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Adoption of Digital Payment Methods in Vietnam: Key Determinants and Distribution Analysis

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Abstract

Purpose: This study aims to identify the key determinants influencing the adoption of digital payment methods (DPMs) and to examine the primary channels through which these methods are commonly utilized. **Research design, data and methodology:** A survey of 811 residents from the Northern mountainous region was conducted, and the collected data were analyzed using the multivariate probit model. **Results:** Descriptive analysis indicates that Bank transfers are the most widely adopted DPMs, followed by Smart Banking/QR codes, E-wallets, and Visa cards. High adoption rates in retail, utility payments, and online shopping highlight the immediate value and convenience these contexts offer users. The main result further uncovers notable differences in the distribution and usage of DPMs influenced by socioeconomic and contextual factors. **Conclusions:** Key motivators for adoption include habitual use, prior exposure, and promotional incentives. Investments in digital infrastructure are critical to bridging the urban-rural divide, particularly in rural areas. Financial literacy programs tailored to rural populations can enhance familiarity with DP systems, especially Smart Banking/QR codes and Visa cards. The findings provide actionable insights for stakeholders, including policymakers, financial institutions, and technology providers, to foster a more inclusive and accessible DP ecosystem.

Keywords: Cashless, Digital payment, Digital payment adoption, E-payment, Mvprobit

JEL: D30, D33, D53, E51, G20

1. Introduction

The advent of digital payment methods (DPMs) has marked a significant transformation in global financial transactions, driven by advancements in technology and the growing demand for seamless and secure payment solutions (Susmitha et al., 2024). Digital payment (DP) systems, encompassing E-wallets, internet banking, QR code-based payments, and near-field communication (NFC) technologies, have shown exponential growth worldwide (Ashar, 2024; Hartmann et al., 2019; Susanto et al., 2022). According to Statista (2024) the global DPs market is expected to reach a total transaction value of $20.37 trillion by 2025, with an annual growth rate (CAGR) of 15.90% from 2025 to 2029. This surge is fueled by factors such as increasing smartphone penetration, the expansion of e-commerce, and the emphasis on financial inclusion policies (Ciupac-Ulici et al., 2023). DPMs have revolutionized how financial transactions occur globally. This trend has been facilitated by technological advancements and increased internet penetration, particularly in urban areas (Liu et al., 2015). However, disparities in adoption rates persist,

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especially in rural and mountainous regions where infrastructural and socio-economic challenges prevail. Understanding these disparities and identifying the key determinants of DP adoption in such regions is crucial for promoting financial inclusion and economic growth (Afjal, 2023).

DP systems not only enhance financial inclusion but also streamline logistics and trade operations by enabling faster, more secure transactions across distribution networks (Silvestro & Lustrato, 2014). These systems are critical for improving supply chain efficiency, facilitating cross-border trade, and integrating digital commerce with traditional retail models.

In Vietnam, DPMs have gained substantial traction, aligning with global trends and the national agenda for digital transformation (Chuc & Anh, 2023; Huyen & Linh, 2024; Linh et al., 2024; Linh & Huyen, 2024b). The Vietnamese government has prioritized the development of cashless payment systems as outlined in Decision No. 1813/QĐ-TTg, with the strategy aiming to reduce cash transactions to less than 10% of total market transactions by 2030 (Prime Minister of Vietnam, 2021). For instance, Decree No. 52/2024/ND-CP, dated May 15, 2024, regulates cashless payments, which aim to promote non-cash payments, facilitating the digital transformation of the banking industry and developing superior payment products and services (L. Hang, 2024). In the first six months of 2024, non-cash payment transactions totaled 7.83 billion, amounting to VND 134.9 trillion, representing an increase of 58.23% in volume and 35.01% in value compared to the same period in 2023 (D. Hang, 2024). Regarding the types of DPMs prevalent in Vietnam, E-wallets dominate the landscape, followed by Internet banking, QR code-based payments, and NFC-enabled solutions (Statista, 2024a).

Focusing on the Northern mountainous region of Vietnam, adopting DPMs reflects both opportunities and challenges unique to this locale. Initiatives such as the Mobile Money pilot program, launched in 2022, aim to bridge the financial accessibility gap for underserved populations. As of the end of May 2024, the number of Mobile money users in Vietnam exceeded 8.8 million, reflecting a 3.3% increase from the previous month (Ministry of Information and Communications, 2024). Four common DPM types exist in this region: bank transfers, Visa cards, E-wallets, and QR code payments. Despite many efforts, challenges persist, including limited digital literacy, infrastructural barriers, and concerns over security and trust in digital transactions.

Research on DP adoption methods in Vietnam remains limited. Dung et al. (2021) conducted a study integrating the UTAUT, TAM, and TPB frameworks, identifying mobility, accessibility, compatibility, convenience, and personal innovation as key factors influencing the intention to adopt mobile payments. Similarly, Son et al. (2020), using a logit regression model, demonstrated that having accounts with financial intermediaries positively impacts mobile payment usage. Research focusing on the Northern mountainous region remains sparse, creating a gap that this study aims to address. Recently, Linh et al. (2024) extended the UTAUT2 framework, highlighting the roles of trust, voluntariness of use, facilitating conditions, and hedonic motivation in shaping the intention to use DP systems.

However, to date, no research has explored the factors influencing the adoption of DPMs or analyzed the primary payment methods commonly used by citizens in this region, such as residential location, socio-economic factors, and behavioral factors. Therefore, this study aims to identify the key determinants influencing the adoption of DPMs and examine the primary channels through which citizens commonly utilize these methods. The rest of the paper is structured as follows: Section 2 provides a literature review, while Section 3 outlines the methodology and data collection process. Section 4 presents the results and discussion. Finally, Section 6 concludes the study.

2. Literature Review

To comprehensively analyze the determinants influencing individuals' adoption of multiple DP methods, this study employs a Multivariate Probit (MVP) model. This approach is particularly suitable for scenarios where individuals can simultaneously adopt multiple payment methods, such as bank transfers, Visa cards, E-wallets, and QR code payments. Unlike traditional multinomial models that assume mutually exclusive choices, the MVP model allows for overlapping selections and accounts for the correlations between unobserved factors influencing these decisions (Mussida & Zanin, 2020; Ngenoh et al., 2019; Tarekegn et al., 2017). This framework is essential in capturing the interdependencies among payment methods, thereby providing a robust understanding of individuals' behavior.

Bank transfer remains a widely used DP method globally and in Vietnam, valued for its security and reliability. In Vietnam, Nguyen et al. (2020) found that accessibility to banking services and user-friendly interfaces are critical factors for promoting this payment method, especially in underserved regions. In the Northern mountainous region, bank transfer adoption is constrained by limited banking infrastructure and digital literacy. However, the proliferation of mobile banking services offers potential for broader usage. Phuc et al. (2019) emphasized the role of local banking initiatives in building trust and expanding access.

Visa cards, a common form of credit and debit payment, have seen slower adoption in rural Vietnam compared to urban areas due to cultural and infrastructural barriers. In Vietnam, Phuc et al. (2019) highlighted the limited penetration of point-of-sale (POS) systems in rural areas as a significant barrier to Visa card usage. Efforts to promote Visa card adoption in the Northern mountainous region have focused on partnerships between financial institutions and local merchants.

E-wallets such as Momo, ZaloPay, VNPay, and Viettel Money have emerged as leading DP platforms in Vietnam. E-wallets are gaining popularity in the Northern mountainous region due to their compatibility with mobile devices and the increasing penetration of mobile networks. In this region, MoMo is the most widely used, followed by Viettel Money, ZaloPay, ShopeePay, VNPay, and AirPay (Khanh, 2024). However, concerns over security and digital literacy persist.

Smart banking and QR code payments represent a growing trend in Vietnam's DP landscape, offering simplicity and transaction speed. Smart banking is a service delivered through advanced digital platforms, often accessed via smartphones, enabling seamless and real-time financial transactions. QR code is a contactless payment method where users scan a QR (Quick Response) code to complete a transaction, often linked to their digital wallets or banking apps (Ashar, 2024; CHOHAN et al., 2022; Susmitha et al., 2024). In Vietnam, the role of government policies and mobile banking applications in promoting QR code usage (Statista, 2024a). In the northern mountainous region, mobile banking apps such as Agribank's E-Mobile Banking, MB Bank, and BIDV's SmartBanking have facilitated the adoption of QR code payments (Phuc et al., 2019). However, challenges such as inconsistent network connectivity and limited awareness among users hinder broader adoption. Van Tam et al. (2024) recommend targeted training programs and infrastructure investment to overcome these barriers.

Adopting DPMs is significantly influenced by a combination of residential location, socio-economic and behavioral factors. Key variables include demographic and household characteristics, as well as individual knowledge and experience with DPs. Residential location (Province) is critical in determining access to and adoption of DP methods. In the Northern mountainous region, provincial disparities in network coverage and financial service availability exacerbate the rural-urban divide.

The frequency of DP usage (Frequency) with which households utilize DPs for daily transactions reflects familiarity and acceptance of these technologies. Research by Nguyen and Ao (2022) found that frequent usage positively correlates with perceptions of convenience and trust, reinforcing behavioral intention to adopt. Experience with DPs (Buyatstore) is prior experience with DPs, particularly in retail contexts, significantly impacts adoption rates. According to P. T. Nguyen et al. (2024), consumers using DPs in stores are more likely to continue using them due to enhanced trust and perceived ease of use. Awareness of retailer acceptance (Knowstore) is another key determinant of retailers' acceptance of DPs. A lack of information about participating stores has been identified as a barrier to adoption in rural areas (Seethamraju & Diatha, 2018). Knowledge of discounts and promotions (Discount) is about promotional incentives and discounts offered by DP platforms that motivate adoption. Studies in global and Vietnamese contexts (Didied, Yunitasari, & Oktavina Diah Puspita., 2022; Zhao, Anong, & Zhang., 2019; Linh & Huyen., 2024a) highlight the role of marketing strategies in influencing consumer behavior.

Socio-economic characteristics such as gender, age, education level, occupation, individual income, and household composition influence DP adoption. Men and women exhibit differing adoption patterns, often influenced by cultural and social norms (Cao et al., 2018). Younger individuals are more inclined to adopt DPs due to higher technological affinity (Cao et al., 2018; Huyen & Linh, 2024). Higher levels of education are positively associated with DP usage, as they correlate with greater financial and technological literacy (Cao et al., 2018; Huyen & Linh, 2024). Employment in sectors that require frequent transactions encourages DP usage. Farmers are less likely to use DP transactions than others, like workers and commune-level civil servants (Linh et al., 2024). Higher-income levels facilitate access to digital devices and financial services. Larger households may adopt DPs to manage shared expenses efficiently (Linh et al., 2024). Households with more working-age members tend to have higher adoption rates due to diversified income sources and financial needs.

3. Research Methods and Data Collection

3.1. Research Methods

The adoption of multiple payment methods is modeled using a latent utility framework. For each payment method, a latent variable represents the unobserved utility derived from its adoption. An individual adopts a particular payment method if the latent utility exceeds a certain threshold. Mathematically, the decision is modeled as follows: let Y_k^* represent the latent utility for the k-th payment method, determined by a set of explanatory variables and an error term. The observed decision Y_k^* is binary, taking the value of 1 if $Y_k^* > 0$ and 0 otherwise. The latent utility is specified as:

$$Y_{ik}^{*} = X_i'\beta_k + \varepsilon_i \qquad (k= Y_1, Y_2, Y_3, Y_4) \qquad (1)$$

where X_i denotes the vector of explanatory variables, β_k represents the coefficients, and ε_i is the error term. The error terms are assumed to follow a multivariate normal distribution with a mean vector of zero and a covariance matrix Σ. The off-diagonal elements of Σ capture the correlations between the unobserved factors influencing different payment methods.

Therefore, the econometric approach for this study utilizes the indicator function; the unobserved preferences in Equation (1) are expressed through the observed binary outcome equation for each choice as follows:

$$Y_{i,k} = \begin{cases} 1 \; if \; Y_{ik}^{*} > 0 \\ 0 \; Otherwise \end{cases} \qquad (k= Y_1, Y_2, Y_3, Y_4) \quad (2)$$

The covariance structure plays a critical role in the MVP model, as it captures the degree of association between the choices of different payment methods. The covariance matrix Σ is specified as:

$$\Sigma = \begin{bmatrix} 1 & \rho_{12} & \rho_{13} & \rho_{14} \\ \rho_{21} & 1 & \rho_{23} & \rho_{24} \\ \rho_{31} & \rho_{32} & 1 & \rho_{33} \\ \rho_{41} & \rho_{42} & \rho_{43} & 1 \end{bmatrix} \qquad (3)$$

Here, ρ_{ij} represents the correlation between the error terms of the *i*-th and *j*-th payment methods. Non-zero correlations indicate that unobserved factors jointly influence the choices of these payment methods, underscoring the importance of accounting for such interdependencies.

The MVP model is estimated using the Simulated Maximum Likelihood (SML) method, which approximates the joint probabilities of the observed outcomes through simulation techniques. This approach, developed by Cappellari and Jenkins (2003), is computationally efficient and ensures accurate parameter estimation in models with complex covariance structures. The log-likelihood function for the MVP model is given by:

$$lnL = \sum_{i=1}^{N} \omega_i \ln \emptyset \, (\mu_i, \Sigma) \qquad (4)$$

where ω_i is an optional weight for observation *i* and ∅ is the multivariate normal distribution, μ_i represents the mean vector derived from the explanatory variables, and Σ is the covariance matrix.

The explanatory variables included in the model are categorized into three main groups: residential location, socio-economic factors, and behavioral factors. By integrating these variables, the MVP model not only identifies the key determinants of DP adoption but also provides insights into how these factors interact across different payment methods. The inclusion of behavioral factors is particularly relevant, as it reflects the role of user habits and awareness in shaping adoption decisions. The socio-economic and regional variables further contextualize these choices, offering a comprehensive framework for understanding the dynamics of DP adoption.

3.2. Data Collection

Both primary and secondary data were used for this study. Primary data were collected using a structured questionnaire for citizens. This study was conducted in two provinces in the northern mountainous region of Vietnam: Lang Son and Cao Bang. These provinces were chosen due to their vibrant border trade and notable growth in tourism economies (Linh et al., 2024). The data used in this study were collected in a stratified, random sample of citizens in Lang Son and Cao Bang province. Two districts in each province were chosen based on their distance to the border. Then, one commune or ward in the center and another far from it in each district were chosen. Then, we randomly selected 200 citizens and more, if possible, from each commune or ward to take the primary survey. Before the research, a pre-test interview was conducted to ensure the adequacy and reliability of the tools used to collect the relevant information.

Face-to-face interviews were conducted with a total of 860 citizens in eight districts of two provinces. The survey captured detailed information on DP behaviors and socio-economic characteristics. Interviews took place from December 2023 to January 2024. We gave them our phone number and email to contact if they wanted to modify their answers. Of the initial surveys, 811 questionnaires met the established criteria, resulting in a response rate of 94.30%.

3.3. Characteristics of Sampled Respondents

This section presents a descriptive analysis of the respondents' location, socio-economic, and behavioral characteristics, summarized in Table 1. The analysis provides insights into the demographic, socio-economic, and behavioral factors influencing the adoption of DPMs in the Northern mountainous region of Vietnam.

The average age of respondents is 39.04 years, indicating a predominantly middle-aged population. The mean educational level is 11.80 years, reflecting relatively high literacy levels in the mountainous region. The average monthly income is 3.30 million VND, which is modest but consistent with the region's economic conditions. Household size averages 4.44 members, with an average of 2.51 working-age individuals per household. The sample comprises respondents from Lang Son (53.14%) and Cao Bang (46.86%). The slight overrepresentation of Lang Son

ensures a robust analysis of potential regional differences. Males constitute 55.98% of the sample, while females represent 44.02%, suggesting a slight gender imbalance. Farmers constitute 47.23% of the sample, indicating their significant representation in the dataset. This highlights the prominence of agricultural activities among the surveyed population, likely reflecting the rural or semi-rural focus of the study. The dominant cultural group is "Others" (81.50%), mostly Tay and Nung ethnic minorities, while the Kinh group accounts for 18.50%. The distribution of DP usage frequency indicates that 37.73% use DPMs sometimes per week, while 28.85% use them at least once weekly. Daily users account for 18.62%, showing a growing reliance on DPs. A significant majority (88.53%) have used DPs to purchase goods at retail stores, suggesting high familiarity with this method. Approximately 73.74% of respondents know which local retailers accept DPs, indicating substantial awareness. Most respondents (32.43%) know about discounts but do not care, followed by those with limited knowledge (24.54%). Notably, only 8.51% are well-informed about promotions.

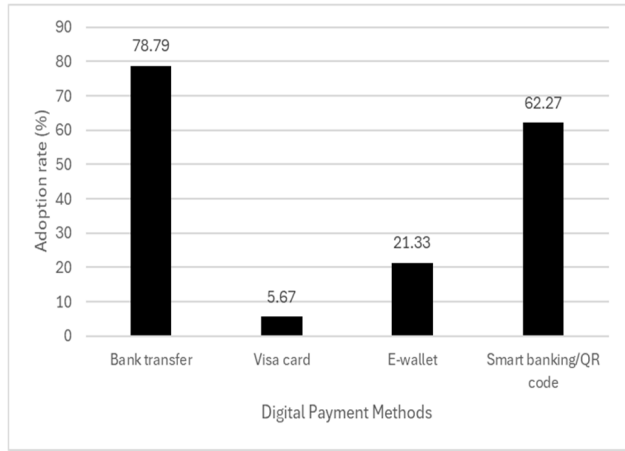
Table 1: Summary Statistics of Respondents

Continuous variables	Observations	Mean	Std.Dev
Age	811	39.04	9.20
Educational level	811	11.80	4.06
Income (Million VND/month)	811	3.30	1.43
Household size	811	4.44	1.22
Labor	811	2.51	0.96
Dummy and categorical variables	**Responses (value)**	**Frequency**	**Percentage**
Province	Lang Son (1)	431	53.14
	Cao Bang (0)	380	46.86
Gender	Male (1)	454	55.98
	Female (0)	357	44.02
Job	Farmers (1)	383	47.23
	Other (0)	428	52.77
Culture	Kinh (1)	150	18.50
	Others (0)	661	81.50
Frequency	Rarely (1)	53	6.54
	At least one time per month (2)	67	8.26
	At least one time per week (3)	234	28.85
	Sometime per week (4)	306	37.73
	Daily (5)	151	18.62
Buyatstore	Yes (1)	718	88.53
	No (0)	93	11.47
Knowstore	Yes (1)	598	73.74
	No (0)	213	26.26
Discount	Don't know and don't care (1)	38	4.69
	Don't know (2)	242	29.84
	Know a little (3)	199	24.54
	Know, but don't care (4)	263	32.43
	Well know (5)	69	8.51

Source: Authors

4. Results and Discussion

Figure 1 summarizes the adoption rates for four key DPMs. The results indicate that bank transfer is the most widely adopted DP method, with 78.79% of respondents using this method. In contrast, Visa cards have the lowest adoption rate, with only 5.67% of respondents utilizing them. E-wallets are used by 21.33% of respondents, reflecting their growing but still limited reach in the region. Smart banking/QR code payments are moderately adopted, with 62.27% of respondents indicating usage.



Source: Authors

Figure 1: Adoption Rate of Digital Payment Methods

The high adoption rate of bank transfers can be attributed to their perceived security and reliability and widespread familiarity among users. However, the lower adoption rates for other methods suggest barriers such as limited infrastructure, low digital literacy, and lack of trust in newer technologies. The limited use of Visa cards highlights infrastructural and cultural challenges, such as the lack of point-of-sale (POS) terminals and preferences for non-credit-based financial solutions in rural areas. While still in the minority, E-wallet adoption reflects a growing awareness and acceptance of digital financial services driven by mobile network penetration and promotional campaigns. The adoption of smart banking and QR code payments underscores their convenience and alignment with mobile banking trends. However,

challenges such as inconsistent internet connectivity and limited retailer acceptance hinder broader adoption. These findings provide a foundation for a deeper analysis of the socioeconomic and behavioral determinants influencing DP adoption in subsequent sections.

Table 2 presents the distribution of common transaction types for DPs among respondents. DP usage is moderately high in retail and supermarket transactions, with 44.02% of respondents indicating adoption. Retail and supermarket transactions serve as one of the primary contexts for DP adoption, reflecting the increasing role of modern trade outlets in rural Vietnam. Only 26.39% of respondents use DPs in restaurants, highlighting the limited penetration of such methods in dining services. This may be attributed to lower POS system availability and cultural preferences for cash transactions in smaller establishments. DPs for online shopping are utilized by 47.60% of respondents.

Table 2: Common Types of Digital Payment Transactions

Decision	Retail and supermarket		Restaurants		Online shopping		Bills and Utilities		Transportation		Others	
	Freq	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*
No	454	55.98	597	73.61	425	52.40	393	48.46	757	93.34	795	98.03
Yes	357	44.02	214	26.39	386	47.60	418	51.54	54	6.66	16	1.97

Source: Authors

This rate underscores the growing role of e-commerce platforms, even in rural areas, facilitated by mobile internet penetration. A slight majority (51.54%) of respondents use DPs for bills and utilities, indicating the convenience these methods provide in routine household financial management. It is also confirmed by the research of K. Dung ans Thu (2019); Linh and Huyen (2023). The adoption rate is minimal, with only 6.66% using DPs for transportation. This may reflect a lack of integration between local transport systems and DP solutions. DP adoption for other types of transactions is the lowest (1.97%), indicating limited diversification in usage.

The analysis of transaction types reveals significant variation in DP adoption across different use cases. High adoption rates in retail, utilities, and online shopping suggest that these contexts provide immediate value and convenience to users. Conversely, low adoption in transportation and other transactions points to infrastructural and cultural barriers that require targeted policy and technological interventions to address. These findings highlight the need for tailored strategies to expand DP applications and enhance user experience in diverse transaction environments.

Table 3: Overall Fitness, Probabilities, and Correlation Matrix of the DPMs from the MVP Model

Variables	Bank transfer	Visa card	E-wallet	Smart banking/QR code
Predicted probability	0.091	0.401	0.758	0.421
Joint probability (success)	0.007			
Joint probability (failure)	0.088			
Estimated correlation matrix				
	ρ_1	ρ_2	ρ_3	ρ_4
ρ_1	1			
ρ_2	-0.026 (0.104)	1		
ρ_3	0.168** (0.071)	0.103 (0.080)	1	
ρ_4	-0.315***(0.061)	-0.126 (0.079)	0.065 (0.064)	1
Likelihood ratio test of $\rho_{21}= \rho_{31}= \rho_{41}= \rho_{32} = \rho_{42}= \rho_{43}=0$ χ^2 (6)= 36.5077 Prob > χ^2=0.0000* Number of draws (#): 5 Number of observations: 811 Log-likelihood: -1356.7355 Wald (χ^2(48)): 317.24 Prob > χ^2: 0.0000***				

Note: *, **, ***= significance level at 10, 5, and 1%, respectively
Source: Authors

Table 3 reveals significant insights into the factors influencing the adoption of DPMs in Vietnam, including bank transfers, Visa cards, E-wallets, and QR code payments. The Wald test Wald (χ^2(48))= 317.24, p=0.000 is

significant at the 1% level, indicating that the subset of coefficients in the model is jointly significant and that the explanatory power of the factors included in the model is satisfactory. This result demonstrates that the MVP model fits the data reasonably well. Similarly, the model is significant because the null hypothesis that the adoption decisions for the four DPMs are independent was rejected at the 1% significance level. The results of the likelihood ratio test (LR χ^2 (6)= 36.5077,p=0.0000) indicate that the null hypothesis of independence between the payment method adoption decisions (ρ_{21}= ρ_{31}= ρ_{41}= ρ_{32} = ρ_{42}= ρ_{43} =0) is rejected at the 1% significance level. This confirms significant joint correlations for two estimated coefficients across the equations in the model. It verifies that separate estimations for the adoption decisions would be biased, as the choices for the four payment methods are interdependent.

There are differences in the adoption behavior for DPMs, which are reflected in the likelihood ratio statistics and the estimated correlation matrix. Individually considered, the correlation values (ρ_{ij}) indicate the degree of relationship between each pair of dependent variables. For instance, ρ_{31} =0.168 (5%) reveals a complementary relationship between bank transfers and E-wallets, while ρ_{41} =−0.315 (1%) indicates a competitive relationship between bank transfers and QR code payments. This suggests that individuals who adopt QR code payments are less likely to use bank transfers as a payment method. Other correlations, such as ρ_{32} = 0.103 and ρ_{42}= - 0.126, are not statistically significant, suggesting weaker or no observable relationships between these pairs of payment methods.

The simulated maximum likelihood (SML) estimation results show that the probability of adopting bank transfer, Visa card, E-wallet, and QR code payments is 9.1%, 40.1%, 75.8%, and 42.1%, respectively. This indicates that E-wallets are the most likely to be adopted, reflecting their convenience and growing acceptance, while bank transfer shows the lowest probability of adoption. The joint probabilities of success or failure for adopting all four payment methods further suggest selective rather than comprehensive adoption. The likelihood of simultaneously adopting all four methods is only 0.7%, while the likelihood of adopting none of them is 8.8%. These findings emphasize the interdependent and selective nature of DP adoption in Vietnam.

Table 4 provides an integrated horizontal analysis of the determinants influencing the adoption of four DPMs: Bank transfers, Visa cards, E-wallets, and Smart Banking/QR codes. The findings identify both unique and shared factors driving the use of these payment methods while situating them within the context of existing literature.

Table 4: Multivariate Probit Estimation for Determinants of User's DPMs

Decision	Bank transfer		Visa card		E-wallet		Smart banking/QR code	
	Coeff	*Std*	*Coef*	*Std*	*Coef*	*Std*	*Coef*	*Std*
Province	-0.070	0.118	0.575***	0.175	0.130	0.111	0.203**	0.103
Frequency	0.301***	0.058	0.057	0.097	0.242***	0.065	0.109**	0.051
Buyatstore	0.381**	0.186	-0.099	0.385	0.360	0.278	0.299*	0.178
Knowstore	0.016	0.134	0.094	0.209	0.131	0.139	0.186	0.118
Discount	-0.043	0.053	0.189**	0.076	0.219***	0.052	0.170***	0.047
Gender	0.189*	0.110	0.099	0.161	0.057	0.110	-0.119	0.097
Age	-0.005	0.005	-0.012	0.009	-0.010*	0.006	0.005	0.005
Education	0.042***	0.014	0.023	0.026	0.003	0.015	0.043***	0.013
Job	0.089	0.158	0.162	0.235	-0.020	0.159	-0.304**	0.142
Income	0.030	0.054	0.154*	0.084	0.124**	0.057	-0.028	0.049
HHsize	0.087*	0.047	-0.027	0.070	-0.119**	0.048	0.005	0.041
Labor	0.074	0.063	-0.101	0.095	0.163***	0.059	-0.077	0.054
Constant	-1.47***	0.484	-2.868***	0.867	-2.892***	0.565	-1.335***	0.457

*, **, ***= significance level at 10, 5, and 1%, respectively
Coeff= Coefficient, Std= Standard errors
Source: Authors

The place of residence significantly influences the adoption of Visa cards (0.575) at the 1% level and Smart Banking/QR codes (0.203) at the 5% level, indicating a higher likelihood of adoption among users in Lang Son province due to better digital infrastructure and service availability. Conversely, this factor does not significantly impact the use of Bank transfers or E-Wallets, which may reflect their broader accessibility across regions.

The frequency of DP usage emerges as a critical determinant for Bank transfers, E-wallets at a 1% level, and Smart Banking/QR codes at a 5% level, highlighting the role of habitual behavior in driving payment preferences. However, its lack of significance for Visa cards suggests

that credit card usage may rely more on specific contextual factors, such as high-value purchases, as noted in prior research of Ryu (2018).

The use of DPs for transactions at physical retail stores positively affects the adoption of Bank transfers (0.381***) and Smart Banking/QR codes (0.299*). This indicates that these methods are predominantly used for in-store payments, contrasting with Visa cards and E-Wallets, which are more frequently associated with online or remote transactions. This observation corroborates the findings by Chawla and Joshi (2019), emphasizing contextual convenience in shaping payment method preferences.

Promotional discounts appear as a universal motivator for adopting Visa cards (0.189 **), E-wallets (0.219***), and Smart Banking/QR codes (0.170***), underscoring the importance of financial incentives in encouraging adoption. However, Bank transfers remain unaffected, possibly due to their entrenched use in traditional transactional contexts. These findings are consistent with Gao et al. (2023), who highlighted the effectiveness of promotions in driving DP adoption.

Demographic factors such as gender and age exhibit limited influence. For instance, minor effects of gender on Bank transfers at 10% show that men prefer using bank transfers over women. Age has a negative significance of 10% on E-Wallets, suggesting that if people become older, they may not use E-wallets for payment transactions. It is in light of the research of Huyen & Linh (2024).

Educational attainment significantly influences the adoption of Bank transfers and Smart Banking/QR codes at a 1% level, indicating that these methods demand higher cognitive engagement. In contrast, the simplicity and intuitive design of Visa cards and E-wallets mitigate the need for higher education. This is similar to the findings of Abdallah et al. (2024) and Kaiser et al. (2022).

The variable representing job stability negatively impacts Smart Banking/QR code adoption at a 5% level, suggesting that financial insecurity may hinder trust in these methods. This finding supports prior studies emphasizing trust as a critical factor in adopting financial technologies (Huyen & Linh, 2024; Linh et al., 2024).

Income levels positively influence the adoption of Visa cards (0.154*) and E-wallets (0.124**), suggesting that these methods appeal more to higher-income users. Conversely, income is insignificant for Bank transfers and Smart Banking/QR codes, which may reflect their broader. utility across all income groups. This result complements findings by Andaregie et al. (2024), emphasizing income disparities in DP adoption.

Finally, household size positively affects Bank transfers (0.087*) while negatively influencing E-Wallet adoption (-0.119**). This indicates that E-wallets cater more to individual-oriented transactions, whereas larger households favor methods suited for collective use. These findings align with Andaregie et al. (2024); Linh et al. (2024), who highlight household-specific financial behaviors in shaping technology adoption.

Some recommendations are proposed to address the identified determinants and improve the adoption of DP methods. The significant location bias in Visa cards and Smart Banking/QR codes suggests the need for improved digital infrastructure in Cao Bang province. Policies targeting expanded internet access and digital services in these regions can bridge the adoption gap. For Bank transfers and E-Wallets, strategies such as loyalty programs and gamified user experiences can reinforce habitual behavior. For Smart Banking/QR codes, incentivizing consistent usage through targeted rewards may increase engagement). Partnerships with retailers to promote Bank transfers and Smart Banking/QR codes can enhance their relevance for physical transactions. Offering exclusive discounts for these methods in stores may further boost their appeal. Aggressive marketing campaigns that emphasize promotional discounts for Visa cards, E-wallets, and Smart Banking/QR codes, particularly during shopping seasons, can maximize their adoption potential. User-friendly interfaces and transparent policies should be prioritized for Smart Banking/QR codes to address barriers faced by less-educated users and individuals with unstable employment. Developing multi-user functionalities for E-wallets and promoting Bank transfers for shared household expenses can cater to the needs of larger families. Affordable Visa card options and subsidized E-Wallet usage can attract lower-income users, while government-backed initiatives can position Smart Banking/QR codes as inclusive financial tools.

Table 5 underscores the complexity of DP adoption, shaped by location, socio-economic, and behavioral factors. The findings provide actionable insights for policymakers and service providers to design targeted strategies that address user-specific barriers and leverage motivators like promotions and habitual behavior. Collaborative efforts between stakeholders are essential to promote equitable and widespread adoption across diverse user groups.

5. Conclusions

This study examines the determinants and distribution patterns of DPMs—bank transfers, Visa cards, E-wallets, and Smart Banking/QR Code—within Vietnam's northern mountainous region. Using a Multivariate probit model, the research evaluates interdependent user preferences to identify factors shaping adoption behaviors and suggests distribution methods for DP providers to increase their products.

The findings reveal significant variations in the distribution and usage of DPMs driven by socioeconomic and behavioral factors. Bank transfers demonstrate the broadest accessibility among all methods, predominantly used for recurring or high-value transactions. Their suitability for shared household expenses and reliance on existing financial networks make them particularly viable in rural areas with limited digital infrastructure. Visa cards are also predominantly adopted in Lang Son province, where infrastructure supports international and e-commerce transactions, reflecting their alignment with modern consumer preferences. E-wallets show widespread distribution across demographic groups, driven by simplicity and aggressive promotional campaigns. However, they are primarily individual-centric, catering to personal transactions rather than shared or household use. Meanwhile, Smart Banking/QR codes are gaining traction in urban and semi-urban retail contexts. The rise of this method is supported by increasing smartphone penetration and user-friendly interfaces, making them appealing for in-store and contactless payments.

Several cross-cutting themes emerged. Habitual use, prior exposure, and promotional incentives are universal motivators for DP adoption. However, regional disparities persist, with Visa cards and Smart Banking/QR codes concentrated in Lang Son province, while Bank transfers and E-wallets exhibit more equitable distribution across rural and urban users. Socio-economic factors, particularly income and education, significantly influence adoption patterns. High-income and well-educated users are more likely to adopt Visa cards and Smart Banking/QR codes, which demand greater financial and technological literacy.

The study proposes several policy interventions to address disparities and enhance the effectiveness of DP distribution. Investments in rural digital infrastructure are essential to bridging the urban-rural divide. Financial literacy programs tailored to rural contexts can foster familiarity with DP systems, particularly Smart Banking/QR codes and Visa cards, which require higher technological readiness. Partnerships with retailers should focus on integrating QR Code payments and Bank transfers into everyday transactions. Retail environments in semi-urban and rural areas can be crucial touchpoints for promoting these methods. Sustained promotional efforts are critical for the adoption of E-wallets and Smart Banking. Campaigns should focus on peak shopping periods and emphasize incentives for first-time and repeat users, fostering habitual usage across demographics. Simplified interfaces and inclusive designs are necessary to address the needs of vulnerable groups, including low-income and less-educated users. Affordable payment solutions, such as fee waivers for E-wallets and subsidized Smart Banking accounts, can encourage broader adoption.

This study contributes to the literature by integrating distributional perspectives into the analysis of DP adoption. The findings provide actionable insights for stakeholders, including policymakers, financial institutions, and technology providers, to create a more inclusive DP ecosystem. Future research should extend these findings by comparing adoption behaviors across diverse rural and urban contexts, enabling the development of tailored strategies that cater to region-specific needs. Stakeholders can foster a more equitable and sustainable DP landscape by addressing regional and socio-economic disparities.

References

Abdallah, W., Tfaily, F., & Harraf, A. (2024). The impact of digital financial literacy on financial behavior: customers' perspective. *Competitiveness Review: An International Business Journal*, *May*. https://doi.org/10.1108/cr-11-2023-0297

Afjal, M. (2023). Bridging the financial divide: a bibliometric analysis on the role of digital financial services within FinTech in enhancing financial inclusion and economic development. *Humanities and Social Sciences Communications*, *10*(1), 645. https://doi.org/10.1057/s41599-023-02086-y

Andaregie, A., Abebe, G. K., Gupta, P., Worku, G., Matsumoto, H., Astatkie, T., & Takagi, I. (2024). Exploring individuals' socioeconomic characteristics and digital infrastructure determinants of digital payment adoption in Ethiopia. *Digital Business*, *4*(2), 100092. https://doi.org/https://doi.org/10.1016/j.digbus.2024.100092

Ashar, V. R. (2024). *Fintech Landscape BT - E-banking, Fintech, & Financial Crimes: The Current Economic and Regulatory Landscape* (C. M. Gupta & G. Kaur (eds.); pp. 11–26). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-67853-0_2

Cao, X., Yu, L., Liu, Z., Gong, M., & Adeel, L. (2018). Understanding mobile payment users' continuance intention: a trust transfer perspective. *Internet Research*, *28*(2), 456–476. https://doi.org/10.1108/IntR-11-2016-0359

Cappellari, L., & Jenkins, S. P. (2003). Multivariate Probit Regression using Simulated Maximum Likelihood. *The Stata Journal: Promoting Communications on Statistics and Stata*, *3*(3), 278–294. https://doi.org/10.1177/1536867x0300300305

Chawla, D., & Joshi, H. (2019). Consumer attitude and intention to adopt mobile wallet in India – An empirical study. *International Journal of Bank Marketing*, *37*(7), 1590–1618. https://doi.org/10.1108/IJBM-09-2018-0256

CHOHAN, F., ARAS, M., INDRA, R., WICAKSONO, A., & WINARDI, F. (2022). Building Customer Loyalty In Digital Transaction Using QR Code: Quick Response Code Indonesian Standard (QRIS). *The Journal of Distribution Science*, *20*(1), 1–11. https://doi.org/https://doi.org/https://doi.org/10.15722/jds.20.01.202201.1 UL - https://jds/v.20/1/1/36332

Chuc, N. D., & Anh, D. T. (2023). Digital Transformation in

Vietnam. *Journal of Southeast Asian Economies*, *40*(1), 127–144. https://www.jstor.org/stable/27211227

Ciupac-Ulici, M., Beju, D.-G., Bresfelean, V. P., & Zanellato, G. (2023). Which Factors Contribute to the Global Expansion of M-Commerce? In *Electronics* (Vol. 12, Issue 1). https://doi.org/10.3390/electronics12010197

Didied, N. M., Yunitasari, F., & Oktavina Diah Puspita. (2022). Effect of promotion, perceived usefulness, and perceived ease of use on interest in adopting e-wallet (Ovo And Dana). *International Journal of Research in Business and Social Science (2147- 4478)*, *11*(8), 191–201. https://doi.org/10.20525/ijrbs.v11i8.2060

Dung, K., & Thu, D. (2019). *Cao Bang Electricity Company: Implementing non-cash electricity payment*. http://caobangtv.vn/tin-tuc-n25589/cong-ty-dien-luc-cao-bang-trien-khai-thanh-toan-tien-dien-khong-su-dung-tien-mat.html

Dung, N. N., Nhung, H. T. T., Nhung, N. T. A., & Han, P. T. T. (2021). Factors affecting people's intention to use mobile payments in the digital age in Vietnam. *Journal of Asian Business and Economic Studies*, *32*, 66–98. www.jabes.ueh.edu.vnhttp://www.emeraldgrouppublishing.com/services/publishing/jabes/

Gao, J., Siddik, A. B., Khawar Abbas, S., Hamayun, M., Masukujjaman, M., & Alam, S. S. (2023). Impact of E-Commerce and Digital Marketing Adoption on the Financial and Sustainability Performance of MSMEs during the COVID-19 Pandemic: An Empirical Study. *Sustainability*, *15*(2). https://doi.org/10.3390/su15021594

Hang, D. (2024, July 25). Cashless payments and digital banking transformation continue to achieve positive results. *Finance & Monetary Market Review*. https://thitruongtaichinhtiente.vn/thanh-toan-khong-dung-tien-mat-va-chuyen-doi-so-ngan-hang-tiep-tuc-dat-ket-qua-tich-cuc-60380.html

Hang, L. (2024). *SBV always considers administrative reforms to be one of key tasks*. https://sbv.gov.vn/webcenter/portal/en/home/sbv/news/Latestnews/Latestnews_chitiet?leftWidth=20%25&showFooter=false&showHeader=false&dDocName=SBV607214&rightWidth=0%25&centerWidth=80%25&_afrLoop=113366688797 94755#%40%3F_afrLoop%3D1133666887979 4755%26cent e

Hartmann, M., Gijsel, L. H., Plooij, M., & Vandeweyer, Q. (2019). *Are instant payments becoming the new normal? A comparative study* (Issue 229). European Central Bank (ECB). https://doi.org/10.2866/845816

Huyen, N. T. T., & Linh, T. T. (2024). Factors influencing the decision to use digital payment methods among residents in the Northern mountainous areas (in Vietnamese). *Review of Finance*, *938*(1), 188–191.

Kaiser, T., Lusardi, A., Menkhoff, L., & Urban, C. (2022). Financial education affects financial knowledge and downstream behaviors. *Journal of Financial Economics*, *145*(2), 255–272. https://doi.org/10.1016/j.jfineco.2021.09.022

Khanh, M. X. (2024). The use of digital wallets in Lang Son province: Current situation and solutions. *Industry and Trade Magazine*. https://tapchicongthuong.vn/thanh-toan-qua-vi-dien-tu-cua-nguoi-dan-tai-lang-son--thuc-trang-va-giai-phap-119189.htm

Linh, T. T., & Huyen, N. T. T. (2023). Factors Affecting the Use of ICT in Resolving Work of Community Officers in Vietnam. *Journal of Asian Finance, Economics and Business*, *10*(2), 313–320. https://doi.org/10.13106/jafeb.2023.vol10.no2.0313

Linh, T. T., & Huyen, N. T. T. (2024a). Factors Affecting the Intention to Use Digital Payments Among People in the Northern Mountainous Region of Vietnam. *Sustainable Development of Agriculture, Rural Economy, and Farmers in Association with National Digital Transformation, Urbanization, and Climate Change Adaptation (KX04.20/21-25)*, 107–115.

Linh, T. T., & Huyen, N. T. T. (2024b). Factors influencing digital payment adoption in the Northern mountainous area of Vietnam: An integration of TAM and TPB. *International Conference on Net Zero Emissions and Sustainable Development in Vietnam and Taiwan (NETZED 2024)*, 749–759.

Linh, T. T., Thi, N., Huyen, T., Thang, D. N., & Mai, N. (2024). How neighbor influence negatively affects digital payment adoption in Vietnam. *Cogent Business & Management*, *11*(1). https://doi.org/10.1080/23311975.2024.2431654

Liu, J., Kauffman, R. J., & Ma, D. (2015). Competition, cooperation, and regulation: Understanding the evolution of the mobile payments technology ecosystem. *Electronic Commerce Research and Applications*, *14*(5), 372–391. https://doi.org/https://doi.org/10.1016/j.elerap.2015.03.003

Ministry of Information and Communications. (2024). *Vietnam sees surge in mobile money adoption with 8.8 million users*.

Mussida, C., & Zanin, L. (2020). Determinants of the Choice of Job Search Channels by the Unemployed Using a Multivariate Probit Model. *Social Indicators Research*, *152*(1), 369–420. https://doi.org/10.1007/s11205-020-02439-z

Ngenoh, E., Kurgat, B. K., Bett, H. K., Kebede, S. W., & Bokelmann, W. (2019). Determinants of the competitiveness of smallholder African indigenous vegetable farmers in high-value agro-food chains in Kenya: A multivariate probit regression analysis. *Agricultural and Food Economics*, *7*(1), 2. https://doi.org/10.1186/s40100-019-0122-z

Nguyen, P. T., Phung, M. T., Pham, T. M. L., Vo, T. L. T., & Tran, L. B. T. (2024). Factors affecting Vietnamese consumers' intention to continue using e-wallet: A case study of MoMo. *Ministry of Science and Technology, Vietnam*, *66*(1), 29–44. https://doi.org/10.31276/vmostjossh.66(1).29-44

Nguyen, T. T., Nguyen, H. T., Mai, H. T., & Tran, T. T. M. (2020). Determinants of digital banking services in Vietnam: Applying utaut2 model. *Asian Economic and Financial Review*, *10*(6), 680–697. https://doi.org/10.18488/journal.aefr.2020.106.680.697

Nguyen, V. C., & Ao, T. H. (2022). Factors affecting consumer behaviour to use e-wallets: an empirical study from Vietnam context. *Ministry of Science and Technology, Vietnam*, *64*(1), 10–24. https://doi.org/10.31276/vmostjossh.64(1).10-24

Phuc, D. M., Manh, N. H., & Hien, D. T. (2019). Promoting cashless payments in rural, remote and isolated areas. *Banking Review*, *12*.

Prime Minister of Vietnam. (2021). *Decision 1813/QD-TTg 2021*

approving the Scheme on development of non-cash payment in Vietnam during 2021-2025.

Ryu, H. S. (2018). Understanding benefit and risk framework of Fintech adoption: Comparison of early adopters and late adopters. *Proceedings of the Annual Hawaii International Conference on System Sciences*, *2018-Janua*, 3864–3873. https://doi.org/10.24251/hicss.2018.486

Seethamraju, R., & Diatha, K. S. (2018). Adoption of digital payments by small retail stores. *ACIS 2018 - 29th Australasian Conference on Information Systems*, 1–11. https://doi.org/10.5130/acis2018.as

Silvestro, R., & Lustrato, P. (2014). Integrating financial and physical supply chains: the role of banks in enabling supply chain integration. *International Journal of Operations & Production Management*, *34*(3), 298–324. https://doi.org/10.1108/IJOPM-04-2012-0131

Son, T. H., Liem, N. T., & Khuong, N. V. (2020). Mobile money, financial inclusion and digital payment: The case of Vietnam. *International Journal of Financial Research*, *11*(1), 417–424. https://doi.org/10.5430/IJFR.V11N1P417

Statista. (2024a). *Digital Payments - Vietnam*. https://www.statista.com/outlook/dmo/fintech/digital-payments/vietnam

Statista. (2024b). *Digital Payments - Worldwide*. https://www.statista.com/outlook/dmo/fintech/digital-payments/worldwide

Susanto, E., Solikin, I., & Purnomo, B. S. (2022). A Review of Digital Payment Adoption in Asia. *Advanced International Journal of Business, Entrepreneurship and SMEs*, *4*(11), 01–15. https://doi.org/10.35631/aijbes.411001

Susmitha, K., Leelavati, T. S., & Sripathi, M. (2024). *Transformative Trends in Digital Banking: Exploring e-Banking, Mobile Banking, Digital Payments, and Innovative Solutions BT - E-Financial Strategies for Advancing Sustainable Development: Fostering Financial Inclusion and Alleviating Poverty* (N. Mansour, S. Baral, & V. Garg (eds.); pp. 169–182). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-67523-2_10

Tarekegn, K., Haji, J., & Tegegne, B. (2017). Determinants of honey producer market outlet choice in Chena District, southern Ethiopia: a multivariate probit regression analysis. *Agricultural and Food Economics*, *5*(1), 20. https://doi.org/10.1186/s40100-017-0090-0

Van Tam, N., Toan, N. Q., & Van Phong, V. (2024). Investigating potential barriers to construction digitalization in emerging economies: A study in Vietnam. *International Journal of Information Management Data Insights*, *4*(1), 100226. https://doi.org/https://doi.org/10.1016/j.jjimei.2024.100226

Zhao, H., Anong, S. T., & Zhang, L. (2019). Understanding the impact of financial incentives on NFC mobile payment adoption: An experimental analysis. *International Journal of Bank Marketing*, *37*(5), 1296–1312. https://doi.org/10.1108/IJBM-08-2018-0229