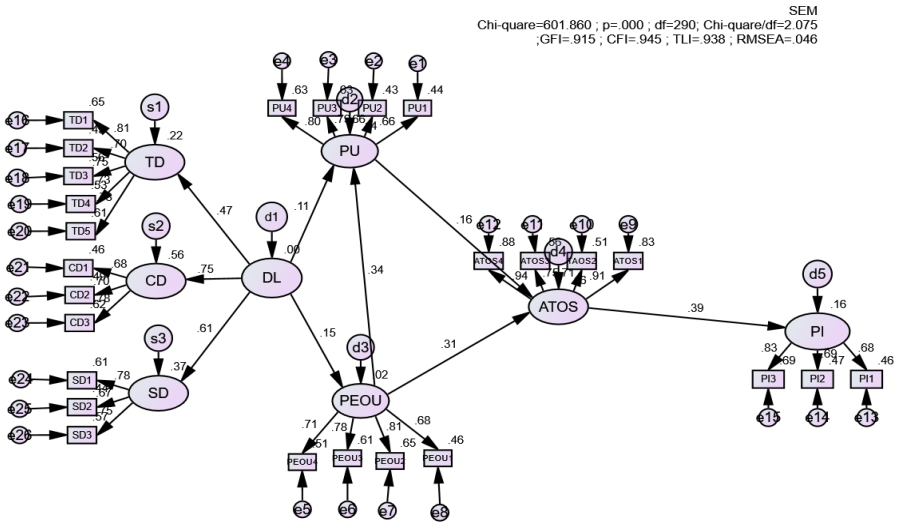

Fig. 3: Structural Equation Modeling Examination.

Authors' own research

Table 3: Structural Path Analysis (Standardized)

Hypotheses	Structural Path			Standardized Estimate	S.E.	C.R.	P
H1	PEOU	<---	DL	0.155	0.080	2.337	.019
H2	PU	<---	DL	0.113	0.095	1.779	.048
H3	PU	<---	PEOU	0.344	0.070	6.139	***
H5	ATOS	<---	PU	0.159	0.059	3.041	.002
H4	ATOS	<---	PEOU	0.310	0.075	5.721	***
H6	PI	<---	ATOS	0.394	0.037	7.349	***

4.4. Bootstrap estimation

This study uses Bootstrap analysis as a sampling technique with replacement to assess the stability and reliability of the parameter estimates in the conceptual model. As recommended by Schumacker & Lomax (2004), Bootstrap allows checking the robustness of the coefficients in the model, which is useful in studies using social data. The results are presented in Table 4, including the standard error, bias, and confidence interval of each path coefficient in the structural model. The absolute value of CR is very small compared to 2, so it can be said that the bias is very small, not statistically significant at the 95% confidence level.

Table 4: Bootstrap Analysis, N=1000

Structural Path	Estimate	SE	SE-SE	Mean	Bias	SE-Bias	CR	P	Conclusion
PEOU <- DL	0.155	0.063	0.001	0.156	0.001	0.002	0.500	0.617	Consistent
PU <- DL	0.113	0.062	0.001	0.110	-0.003	0.002	-1.500	0.134	Consistent
PU <- PEOU	0.344	0.054	0.001	0.345	0.001	0.002	0.500	0.617	Consistent
ATOS <- PU	0.159	0.054	0.001	0.160	0.001	0.002	0.500	0.617	Consistent
ATOS <- PEOU	0.310	0.050	0.001	0.395	0.001	0.002	0.500	0.617	Consistent
PI <- ATOS	0.394	0.050	0.001	0.395	0.001	0.002	0.500	0.617	Consistent

4.5. Discussion

Kết quả phân tích SEM đã kiểm định toàn bộ các giả thuyết trong mô hình eTAM được mở rộng, qua đó cho thấy DL đóng vai trò nền tảng trong việc hình thành nhận thức công nghệ và hành vi tiêu dùng số của người tiêu dùng nông thôn tại Việt Nam. Cụ thể, DL ảnh hưởng tích cực đến cả cảm nhận về tính dễ sử dụng (PEOU) và tính hữu ích (PU), điều này phù hợp với các nghiên cứu trước đây như Ng (2012), Hargittai (2010) và Al-Okaily et al. (2020), nhấn mạnh rằng người tiêu dùng có kỹ năng số tốt thường đánh giá cao khả năng tương tác và lợi ích mà nền tảng số.

Ngoài ra, PEOU cũng được nhiều bằng chứng thực nghiệm xác thực là yếu tố trung gian then chốt, không chỉ tác động trực tiếp đến PU mà còn ảnh hưởng mạnh đến ATOS. Điều này phù hợp với Davis (1989) và Venkatesh & Davis (2000), những người đã khẳng định rằng sự đơn giản trong thao tác kỹ thuật làm giảm lo âu và gia tăng sự tự tin trong tương tác với hệ thống. Tương tự, PU cũng ảnh hưởng đáng kể đến ATOS, qua đó củng cố nhận định của Pavlou (2003) và Al-Gahtani et al. (2007) rằng tính hữu ích là động lực quan trọng thúc đẩy sự chấp nhận công nghệ.

Đặc biệt trong kết quả tìm thấy này, ATOS là yếu tố có ảnh hưởng mạnh nhất đến PI, phản ánh đúng vai trò trung gian của yếu tố thái độ trong lý thuyết TPB (Ajzen, 1991). Kết quả này tương đồng với các nghiên cứu trong bối cảnh tương tự như San Martín & Herrero (2012), Akman & Mishra (2017).

5. Conclusion, Implications, and Limitations

5.1. Conclusion

The study has shed light on the role of digital literacy in technology awareness and online shopping behavior of rural consumers in Vietnam, in the context of strong digital transformation. Based on eTAM, the results show that digital literacy not only has a direct impact on PU and PEOU of the e-commerce system, but also indirectly affects ATOS and PI of the consumer.

The findings emphasize that promoting digital consumer behavior in rural areas cannot rely solely on developing technology infrastructure or expanding e-commerce platforms, but should focus on improving digital skills for people. In fact, when consumers feel easy to operate easily and see the practical benefits that technology brings, it will promote positive attitudes in consumers and willingness to change consumer behavior.

5.2. Implications

The results of the study provide several important implications for both businesses and policymakers regarding the development of e-commerce in rural areas:

Digital literacy (DL) plays a decisive role in shaping individuals' attitudes and behaviors toward online consumption, particularly within rural communities where access to technology remains limited. Strengthening digital inclusion, therefore, requires coordinated actions across multiple stakeholders. For individuals, community-based programs should prioritize essential skills such as mobile payment usage, safe engagement with e-commerce platforms, and basic cybersecurity practices. From the business perspective, especially for e-commerce providers, designing intuitive interfaces, simplifying navigation, and using clear, non-technical language can significantly lower participation barriers for rural users.

Governmental and regulatory bodies also hold a central role in creating enabling conditions for digital adoption. This includes infrastructure investment, financial incentives for private sector engagement, and embedding digital transformation within broader rural development agendas. Concrete actions may involve funding grassroots DL training, offering targeted broadband subsidies, and launching localized initiatives (e.g., "One Citizen, One Digital Account") to encourage long-term adoption.

Aligning these measures with Environmental, Social, and Governance (ESG) principles can enhance their broader impact. Environmentally, increased digital commerce may cut transport emissions; socially, digital inclusion advances equity and empowerment; and from a governance standpoint, improved participation fosters greater transparency. Integrating DL initiatives within ESG strategies helps stimulate rural economic growth while narrowing digital divides.

5.3. Limitations

Although this study has made valuable contributions to both theory and practice, there are some limitations. First, the study data were collected mainly from rural areas in Vietnam, so the results are limited in generalization to other areas. Second, the research model is mainly based on cognitive factors and does not address emotional or social factors. Finally, the study used a cross-sectional design, so it is not possible to assess long-term causal relationships between variables.

References

[1] Ajzen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall. https://www.scirp.org/reference/referencespapers?referenceid=775864.

[2] Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Process,* 50(2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-T.

[3] Akman, I., & Mishra, A. (2017). Factors influencing consumer intention in social commerce adoption. *Information Technology & People*, 30(2), 356-370. https://doi.org/10.1108/ITP-01-2016-0006.

[4] Al-Gahtani, S. S., Hubona, G. S., & Wang, J. (2007). Information technology (IT) in Saudi Arabia: Culture and the acceptance and use of IT. *Information & Management*, 44(8), 681-691. https://doi.org/10.1016/j.im.2007.09.002.

[5] Al-Okaily, M., Lutfi, A., Alsaad, A., Taamneh, A., & Alsyouf, A. (2020). The determinants of digital payment systems' acceptance under cultural orientation differences: The case of uncertainty avoidance. *Technology in Society*, *63*, 101367. https://doi.org/10.1016/j.techsoc.2020.101367.

[6] Amaro, S., & Duarte, P. (2015). An integrative model of consumers' intentions to purchase travel online. *Tourism Management*, 46, 64–79. https://doi.org/10.1016/j.tourman.2014.06.006.

[7] Awa, H. O., Ukoha, O., & Emecheta, B. C. (2015). Integrating TAM, TPB, and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. *Journal of Science & Technology Policy Management*, 6(1), 76-94. https://doi.org/10.1108/JSTPM-04-2014-0012.

[8] Carmines, E. G., & McIver, J. P. (1981). *Analyzing Models with Unobserved Variables: Analysis of Covariance Structures*. In G. W. Bohrnstedt & E. F. Borgatta (Eds.), *Social Measurement: Current Issues* (pp. 65-115). Beverly Hills: Sage Publications, Inc.

[9] Chong, A. Y. L. (2013). Predicting m-commerce adoption determinants: A neural network approach. *Expert Systems with Applications*, 40(2), 523–530. https://doi.org/10.1016/j.eswa.2012.07.068.

[10] Davis, F. D. (1986). *A Technology Acceptance Model for Empirically Testing New End-user Information System: Theory and Results, Doctoral Dissertation*, MIT Sloan School of Management Cambridge, MA. https://core.ac.uk/download/pdf/4387241.pdf.

[11] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly,* 13(3), 319-340. https://doi.org/10.2307/249008.

[12] Eagly, A. H., & Chaiken, S. (1993). *The Psychology of Attitudes*. Fort Worth, TX: Harcourt Brance Javanovich. https://archive.org/details/psychologyofatti0000eagl.

[13] Edwin Cheng, T. C., David Y. C. L, Andy C. L.Y. (2006). Adoption of internet banking: An empirical study in Hong Kong. *Decision Support Systems*, 42(3), 1558-1572. https://doi.org/10.1016/j.dss.2006.01.002.

[14] Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia*, 13(1), 93–106. https://www.learntechlib.org/primary/p/4793/.

[15] Fishbein, M. & Ajzen, I.(1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley. https://lib.ugent.be/catalog/rug01:000839739.

[16] Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, 27(1), 51-90. http://www.jstor.org/stable/30036519. https://doi.org/10.2307/30036519.

[17] Gerbing, D. W., & Anderson, J. C. (1988). An updated paradigm for scale development incorporating unidimensionality and its assessment. *Journal of marketing research, 25*(2), 186-192. https://doi.org/10.1177/002224378802500207.

[18] Hargittai, E. (2010). Digital na(t)ives? Variation in internet skills and uses among members of the "net generation". *Sociological Inquiry*, 80(1), 92-113. https://doi.org/10.1111/j.1475-682X.2009.00317.x.

[19] Ha, S., & Stoel, L. (2009). Consumer e-shopping acceptance: Antecedents in a technology acceptance model. *Journal of Business Research*, 62(5), 565–571. https://doi.org/10.1016/j.jbusres.2008.06.016.

[20] Hee-dong, Y. & Youngjin, Y. (2004). It's all about attitude: revisiting the technology acceptance model. *Decision Support Systems*, 38, 19-31. https://doi.org/10.1016/S0167-9236(03)00062-9.

[21] Hung, S. Y., Chang, C. M., & Yu, T. J. (2006). Determinants of user acceptance of the e-Government services: The case of online tax filing and payment system. *Government information quarterly*, *23*(1), 97-122. https://doi.org/10.1016/j.giq.2005.11.005.

[22] Lin, H. F. (2007). Predicting consumer intentions to shop online: An empirical test of competing theories. *Electronic Commerce Research and Applications*, 6(4), 433–442. https://doi.org/10.1016/j.elerap.2007.02.002.
[23] Linh, T. T., Thi, N., Huyen, T., Thang, D. N., & Mai, N. (2024). How neighbor influence negatively affects digital payment adoption in Vietnam. *Cogent Economics & Finance*, 12(1), 2431654. https://doi.org/10.1080/23311975.2024.2431654.
[24] Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education*, 59(3), 1065-1078. https://doi.org/10.1016/j.compedu.2012.04.016.
[25] Nguyen, T. D., & Nguyen, T. T. M. (2011). Psychological Capital, Quality of Work Life, and Quality of Life of Marketers: Evidence from Vietnam. *Journal of Macromarketing, 32*(1), 87-95. https://doi.org/10.1177/0276146711422065.
[26] Nguyen, T. T., Tran, T. N. H., Do, T. H. M., Dinh, T. K. L., Nguyen, T. U. N., & Dang, T. M. K. (2024). Digital literacy, online security behaviors and E-payment intention. *Journal of Open Innovation: Technology, Market and Complexity*, 10(2), 100292. https://doi.org/10.1016/j.joitmc.2024.100292.
[27] Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory*. New York: McGraw-Hill. https://doi.org/10.1177/014662169501900308.
[28] Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, 7(3), 101-134. https://doi.org/10.1080/10864415.2003.11044275.
[29] San Martín, H., & Herrero, Á. (2012). Influence of the user's psychological factors on the online purchase intention in rural tourism: Integrating TAM and TPB. *Tourism Management*, 33(2), 341–350. https://doi.org/10.1016/j.tourman.2011.04.003.
[30] Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling (2 ed.)*. Psychology press. https://doi.org/10.4324/9781410610904.
[31] Van Deursen, A. J., & Van Dijk, J. A. (2014). The digital divide shifts to differences in usage. *New media & society*, *16*(3), 507-526. https://doi.org/10.1177/1461444813487959.
[32] Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-204. https://ssrn.com/abstract=4062393. https://doi.org/10.1287/mnsc.46.2.186.11926.
[33] Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478. https://ssrn.com/abstract=3375136. https://doi.org/10.2307/30036540.
[34] Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly, 36*(1), 157–178. https://doi.org/10.2307/41410412.
[35] Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186–204. https://www.jstor.org/stable/2634758. https://doi.org/10.1287/mnsc.46.2.186.11926.
[36] World Bank. (2020). *Vietnam Digital Economy Assessment*. Washington, DC: World Bank. https://www.worldbank.org/en/country/vietnam/overview.
[37] Yin, J., Qiu, X., & Wang, Y. (2025). The Impact of AI-Personalized Recommendations on Clicking Intentions: Evidence from Chinese E-Commerce. Journal of Theoretical and Applied Electronic Commerce Research, 20(1), 21. https://www.mdpi.com/0718-1876/20/1/21. https://doi.org/10.3390/jtaer20010021.
[38] Zhou, L., Dai, L., & Zhang, D. (2007). Online shopping acceptance model–a critical survey of consumer factors in online shopping. *Journal of Electronic Commerce Research*, 8(1), 41–62. http://www.jecr.org/sites/default/files/08_1_p04.pdf.

Appendix

Items	Latent variable		Measurement items
TD1	DL	Technical dimension	I know how to solve basic technical issues when participating in e-commerce transactions (e.g., handling errors in placing orders or making online payments).
TD2			I can easily learn and use new technologies related to e-commerce (e.g., online shopping apps, e-wallets).
TD3			I always keep up with and update important new technologies related to online shopping.
TD4			I know about many different technologies that can support online shopping and transactions.
TD5			I have skills in using information and communication technologies to engage in e-commerce (e.g., using the Internet to search for products and make payments).
CD1		Cognitive dimension	I am confident in my skills to search for and evaluate information when looking for products or services on e-commerce websites.
CD2			I am aware of issues related to web-based activities (e.g., cybersecurity, product information search issues).
CD3			I can judge the quality and reliability of online information for myself when shopping.
SD1		Social-emotional dimension	Information and Communication Technology (ICT) helps me share information about products and services with the community.
SD2			I frequently receive help from friends over the Internet in searching for and choosing products or services online.
SD3			I can participate in online discussions and share my shopping experiences with the community.
PU1	PU		Using the online shopping system would increase the convenience of shopping and payment.
PU2			Using the online shopping system would improve the efficiency of the shopping and payment process.
PU3			Using the online shopping system would help me receive products faster.
PU4			I would find the online shopping system useful for making purchases, payments, and returns.
PEOU1	PEOU		Learning how to use online shopping systems to place orders and make payments is easy for me.
PEOU2			I find it easy to use e-commerce systems to place orders and make payments.
PEOU3			I would find it easy to become skillful at using online shopping and payment systems.
PEOU4			I would find online shopping, payment, and return systems easy to use.
ATOS1	ATOS		The online shopping system is a useful tool for shopping.
ATOS2			The online shopping system is a beneficial tool for making purchase transactions.
ATOS3			I support the method of online shopping.
ATOS4			I believe that online shopping is a convenient and beneficial method for making purchase transactions.
PI1	PI		I will use the online shopping system regularly in the future to place orders and make payments.
PI2			I will actively learn to use the online shopping system.
PI3			I expect that I will continue to use the online shopping system.