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Merchants' typology of digital wallet users in the peruvian retail sector

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Abstract

Despite the recent global surge in digital wallet adoption, penetration rates remain uneven across Latin American countries, with Peru exhibiting relatively low uptake despite market growth. Existing research has predominantly examined factors driving digital wallet adoption from the customer perspective. This study focuses on the merchant side within Peru's retail sector to broaden knowledge about adopting these platforms. Using a K-means clustering approach, this study identified three distinct merchant segments (i.e., user typology) based on their perceptions of the benefits associated with digital wallet usage. These findings reinforce existing literature on digital wallet adoption in the Latin American retail sector, offering valuable insights for developing targeted business strategies, digital inclusion policies, and the evolution of the digital payment ecosystem within Peru's retail environment, which may be extended to similar contexts.

Keywords: digital wallet, user typology, retail sector, merchants adoption, k-means.

Introduction

The digitalization of financial services has undergone a significant transformation in recent years, marked by increasing access to and use of new information technology networks, the emergence of multiple communication channels, the evolution of Internet services, and cross-industry product co-innovation. Consequently, 92% of the global population can access a mobile broadband network (Brown et al., 2024). This exponential growth has prompted technology companies to prioritize developing and implementing new services through these channels, thereby driving digital transformation and enhancing the customer experience (Libaque-Saenz et al., 2024). Financial services have been of particular interest within this trend, as promoting financial inclusion can stimulate economic growth, reduce poverty, and narrow gender and educational gaps (Aurazo & Gasmi, 2024). Therefore, a worldwide transition to cashless transactions has occurred, partly prompted by the pandemic, which has accelerated the proliferation of electronic payment platforms globally (Ly & Ly, 2024). Within these platforms, digital wallets, introduced by BigTech and FinTech companies over the past decade, are of special interest in the retail sector. These services provide functionalities that enhance user experience (de Luna et al., 2020), positioning them as essential components in businesses' digital transformation.

This phenomenon has emerged in Peru since the COVID-19 pandemic, characterized by a greater acceptance of innovative payment methods and a substantial increase in cashless transactions. This growth can be attributed to the widespread adoption of digital wallets such as Yape and Plin, which have increased in popularity due to mobility restrictions that prompted the need for virtual payment alternatives. Furthermore, the Peruvian government employed digital wallets—specifically, Yape, Bim, and Agora—to facilitate the transfer of social program funds through direct deposits to bank and electronic money accounts. This strategy led to a substantial acceleration in the development of the national digital ecosystem. By March 2023, Yape and Plin accounted for over half of all cashless retail transactions, while card payments declined to just 22% of the total volume (Libaque-Saenz et al., 2024).

Digital wallets are expected to experience significant growth in the coming years, with projections indicating a 14% to 28% increase in the Peruvian market by 2027 (García Briceño, 2025). However, this growth has also raised concerns about potential system fragmentation and the risk that dominant players, such as Yape, may face insufficient competitive pressure due to the strong network effects inherent in such platforms. To address these risks, the Central Reserve Bank of Peru (BCRP, its Spanish acronym) introduced interoperability obligations between Yape and Plin, starting in April 2023. This change enables users of both networks to transfer funds directly without requiring affiliation with the counterparty's financial institution (Castillo et al., 2023). This initiative forms part of a broader roadmap to achieve comprehensive interoperability across various instruments and stakeholders, including instant interbank transfers, QR code-based payment systems, and other Payment Service Providers (PSPs), such as fintech firms. Enhanced interoperability is expected to promote the adoption of digital payments and lower entry barriers for new competitors, mitigate the monopolistic tendencies reinforced by network effects, and improve the overall efficiency of the Peruvian digital payment ecosystem.

Based on the above discussion, digital wallets have gained traction in the retail market as a preferred payment method. Therefore, a comprehensive understanding of the current users of these platforms is crucial for developing effective business strategies and formulating digital inclusion policies. The present study aims to categorize Peruvian merchants who use digital wallets, seeking to establish a typology that describes and characterizes these users according to their perceptions of the benefits derived from using these platforms. The results of this study can provide a deeper understanding of the behavior of digital wallets users in the retail sector of a developing country, facilitating the development of more personalized services and contributing to the acceleration of digital transformation, as well as an improvement in customer experience.

However, it is also necessary to highlight that the Peruvian context presents unique cultural, economic, and regulatory characteristics that may limit the generalizability of the findings to other countries or regions. These limitations suggest that while the results are valuable for understanding a specific segment of digital wallet users, further research in diverse contexts and using longitudinal methods is recommended. Despite these constraints, this study contributes to the existing literature by offering a typological perspective on digital wallet adoption in the Peruvian retail sector, laying the groundwork for future investigations and more inclusive digital financial strategies.

Background and Literature Review

Recent academic literature on digital wallet adoption in the retail sector has increased significantly from 1997 to 2025, with an annual publication growth rate of 5.92%. Previous studies have reported mixed findings on the adoption of mobile payments in the retail sector. Figure 1 presents a heatmap of keywords

from recent articles related to digital wallets and retail stores, highlighting current research trends in this area. This visualization reveals the most frequently studied themes, such as electronic money, offline challenges, and sales impact, offering insights into the evolving academic focus.

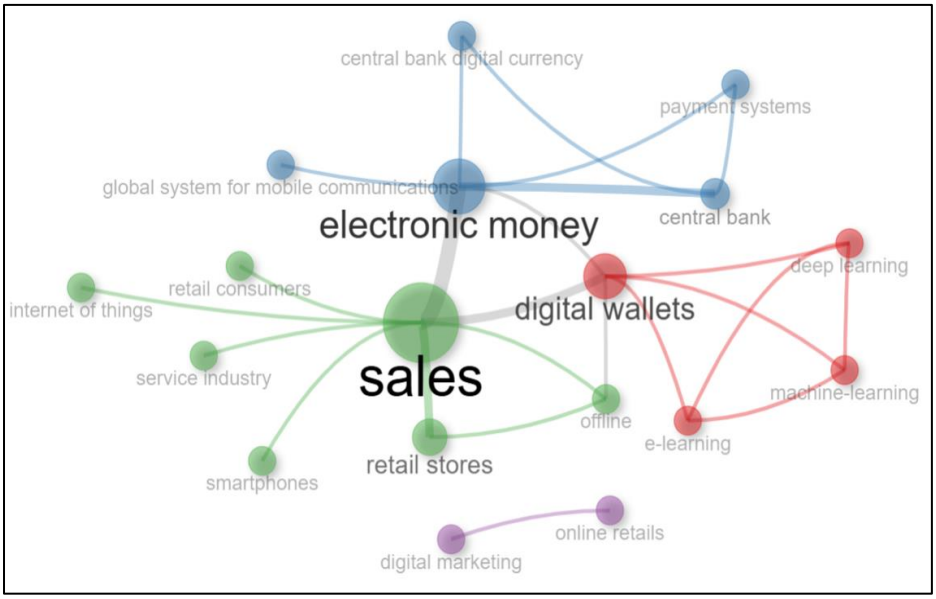

Figure 1. Semantic net of literature related to e-wallet in the retail sector

For example, a study conducted by Flavián et al. (2020) used a sample of 414 USA and 380 Spanish users to identify the main determinants of adopting mobile payment systems in general. The results showed that mindfulness, perceived ease of use, perceived usefulness, subjective norms, and attitude significantly influence users' decisions. In the specific case of digital wallets, Omarini (2018) provides a comprehensive understanding of the digital wallet ecosystem, analyzing trends in the financial services industry, including the emergence of new players (Fintech), the evolution of payment systems, the concept of ecosystems in the digital payment landscape, and the evolving role of banks within this context. In addition, research conducted in the USA found strong evidence of the effect of risk, security, and trust on customer intention to use digital wallets (Shaw, 2015; The Pew Charitable Trusts, 2019). These findings were complemented by Shin and Lee (2021), who proposed a model to assess the adoption of these platforms in the USA and Korea. The results of this study showed that performance expectancy, effort expectancy, credibility, service intelligence, and habit have a strong positive relationship with user intention. All these studies focused on the customers' perspective, leaving the merchants' adoption process unattended.

Some studies have focused on alternative digital payment methods, excluding digital wallets. It is the case of Issa (2011), who found that NFC-based mobile payment was comparatively the easiest to use and most useful among existing mobile payment systems. Similarly, a study conducted in Brazil through an online survey of 423 users found that the factors that directly and indirectly influence the adoption of NFC-based payment systems are attitude, personal innovation, and perceived usefulness (Ramos de Luna et al., 2016, 2020). Additionally, Abdullahi et al. (2024) analyzed digital currency acceptance by conducting a study on Nigeria's eNaira digital currency, examining the primary variables that influence its adoption. Their analysis revealed that adoption in Nigeria is shaped by several interrelated factors, including public trust in the Central Bank, the availability and reliability of supporting technology, levels of digital literacy, and perception of benefits. Similar to the prior paragraph, these studies were limited to understanding customers' adoption.

Furthermore, studies on digital payment methods in Peru were identified. Inciso-Vera and Libaque-Saenz (2023) contributed to understanding continued usage behavior in digital wallets by identifying key factors that influence users' loyalty toward digital wallets in the Peruvian context. Their findings highlighted the relevance of perceived usefulness, perceived security, interoperability, system availability, and social distancing, with the last being the strongest predictor of continued use. Complementing this, Aguilar-Herreras and Libaque-Saenz (2023) explored the adoption of NFC-based mobile payment systems in Peru. Their study found that convenience, perceived physical and technological risks, the number of accepting establishments, and ease of use significantly shape users' intention to adopt this technology. Physical security concerns and limited system availability were identified as context-specific barriers, which may be particularly relevant in regions with high crime or digital infrastructure gaps. However, both studies were also related to customers' adoption of these platforms and did not focus on the merchant side of the adoption process.

Finally, the only study that investigated merchant adoption of digital payment methods was Libaque-Saenz et al. (2024). The authors discussed the adoption of digital wallets by Peruvian merchants within the context of a two-sided market dynamic. Their findings validated the two-sided market concept for digital wallets, showing that merchant adoption results from balancing benefits for both sides, with this interaction varying by socioeconomic level. The study also highlighted the significance of interoperability for merchants, recommending policies to enhance connectivity between digital wallets and third-party services, and suggesting that providers improve infrastructure scalability for better system availability. Although this study provided insights into merchants' adoption process, its scope was limited to understanding factors impacting merchants' decisions.

Based on the above discussion, prior studies have primarily focused on the customer side of digital wallet adoption, with limited research on merchant-side adoption of digital payment methods. In addition, literature has focused on determining the antecedents to adoption, while there is a lack of studies assessing the user typology of digital wallets. Therefore, this study aims to fill these gaps by proposing a merchant typology based on their perceptions of the benefits associated with using digital wallets.

K-means

According to Huang et al. (2014), clustering algorithms can be categorized into several distinct methods: partitioning, hierarchical, density-based, grid-based, and model-based. This study employed K-means as the clustering algorithm because it is a robust method for categorizing similar objects into distinct groups (Huang et al., 2014). The K-means clustering algorithm is a widely used partitioning method, meaning K-means does not automatically select the optimum number of clusters (Kigerl, 2016). Hence, it is necessary to provide this technique with information on the number of required clusters.

K-means clustering decision is based on the proximity of the values of a given case to the cluster's centroid (Kigerl, 2016). This technique aims to minimize the intra-cluster compactness to identify a partition for a dataset. Thus, K-means attempts to reduce the sum of the squared distances between the empirical centroids of the clusters and the objects within the clusters, resulting in a solution where objects inside a cluster are similar to each other. In contrast, objects from different clusters are different (Brandtzæg et al., 2011).

Identification process of potential benefits associated with merchant use of digital wallets

To identify the benefits of using digital wallets from the merchants' perspective, this study followed Ajzen's (2006) recommendation to identify salient beliefs. This preliminary study gathered responses from 20 merchants to the question: What are the advantages of using digital wallets? Responses were varied, but seven benefits were identified within the salient beliefs: time savings, no need to carry cash, no need to worry about change, the possibility of transacting with more customers (network externalities), customer

convenience, system availability, and the potential for increased sales. Regarding the first benefit (time saving), participants responded, "They are faster and do not need contact." For the second benefit (no need to keep cash), an example of a respondent's answer is, "We do not need to keep cash."

Regarding the third benefit (no need to worry about change), respondents said, for example, "Now we do not have to think about giving change." Regarding the fourth benefit (the possibility of transacting with more customers), participants in this preliminary step indicated that "More customers prefer to use digital wallets to pay." Furthermore, for the fifth benefit (customer convenience), merchants replied, for example, "Customers can buy even if they do not have physical money, but they do have a mobile phone." Regarding the sixth benefit (system availability), responses included, "Sometimes digital wallets crash." Finally, for the seventh benefit (possibility of increased sales), responses included, "An advantage is that we do not miss sales."

It is essential to note that this preliminary step is qualitative and exploratory; therefore, it is not necessary to reach a minimum sample size. However, this study has reviewed prior studies to validate that these concepts impact user intention to engage with digital wallets. For instance, Libaque-Saenz et al. (2024) described that merchants' perception of self-benefits associated with digital wallet usage impacts their decision to continue using these platforms. According to the authors, the conceptualization of this benefit perception encompasses the dimensions of time savings (benefit 1), eliminating the need to carry cash (benefit 2), avoiding worries about change (benefit 3), and the potential for increased sales (benefit 7). Likewise, Libaque-Saenz et al. (2024) found evidence of a significant impact of merchants' perception of the benefits of these platforms for their customers on their decision to use these payment systems (benefit 5). Finally, the same study found evidence of the significant role of interoperability and system availability, which are concepts related to the possibility of transacting with more customers (benefit 4) and system availability (benefit 6). Hence, prior literature supports the importance of these benefits in merchants' decisions to use digital wallets.

Research Methodology

As described in the previous section, this study used seven variables for the clustering analysis (time saving, no need to keep cash, no need to be worried about change, possibility to transact with more customers (network externalities), customer convenience, system availability, and the possibility of increased sales) as dimensions of Peruvian merchants' perceptions of the benefits associated with the use of digital wallets. All variables were measured using 5-point Likert scales, and their respective wording is shown in Table 1. In addition, this study collected data on merchants' gender (a nominal variable), age (a metric variable), previous experience with digital wallets (a metric variable), and the district where the retail store was located (a nominal variable). This last information divided the retail stores in terms of the socioeconomic level of their district. Finally, merchants' intention to continue using digital wallets was measured using a 5-point Likert scale which stated as follows: I intend to continue using this e-wallet in the future.

Data collection and analysis

Nanostores in Lima (the capital of Peru) were targeted for this study. This study focused on nanostores because the Peruvian traditional retail sector consists of conventional markets, nanostores, and kiosks, which collectively represent around 75% of the market share (Castillo et al., 2023). In addition, within the Peruvian traditional retail sector, nanostores are the most important spots for purchasing basic goods, representing almost S/ 44 million in total sales in 2021 (Libaque-Saenz et al., 2024). A quota sampling technique was implemented to select nanostores from various districts. The element of study within the nanostore was the owner (i.e., merchant). Previous experience with digital wallets was used as a filter

question to discard merchants who have never used these platforms. After excluding respondents with incomplete answers, 530 valid survey responses were used for further analysis.

Table 1. Measurement instrument

Variable	Question
TIME	Using this e-wallet enables me to save time selling.
CASH	Using this e-wallet enables me not to keep much cash in the store.
CHANGE	Using this e-wallet enables me not to worry about having exact change.
EXT	I prefer using this e-wallet because the people I transact with use the same app.
CUST	It is convenient for my clients to use only a cell phone for this e-wallet.
AVA	This e-wallet is always available for transactions.
SALE	Using this e-wallet enables me to increase my sales.
Note: TIME: Time saving, CASH: No need to keep cash, CHANGE: No need to be worried about change, EXT: Possibility to transact with more customers (network externalities), CUST: Customer convenience, AVA: System availability, SALE: Possibility of increased sales	

This study used a K-means technique as a statistical tool, given that its objective is to determine groups (clusters) of merchants with similar features in terms of their perception of the benefits associated with the use of digital wallets. In addition, given that benefit perceptions were measured with Likert scales (i.e., metric variables), an ANOVA test was employed to determine the differences across the identified clusters. Finally, once the clusters were defined, each group was profiled using the demographic features of the merchants (i.e., nanostore owners).

An ANOVA test was used to compare the clusters in terms of age and previous experience with digital wallets because these variables are metric. However, when comparing the clusters in terms of gender and socioeconomic level, a chi-squared test was used because these variables are nominal. SPSS was used as the statistical package to run this analysis.

Sample

Sample features are described in Table 2. The sample includes a slightly higher proportion of females (59.62%) than males (40.38%). Most respondents are between 18 and 30 years old (36.04%), reflecting a younger demographic among business owners and managers. The majority (61.51%) have between one and two years of experience using e-wallets, indicating a growing but relatively recent adoption of digital payment systems. Yape stands out as the dominant platform, used by 97.92% of participants, while Plin and F-Pay are used by only 1.89% and 0.19%.

In terms of socioeconomic status, 54.91% of respondents belong to the high-income segment, while 45.09% fall into the medium income category. This profile indicates that users are young, moderately experienced with e-wallets, and come from relatively stable economic backgrounds.

Table 2. Sample demographics

Demographics	Number	Percentage
Age		
18 - 25	98	18.49%
26 - 30	93	17.55%
31 - 35	63	11.89%
36 - 40	61	11.51%
41 - 45	52	9.81%
46 - 50	51	9.62%
51 and over	112	21.13%
Gender		
Female	316	59.62%
Male	214	40.38%
Experience		
Less than 1 year	116	21.89%
Between 1 and 2 years	326	61.51%
Between 2 and 3 years	61	11.51%
More than 3 years	27	5.09%
e-Wallet		
F-Pay	1	0.19%
Plin	10	1.89%
Yape	519	97.92%
Socioeconomic Level		
Medium	239	45.09%
High	291	54.91%

Results

The clustering decision was made based on user perception of benefits, including time savings, eliminating the need to carry cash, reducing worries about change, the possibility of transacting with more customers (network externalities), customer convenience, system availability, and the potential for increased sales. Given that the K-means algorithm cannot determine the number of clusters (this information must be provided), this study followed the two-stage procedure suggested by Punj & Stewart (1983). First, Ward's method was used to determine the number of clusters to be considered. Then, the K-means routine categorized each respondent into their respective cluster. To identify the optimal number of clusters, this study assessed the change in the agglomeration coefficient from the output of Ward's hierarchical clustering results. This agglomerative approach minimizes the total within-cluster variance by merging, at each step, the pair of clusters that results in the smallest possible increase in the error sum of squares (Ward, 1963). It is particularly effective when the number of clusters is not known beforehand. A dendrogram and the

agglomeration schedule were analyzed as part of the procedure. The dendrogram is like a tree that visually represents how individual observations are progressively grouped into clusters, illustrating the hierarchical structure of the data. By examining the height at which branches merge, researchers can detect significant jumps in cluster dissimilarity, often indicating meaningful divisions in the data (Everitt et al., 2011). This visual tool is especially valuable for identifying natural breakpoints in the clustering process without requiring a predetermined number of clusters. Given this exploratory facet of hierarchical clustering, multiple valid solutions can often be derived (Kaufman & Rousseeuw, 1990). Accordingly, to ensure a parsimonious and interpretable solution, based on the preceding analysis, this study identified three distinct categories representing merchants' typologies, defined by their perceptions of the benefits associated with digital wallet adoption. Once the number of clusters was established, the K-means algorithm was applied to assign each respondent to one of the identified groups. Table 3 presents the classification results.

Table 3. K-Means results

Cluster No.	Participants (Percentage)	TIME	CASH	CHANGE	EXT	CUST	AVA	SALE
1	106 (20.0%)	3.92	3.99	3.96	2.93	3.40	3.44	3.29
2	340 (64.2%)	3.99	3.98	3.99	3.66	3.96	3.91	3.53
3	84 (15.8%)	3.04	2.93	3.01	3.04	3.29	3.36	3.39

Note: TIME: Time saving, CASH: No need to keep cash, CHANGE: No need to be worried about change, EXT: Possibility to transact with more customers (network externalities), CUST: Customer convenience, AVA: System availability, SALE: Possibility of increased sales

This study then analyzed cluster differences with one-way ANOVA for each dimension of benefit perceptions. ANOVA results show significant differences between the clusters in terms of time saving ($F = 904.180$, $p < 0.001$), no need to keep cash ($F = 1{,}650.890$, $p < 0.001$), no need to be worried about change ($F = 977.096$, $p < 0.001$), possibility to transact with more customers ($F = 144.177$, $p < 0.001$), customer convenience ($F = 219.918$, $p < 0.001$), system availability ($F = 113.925$, $p < 0.001$), and possibility of increased sales ($F = 10.352$, $p < 0.001$). A post-hoc analysis further provides details about group differences.

Categories were labeled and interpreted in terms of each cluster's mean of merchants' perception of each dimension of benefits. Considering that means ranged from 2.93 to 3.99, this study used the following labels: Low (when the value is lower than 3.3), Medium (when the value is between 3.3 and 3.65), or High (when the value is higher than 3.65) according to their value. Table 4 shows the labels for each of the means.

Based on the above results, this study proposes the following names for each cluster:

1) Convenience: Merchants who perceive digital wallets as a convenient system to ease their daily transactions, but have some technical doubts and do not see the economic impact
2) Enthusiastic: Merchants who perceive digital wallets as a system full of benefits, not only for their convenience but also for their technical superiority and further economic impact
3) Pessimistic: Merchants who perceive digital wallets as a system full of challenges. They might be those who are using these systems as the last resort.

Table 4. Cluster labels

Cluster No.	Participants (Percentage)	TIME	CASH	CHANGE	EXT	CUST	AVA	SALE
1	106 (20.0%)	HIGH	HIGH	HIGH	LOW	MEDIUM	MEDIUM	LOW
2	340 (64.2%)	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	MEDIUM
3	84 (15.8%)	LOW	LOW	LOW	LOW	LOW	MEDIUM	MEDIUM

Note: TIME: Time saving, CASH: No need to keep cash, CHANGE: No need to be worried about change, EXT: Possibility to transact with more customers (network externalities), CUST: Customer convenience, AVA: System availability, SALE: Possibility of increased sales

To further understand each cluster, this study ran an ANOVA test comparing the clusters in terms of age ($F = 4.218$, $p = 0.015$). A post-hoc analysis revealed that enthusiastic users are younger than the other two clusters. Surprisingly, there are no differences in previous experience with digital wallets ($F = 1.981$, $p = 0.139$). Furthermore, this study assessed gender proportions in each cluster using a chi-squared test, which revealed that gender is equally distributed across clusters ($X_2 = 0.683$, $p = 0.711$). Finally, clusters were compared in terms of socioeconomic levels. This feature was divided into two broad groups to simplify the analysis: medium level and high level. A chi-squared test ($X_2 = 16.350$, $p < 0.001$) shows that the first two clusters are equally distributed across medium and high socioeconomic levels. In contrast, the third cluster (Pessimistic cluster) has more nanostores in high socioeconomic districts than in medium levels. Finally, this study compared the three clusters regarding intention to continue using digital wallets, and significant differences were found ($F = 132.368$, $p < 0.01$). The Enthusiasts have the highest intention to continue using digital wallets (Mean = 3.98), followed by those in the Convenience cluster (Mean = 3.66), and lastly by those in the Pessimistic cluster (Mean = 3.39).

Discussion and Implications

According to the literature review subsection, prior studies have primarily focused on the customer side of digital wallet adoption (Esawe, 2022; Teng & Khong, 2021), with limited research on the merchant side adoption of digital payment methods. In addition, the literature has focused on determining the antecedents to adoption, while there is a lack of studies assessing the user typology of digital wallets. Therefore, these findings contribute to an understanding of technology adoption and user segmentation in the context of digital wallets within emerging economies from the merchants' perspective. This segmentation was conducted based on merchants' perceptions of benefits associated with using digital wallets in the Peruvian retail sector. Figure 2 summarizes the findings of this study.

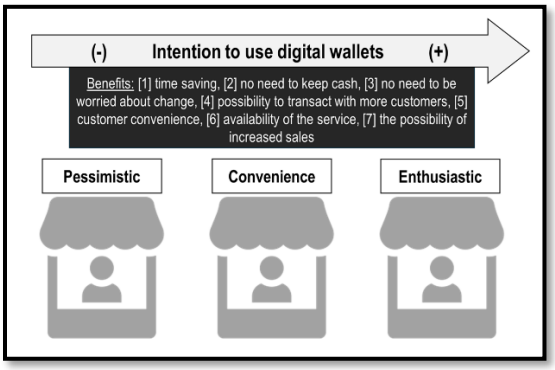

Figure 2. Merchants' typology of digital wallet users in the Peruvian retail sector

Beyond the Peruvian context, the typology of digital wallet users identified in this study may have broader relevance for other emerging markets with similar socio-economic, technological, and retail structures. For instance, studies conducted in India and Indonesia have highlighted the influence of perceived benefits such as satisfaction and improved financial access on the adoption of digital wallets among small businesses, reinforcing the relevance of transactional ease and perceived sales impact as influential factors (Tikku & Singh, 2023; Riandani et al., 2022). Another relevant example comes from Malaysia, where both infrastructure challenges and latent potential in e-wallet ecosystems have been emphasized, as is reflected in similar concerns expressed by Peruvian merchants in the "Pessimistic" cluster (Alam et al., 2021). Similarly, research conducted in Nepal using the TAM and UTAUT models identified perceived usefulness, trust, and price value as significant drivers of adoption, underscoring the importance of communicating concrete functional benefits to improve inclusion in certain sectors (Shrestha & Tamang, 2023).

Although contextual differences may influence the relative importance of each benefit, the segmentation logic based on perceived benefits appears to have cross-contextual applicability. The "Enthusiastic," "Convenience," and "Pessimistic" profiles may serve as a conceptual framework to analyze merchant behavior in other developing regions. Future research could apply or adapt the same clustering methodology to determine whether similar typologies emerge, or whether local characteristics lead to new user categories. Comparative investigations of this kind would enhance the design of inclusive, context-sensitive fintech strategies on a global scale.

Practical implications

Based on the above findings, this study offers recommendations for the Peruvian retail sector regarding strategies for utilizing digital wallets. This quantitative study identified three distinct groups of merchants based on their perception of benefits associated with using digital wallets. The largest group (64.2%), labeled "Enthusiastic," demonstrated a high appreciation across nearly all benefit dimensions, particularly transactional ease (time, cash, and change) and broader advantages (network, convenience, and availability). A second group (20.0%), labeled "Convenience," highly valued the core transactional efficiencies but perceived lower benefits regarding network effects and increased sales. The smallest cluster (15.8%), labeled "Pessimistic," reported low perceptions of benefits across most dimensions, except for medium perceptions of availability and sales potential. This result is noteworthy, as, despite their pessimistic reception of digital wallets, this group holds a more favorable perception than the conservative group of the potential increase in sales resulting from digital wallets.

Given these insights, segment-specific strategies are recommended. For the Enthusiastic users, who show high appreciation for all benefits, especially time saving, avoiding cash, and customer convenience, efforts should focus on retention and continued engagement. This group would respond well to loyalty programs and new features. Their broad acceptance also makes them ideal ambassadors to promote these platforms organically. The Convenience group values transactional benefits such as saving time, avoiding cash, and simplifying change, but perceives less value in broader benefits like network externalities or sales growth. For this segment, marketing should emphasize how the digital wallet ecosystem adds value beyond transactions. Highlighting the number of participating merchants, ease of integration for small businesses, and successful case studies could shift their perception. The Pessimistic cluster perceives most benefits as low, except for medium ratings on system availability and potential for increased sales. Messaging to this group should focus on building trust and clarifying the tangible, measurable advantages of digital wallets, especially in terms of business growth and convenience. Efforts should include simple onboarding, improved user experience, transparent communication, and incentives like cashback or fee reductions. Trust-building measures are critical to this group.

In summary, retention strategies should prioritize the Enthusiastic group while launching evidence-based campaigns and tailored incentives to engage the Convenience and Pessimistic groups. The government could target each group of merchants differently, and the strategies should focus on improving perceptions of benefits in each group, so that a merchant can transition from being part of the Pessimistic cluster and move to the Convenience cluster. Then, those from the Convenience cluster might receive specific messages or incentives to leave this group and move to the Enthusiastic cluster. These strategies will ultimately influence merchants' decisions to use digital wallets, thereby enhancing the dynamics of this ecosystem.

Conclusions

This study identified three distinct typologies of e-wallet users among nanostore retailers in Lima: Enthusiastic, Convenience-oriented, and Pessimistic, based on their perceived benefits from using digital wallets. Using K-means clustering, the analysis revealed statistically significant differences between the groups across seven benefit dimensions: time saving, cash handling, change availability, network externalities, customer convenience, service availability, and perceived sales growth. Enthusiasts exhibited the most favorable perceptions and the highest intention to continue using e-wallets, followed by Convenience users, while Pessimists demonstrated lower perceptions across most dimensions.

These findings emphasize that retailers' adoption of mobile payment technologies is not uniform and is shaped by nuanced perceptions and contextual factors. Demographic variables such as age and socioeconomic location were associated with cluster membership, whereas gender and prior experience with e-wallets were not statistically significant. This segmentation has direct practical implications: retention strategies should focus on Enthusiasts, informational and trust-building initiatives on Pessimists, and ecosystem-based value communication on the Convenience group.

Although this study provides new insights into digital wallet usage patterns, and the proposed typology may be applicable to other emerging markets as a useful framework for understanding merchant behavior and informing inclusive fintech strategies, it is important to recognize that the variables used were derived from a preliminary and exploratory survey specific to the Peruvian context. Therefore, future research should aim to validate these findings in other regions. Additionally, while K-means clustering offered a useful segmentation tool, other clustering techniques such as DBSCAN, Latent Class Analysis, or Hierarchical clustering could provide alternative insights and should be explored in future studies. Future research should aim to replicate and extend these findings in other geographic and cultural contexts, using longitudinal data to capture changes in perception over time. Moreover, qualitative studies could offer deeper insights into the barriers and motivations behind digital wallet adoption. Including variables like digital literacy, institutional trust, and regulation can enhance adoption models. Overall, this study offers a merchant typology that supports more effective, context-sensitive digital inclusion strategies in emerging markets.

References

Abdullahi, M., Ahmad, A., Pandey, B. K., & Pandey, D. (2024). Digital Currency Adoption: A Comparative Analysis of Global Trends and the Nigerian eNaira Digital Currency. *SN Computer Science, 5*(5), 602. https://doi.org/10.1007/s42979-024-02882-6

Aguilar-Herreras, S., & Libaque-Saenz, C. F. (2023). Factors driving NFC-based mobile payment adoption: The case of Peru. *Issues In Information Systems, 24*(1), 55–59. https://doi.org/10.48009/1_iis_2023_105

Ajzen, I. (2006). *Constructing a Theory of Planned Behavior Questionnaire.* https://www.researchgate.net/publication/235913732

Alam, Md. M., Awawdeh, A. E., & Muhamad, A. I. Bin. (2021). Using e-wallet for business process development: challenges and prospects in Malaysia. *Business Process Management Journal, 27*(4), 1142–1162. https://doi.org/10.1108/BPMJ-11-2020-0528

Aurazo, J., & Gasmi, F. (2024). Digital payment systems in emerging economies: Lessons from Kenya, India, Brazil, and Peru. *Information Economics and Policy, 69*, 101113. https://doi.org/10.1016/j.infoecopol.2024.101113

Brandtzæg, P. B., Heima, J., & Karahasanovic, A. (2011). Understanding the new digital divide—A typology of Internet users in Europe. *International Journal of Human-Computer Studies, 69*(3), 123–138.

Brown, W., Wilson, G., & Johnson, O. (2024). *Exploring the Adoption of Digital Payment Systems in Retail.* https://doi.org/10.20944/preprints202407.2424.v1

Castillo, P., Vásquez, J. L., García, M. G., Fernández, M., Ancalle, C., Santos, F., & Saldaña, F. (2023). Interoperabilidad: Acelerando la adopción y uso de los pagos digitales en el Perú. *Moneda, 193*.

Esawe, A. T. (2022). Understanding mobile e-wallet consumers' intentions and user behavior. *Spanish Journal of Marketing - ESIC, 26*(3), 363–384. https://doi.org/10.1108/SJME-05-2022-0105

Everitt, B. S., Landau, S., Leese, M., & Stahl, D. (2011). *Cluster Analysis.* Wiley. https://doi.org/10.1002/9780470977811

Flavián, C., Guinaliu, M., & Lu, Y. (2020). Mobile payments adoption – introducing mindfulness to better understand consumer behavior. *International Journal of Bank Marketing, 38*(7), 1575–1599. https://doi.org/10.1108/IJBM-01-2020-0039

García Briceño, B. (2025). El auge de las billeteras digitales en Perú: Proyecciones para 2027. *Ecommerce News*. https://www.ecommercenews.pe/pagos-online/2025/el-auge-de-las-billeteras-digitales-en-peru-proyecciones-para-2027.html/

Huang, X., Ye, Y., Guo, H., Cai, Y., Zhang, H., & Li, Y. (2014). DSKmeans: A new kmeans-type approach to discriminative subspace clustering. *Knowledge-Based Systems, 70*, 293–300. https://doi.org/10.1016/j.knosys.2014.07.009

Inciso-Vera, L. A., & Libaque-Saenz, C. F. (2023). Critical factors for digital wallet continued usage intention during pandemic in the Peruvian context. *Issues in Information Systems, 24*(1), 26–40. https://doi.org/10.48009/1_iis_2023_103

Issa, H. (2011). Assessment and User Adoption of NFC in Comparison to Other Mobile Payments Systems. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1910471

Kaufman, L., & Rousseeuw, P. J. (1990). *Finding Groups in Data.* Wiley. https://doi.org/10.1002/9780470316801

Kigerl, A. (2016). Cyber Crime Nation Typologies: K-Means Clustering of Countries Based on Cyber Crime Rates. *International Journal of Cyber Criminology*, *10*(2), 147–169.

Libaque-Saenz, C. F., Ortega, C., Rodriguez-Serra, M., Chong, M., & Lopez-Puente-de-la-Vega, S. (2024). The role of interoperability and inter-side benefits on merchants' e-wallet adoption: the case of Peruvian nanostores. *Industrial Management & Data Systems*, *124*(1), 64–84. https://doi.org/10.1108/IMDS-04-2023-0238

Ly, R., & Ly, B. (2024). Digital payment systems in an emerging economy. *Computers in Human Behavior Reports*, *16*, 100517. https://doi.org/10.1016/j.chbr.2024.100517

Omarini, A. E. (2018). Fintech and the Future of the Payment Landscape: The Mobile Wallet Ecosystem - A Challenge for Retail Banks? *International Journal of Financial Research*, 9(4), 97. https://doi.org/10.5430/ijfr.v9n4p97

Punj, G., & Stewart, D. W. (1983). Cluster Analysis in Marketing Research: Review and Suggestions for Application. *Journal of Marketing Research*, *20*(2), 134–148. https://doi.org/10.1177/002224378302000204

Ramos de Luna, I., Montoro-Ríos, F., Martínez-Fiestas, M., & Casado-Aranda, L.-A. (2020). *Analysis of a Mobile Payment Scenario* (pp. 22–47). https://doi.org/10.4018/978-1-7998-0050-7.ch002

Ramos de Luna, I., Montoro-Ríos Francisco, & Liébana-Cabanillas, F. (2016). NFC technology acceptance for mobile payments: A Brazilian Perspective. *Review of Business Management*, *19*(63), 82–103. https://doi.org/10.7819/rbgn

Riandani, O., Sari, D., Rubiyanti, N., Moeliono, N. K., & Fakhri, M. (2022). The Relationship between Digital Wallet Adoption and Usage to Financial Inclusion. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 1–5. https://doi.org/10.46254/AF03.20220203

Shaw, N. (2015). *The Mediating Role of Perceived Security: An Empirical Study of Mobile Wallet Adoption in USA* (pp. 358–369). https://doi.org/10.1007/978-3-319-20895-4_33

Shin, S., & Lee, W.-J. (2021). Factors affecting user acceptance for NFC mobile wallets in the U.S. and Korea. *Innovation & Management Review*, *18*(4), 417–433. https://doi.org/10.1108/INMR-02-2020-0018

Shrestha, R., & Tamang, L. (2023). Financial Inclusion through FinTech Innovation: Predicting User Acceptance of Digital Wallet. *The Batuk*, *9*(2), 37–48. https://doi.org/10.3126/batuk.v9i2.57026

Teng, S., & Khong, K. W. (2021). Examining actual consumer usage of E-wallet: A case study of big data analytics. *Computers in Human Behavior*, *121*, 106778. https://doi.org/10.1016/j.chb.2021.106778

The Pew Charitable Trusts. (2019). *Are Americans Embracing Mobile Payments?*

Tikku, S. R., & Singh, A. K. (2023). Financial Disruption and Microentrepreneurs. *International Journal of E-Collaboration, 19*(1), 1–14. https://doi.org/10.4018/IJeC.315780

Ward, J. H. (1963). Hierarchical Grouping to Optimize an Objective Function. *Journal of the American Statistical Association, 58*(301), 236–244. https://doi.org/10.1080/01621459.1963.10500845