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## Customer Adoption of Contactless Payments: Convenience and Security

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### ABSTRACT

Contactless payments (contactless cards, NFC-enabled mobile wallets and UPI/QR-based tap-and-pay services) are reshaping how consumers pay, yet customers may hesitate to adopt them because of security and privacy concerns. This study examines how perceived convenience and perceived security influence customer adoption of contactless payments. A descriptive and analytical, quantitative design was used. Primary data were collected through a structured five-point Likert-scale questionnaire administered to 126 respondents selected by convenience sampling. The data were analysed in Microsoft Excel using descriptive statistics, Cronbach's alpha, chi-square tests of independence, one-way ANOVA, Pearson correlation and simple and multiple linear regression. All three constructs were highly reliable ( $\alpha = 0.919-0.956$ ). Respondents reported favourable perceptions of convenience ( $M = 3.96$ ), security ( $M = 3.95$ ) and adoption ( $M = 3.97$ ). Convenience ( $\beta = 0.93$ ,  $R^2 = 0.858$ ) and perceived security ( $\beta = 0.95$ ,  $R^2 = 0.901$ ) each significantly predicted adoption; jointly they explained 92.7% of its variance ( $F(2,123) = 776.78$ ,  $p < 0.001$ ), with security carrying the larger standardised weight ( $\beta = 0.613$  versus  $0.372$ ). Mean adoption differed significantly across low, moderate and high convenience groups ( $F(2,123) = 101.49$ ,  $p < 0.001$ ,  $\eta^2 = 0.623$ ) and security groups ( $F(2,123) = 99.93$ ,  $p < 0.001$ ,  $\eta^2 = 0.619$ ), and chi-square tests showed strong associations between perception levels and adoption levels (Cramér's  $V = 0.756$  and  $0.781$ ). All null hypotheses were rejected. The findings suggest that providers should invest simultaneously in faster, easier payment experiences and in visible, trust-building security features and communication. The results should be read with caution because the sample is small, convenience-based and dominated by young male students.

**Keywords:** *contactless payments; customer adoption; convenience; perceived security; chi-square; ANOVA; regression; India*

### 1. Introduction

Digital payment technologies have changed the way individuals transact. In India, the spread of smartphones, affordable data and the Unified Payments Interface (UPI) has reduced dependence on physical cash and encouraged consumers to adopt faster, app-based and tap-based payment methods. Contactless payments – which include contactless debit and credit cards, near-field communication (NFC) enabled mobile wallets, QR-code payments and UPI-enabled tap-and-pay services – allow a transaction to be completed without inserting a card, entering a PIN or handling cash. According to Ramu, Swathi and Thejeswini (2025), contactless technologies improve transaction speed, convenience and security while supporting the development of a cashless economy.

Convenience is widely regarded as a central driver of payment choice. Khan et al. (2017) identify convenience, security and interoperability as important factors influencing the adoption of online payment systems, and Jain (2023) reports convenience as an important factor supporting the growth of digital payments in India. Aggarwal et al. (2021) similarly emphasise that awareness and accessibility determine whether consumers move from cash to cashless transactions. For the user, convenience is experienced as ease of use, speed and freedom from carrying cash.

Security, however, works in the opposite direction when it is perceived to be weak. Kaur (2019) highlights cybersecurity and financial literacy as challenges in India's transition to a cashless economy, Akinola (2012) notes the security problems associated with electronic payment systems, and Gardezi (2025) identifies cybersecurity, privacy and the digital divide as obstacles even while recognising the efficiency gains of financial technology. A customer who finds a payment method fast and simple may still avoid it if he or she doubts that personal data are protected, that fraud is unlikely, or that the transaction can be trusted.

Although contactless payments are increasingly used, much of the available literature is conceptual, technology-oriented or based on secondary data (for example, Trivedi, 2024; Jain, 2023; Kaur, 2019). Few studies offer primary, consumer-level evidence on how convenience and perceived security jointly influence adoption. The present study addresses this gap. It treats convenience and perceived security as independent variables and customer adoption – intention to use, actual usage and continued use – as the dependent variable, and tests the relationships using chi-square, ANOVA and regression analysis on primary survey data. The findings are intended to help banks, payment providers and policymakers design contactless services that customers both want to use and trust.

## 2. Review of Literature

Twenty studies were reviewed. They fall into four broad groups: (i) studies of the future and feasibility of cashless and contactless payments (Ramu et al., 2025; Jain, 2023; Trivedi, 2024; Kumari, 2018; Tarlin, 2021; Engert et al., 2018); (ii) studies of central bank digital currencies and digital money (Carstens, 2019; Bilotta & Botti, 2021; Pani & Maino, 2025; Narasimhaiah & Sam, 2015); (iii) studies of adoption, awareness and consumer segments (Aggarwal et al., 2021; Girija & Nandhini, 2018; Jakubowska, 2020; Khan et al., 2017; Kaur, 2019); and (iv) technology, security and sector-specific studies (Akinola, 2012; Ya'acob et al., 2019; Gardezi, 2025; Sagare et al., 2023; Putri & Rafi'i, 2026). Table 1 summarises each study and the gap it leaves.

**Table 1: Summary of reviewed literature**

| Author(s) and year               | Focus                                                                  | Key finding and research gap                                                                                                      |
|----------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Ramu, Swathi & Thejeswini (2025) | Future of contactless payment (NFC, QR, wallets) in a cashless economy | Contactless payments improve convenience, speed, security and inclusion; no empirical test of customer satisfaction or intention. |
| Carstens (2019)                  | The future of money and payments; CBDCs                                | Digital currencies can transform payments but need regulation; consumer-level adoption unexplored.                                |
| Khan et al. (2017)               | Review of online payment systems                                       | Convenience, security and interoperability drive adoption; no country-specific customer evidence.                                 |
| Kaur (2019)                      | Cash to cashless economy in India                                      | Digital infrastructure, financial literacy and cybersecurity matter; relies on secondary data.                                    |
| Akinola (2012)                   | Cashless society; data mining for fraud detection                      | Security challenges of e-payments; limited insight into customer acceptance.                                                      |
| Bilotta & Botti (2021)           | Risks and opportunities of CBDCs                                       | Inclusion potential alongside privacy and stability concerns; no evidence on public adoption.                                     |
| Jakubowska (2020)                | Cashless methods among sports-active Europeans                         | Sports-active consumers more likely to use innovative payments; geographically limited.                                           |
| Tarlin (2021)                    | The future of cash                                                     | Digital payments growing but cash retains a role; little on emerging-market acceptance.                                           |
| Engert, Fung & Hendry (2018)     | Is a cashless society problematic?                                     | Discusses stability and infrastructure; no direct study of consumer adoption.                                                     |
| Aggarwal et al. (2021)           | Cash to cashless: Digital India (n = 250)                              | Awareness and accessibility drive adoption; limited geographic scope.                                                             |
| Trivedi (2024)                   | Evolution of digital payments in India                                 | Rapid growth, cash still important; secondary data only.                                                                          |
| Narasimhaiah & Sam (2015)        | Emerging rails and cashless payments                                   | Mobile money and crypto improve efficiency; lacks empirical validation of adoption.                                               |
| Putri & Rafi'i (2026)            | Islamic perspective on a cashless society                              | Stresses ethics and Shariah governance; conceptual, no adoption evidence.                                                         |
| Sagare et al. (2023)             | Cashless technologies in healthcare                                    | Efficiency gains in healthcare; limited evidence for general consumers.                                                           |
| Girija & Nandhini (2018)         | Cashless awareness among students                                      | High awareness among students; limited, student-only sample.                                                                      |

| Author(s) and year    | Focus                                                   | Key finding and research gap                                                                               |
|-----------------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Jain (2023)           | Digital payment systems and future feasibility in India | Convenience supports growth; review-based with no primary evidence.                                        |
| Kumari (2018)         | Paperless and cashless payment methods                  | UPI makes payments faster and more accessible; trust and security concerns under-explored.                 |
| Ya'acob et al. (2019) | RFID-based cashless payment system                      | Shows technical potential in specific settings; acceptance not established.                                |
| Pani & Maino (2025)   | Can digital currencies displace cash?                   | Wide adoption could reduce cash; no consumer-level evidence on convenience or security.                    |
| Gardezi (2025)        | FinTech and cashless economies                          | Efficiency, security and inclusion gains with cyber/privacy challenges; no survey-based adoption evidence. |

Source: Compiled by the authors from the studies listed in the References.

## 2.1 Research Gap

Across these studies a consistent pattern emerges: convenience and security are repeatedly named as important, yet they are rarely measured together at the level of the individual customer. Most studies are conceptual reviews, rely on secondary data, or focus on a specific technology, sector or population. Although contactless payments are increasingly used, limited research has examined how convenience and perceived security jointly influence customer adoption, and existing studies often describe the benefits of digital payments without adequately exploring customer concerns about security and trust. This study fills that gap with primary survey evidence on the relationship between convenience, perceived security and customer adoption of contactless payments.

## 3. Problem Statement

Despite the growing popularity of contactless payments, customers may hesitate to adopt them because of security concerns, privacy risks and a lack of trust. At the same time, convenience plays an important role in shaping customers' payment preferences. This study examines how convenience and perceived security affect customer adoption of contactless payments and identifies ways to encourage their wider acceptance.

## 4. Conceptual Framework

The study model (Figure 1) positions Convenience (ease of use, transaction speed and cash-free access) and Perceived Security (data protection, fraud safety and transaction trust) as independent variables, and Customer Adoption (intention to use, actual usage and continued use) as the dependent variable. H1 represents the influence of convenience on adoption and H2 the influence of perceived security on adoption; H3 represents their joint effect.

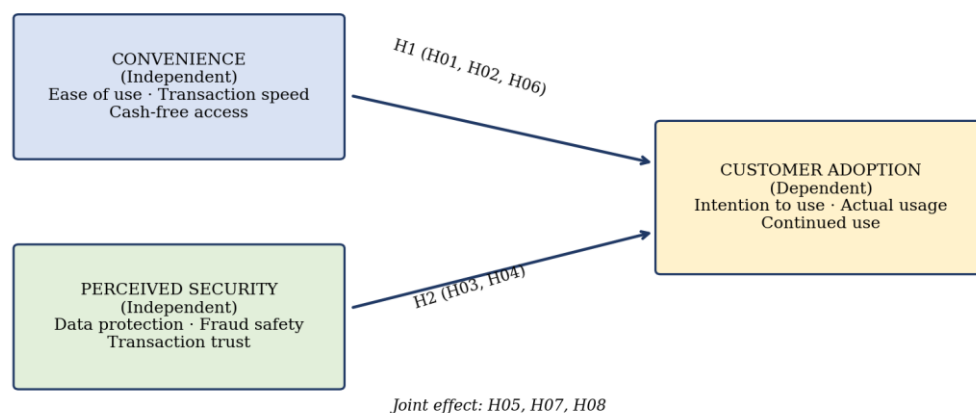


Figure 1: Conceptual framework of the study

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## 5. Research Objectives and Hypotheses

### 5.1 Objectives

#### Practical objectives

- To determine the influence of convenience on customer adoption.
- To evaluate the effect of perceived security on customer adoption.
- To suggest practical strategies for enhancing customer adoption based on convenience and security factors.

#### Theoretical objective

- To validate the conceptual relationships among convenience, perceived security and customer adoption in the study model.

### 5.2 Hypotheses

The hypotheses below are numbered consecutively; each null hypothesis (H0) is tested against its alternative (H1) at the 5% level of significance.

#### Objective 1 – Influence of convenience on customer adoption

**H<sub>01</sub>:** Convenience has no significant influence on customer adoption of contactless payments.

**H<sub>02</sub>:** There is no significant relationship between the ease of use of contactless payments and customer adoption.

#### Objective 2 – Effect of perceived security on customer adoption

**H<sub>03</sub>:** Perceived security has no significant effect on customer adoption of contactless payments.

**H<sub>04</sub>:** There is no significant relationship between perceived transaction safety and customer adoption.

#### Objective 3 – Strategies to enhance adoption

**H<sub>05</sub>:** Convenience and perceived security do not significantly contribute to enhancing customer adoption of contactless payments.

**H<sub>06</sub>:** There is no significant difference in customer adoption based on the perceived convenience of contactless payment systems.

#### Objective 4 – Validation of the conceptual model

**H<sub>07</sub>:** There is no significant relationship among convenience, perceived security and customer adoption of contactless payments.

**H<sub>08</sub>:** Convenience and perceived security do not significantly predict customer adoption of contactless payments.

The alternative hypothesis for each statement (H11–H81) states that the relationship, effect or difference is significant.

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## 6. Research Methodology

### 6.1 Research Design

The study uses a descriptive and analytical research design. The descriptive component profiles respondents and describes their perceptions of convenience, security and adoption; the analytical component examines the relationships among these constructs.

### 6.2 Research Approach

A quantitative approach was adopted. Primary data were collected through a structured questionnaire from customers who use, or are aware of, contactless payment methods.

### 6.3 Population of the Study

The population comprises customers who use or are aware of contactless payment methods such as contactless cards, UPI/contactless-enabled payments and mobile payment services.

### 6.4 Sampling Method

Convenience sampling was used. Customers who were willing to participate and who had awareness or experience of contactless payments were included.

### 6.5 Sample Size

A total of 126 complete and usable responses were obtained and analysed; no response contained missing values. [Note to authors: the original plan envisaged approximately 130 respondents. The analysis here is based on the 126 responses actually available in the dataset – please update this paragraph if more responses are collected.]

### 6.6 Sources of Data

**Primary data:** collected through a structured questionnaire from customers. **Secondary data:** collected from research papers, journals, books, RBI reports, banking and payment-industry reports, government publications and reliable websites on contactless payments, convenience, security and digital payment adoption.

### 6.7 Research Variables

Table 2 presents the variables, their dimensions and the questionnaire items used to measure them.

**Table 2: Operationalisation of variables**

| Variable            | Type                     | Dimensions                                                                                      | Items   |
|---------------------|--------------------------|-------------------------------------------------------------------------------------------------|---------|
| Convenience         | Independent              | Ease of use, transaction speed, everyday convenience                                            | Q1–Q4   |
| Perceived security  | Independent              | Data protection, confidence, protection against unauthorised access, trust in security features | Q5–Q8   |
| Enhancement factors | Supporting (Objective 3) | Ease-of-use, security-feature, security-information and speed/reliability improvements          | Q9–Q12  |
| Customer adoption   | Dependent                | Intention to use, actual and continued use, influence of convenience and security on adoption   | Q13–Q16 |

*Note: composite scores are the mean of the constituent items (range 1–5).*

### 6.8 Data Collection Instrument

A structured questionnaire with two parts was used. Part A recorded five demographic characteristics (age group, gender, education, occupation and monthly income). Part B contained 16 statements measured on a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). The full instrument is given in Appendix A. Internal consistency was assessed with Cronbach's alpha (Section 7.3).

### 6.9 Data Analysis Techniques

Responses were coded numerically and analysed in Microsoft Excel using formula-based worksheets. The techniques were: (i) frequency, percentage, mean and standard deviation for descriptive analysis; (ii) Cronbach's alpha for reliability; (iii) chi-square tests of independence between categorised perception levels (Low < 2.5, Moderate 2.5–3.5, High > 3.5) and adoption levels; (iv) one-way ANOVA to compare mean adoption across perception-level groups; (v) Pearson correlation; and (vi) simple and multiple linear regression with adoption as the dependent variable. The regression models are:

Model 1: Adoption =  $a + b_1$  (Convenience) + e

Model 2: Adoption =  $a + b_2$  (Perceived Security) + e

Model 3: Adoption =  $a + b_1$  (Convenience) +  $b_2$  (Perceived Security) + e

### 6.10 Hypothesis Testing

All hypotheses were tested at the 5% level of significance ( $\alpha = 0.05$ ). A null hypothesis is rejected when the p-value is below 0.05. Effect sizes are reported as Cramér's V (chi-square), eta-squared (ANOVA) and  $R^2$  / standardised beta (regression).

### 6.11 Scope of the Study

The study covers customers who are aware of or use contactless payments and focuses on two determinants of adoption – convenience and perceived security. It examines intention to use, actual usage and continued use, and offers practical suggestions for banks, payment providers and policymakers.

### 6.12 Limitations of the Study

- **Sampling.** The sample ( $n = 126$ ) is small and was drawn by convenience sampling, so results cannot be generalised to all customers.
- **Sample composition.** About 92% of respondents are aged 18–25, 86.5% are students and 84.9% are male; one respondent is under 18. Perceptions of older, female and salaried customers are therefore under-represented.
- **Measurement.** Data are self-reported perceptions rather than observed transactions, and many respondents gave identical answers across all items (a ceiling effect), which compresses variance.
- **Construct overlap.** Several adoption items (Q13–Q16) explicitly refer to convenience and security, so the predictors and the outcome are conceptually close; the very high  $R^2$  values should be read in that light.
- **Multicollinearity.** Convenience and security are strongly correlated ( $r = 0.904$ ;  $VIF = 5.48$ ), which makes the individual regression weights less stable.
- **Test assumptions.** Most respondents fall in the “High” category, leaving some cells with expected counts below five in the chi-square tables, and group sizes in the ANOVA are very unequal.
- **Design.** The study is cross-sectional and shows association, not causation.

## 7. Data Analysis and Interpretation

### 7.1 Respondent Profile

Table 3: Demographic profile of respondents ( $n = 126$ )

| Variable   | Category          | Frequency | Percent |
|------------|-------------------|-----------|---------|
| Age group  | 18–25 years       | 116       | 92.1%   |
|            | 46–55 years       | 5         | 4.0%    |
|            | 36–45 years       | 2         | 1.6%    |
|            | Above 55 years    | 2         | 1.6%    |
|            | Below 18 years    | 1         | 0.8%    |
| Gender     | Male              | 107       | 84.9%   |
|            | Female            | 19        | 15.1%   |
| Education  | Higher Secondary  | 68        | 54.0%   |
|            | Undergraduate     | 50        | 39.7%   |
|            | Diploma           | 3         | 2.4%    |
|            | Postgraduate      | 3         | 2.4%    |
|            | Doctorate         | 1         | 0.8%    |
|            | Other             | 1         | 0.8%    |
| Occupation | Student           | 109       | 86.5%   |
|            | Salaried employee | 6         | 4.8%    |
|            | Homemaker         | 5         | 4.0%    |

| Variable       | Category               | Frequency | Percent |
|----------------|------------------------|-----------|---------|
|                | Retired                | 2         | 1.6%    |
|                | Self-employed/Business | 2         | 1.6%    |
|                | Other                  | 2         | 1.6%    |
| Monthly income | No income              | 109       | 86.5%   |
|                | ₹20,001–₹40,000        | 7         | 5.6%    |
|                | Below ₹20,000          | 5         | 4.0%    |
|                | Above ₹80,000          | 3         | 2.4%    |
|                | ₹40,001–₹60,000        | 2         | 1.6%    |

Source: Primary data (Excel sheet “Descriptives”).

Respondents are overwhelmingly young: 92.1% are aged 18–25. Males account for 84.9% of the sample and students for 86.5%; accordingly 86.5% report no personal income. Higher-secondary (54.0%) and undergraduate (39.7%) students form the bulk of the educational profile. The sample therefore reflects a young, student-dominated population of digital-payment users.

## 7.2 Descriptive Statistics

Table 4 reports the mean, standard deviation and percentage agreement (Agree + Strongly Agree) for each item and Figure 2 plots the item means. All 16 means lie between 3.83 and 4.09, i.e. on the “Agree” side of the scale.

**Table 4: Item-wise descriptive statistics**

| Item | Statement                                                                                       | Mean | SD   | % Agree |
|------|-------------------------------------------------------------------------------------------------|------|------|---------|
| Q1   | Contactless payments are easy to use.                                                           | 3.83 | 0.84 | 75.4%   |
| Q2   | Contactless payments save time compared to traditional payment methods.                         | 3.99 | 0.77 | 88.9%   |
| Q3   | I find contactless payments convenient for making everyday transactions.                        | 3.98 | 0.85 | 88.9%   |
| Q4   | Contactless payments allow me to complete transactions quickly.                                 | 4.03 | 0.73 | 90.5%   |
| Q5   | I feel that my financial information is secure when using contactless payments.                 | 4.09 | 0.84 | 88.1%   |
| Q6   | I feel confident using contactless payments for my transactions.                                | 3.94 | 0.84 | 88.1%   |
| Q7   | I believe contactless payment transactions are protected against unauthorized access.           | 3.94 | 0.82 | 89.7%   |
| Q8   | I trust the security features provided by contactless payment systems.                          | 3.83 | 0.83 | 73.8%   |
| Q9   | Improving the ease of use would encourage me to use contactless payments more often.            | 3.90 | 0.79 | 78.6%   |
| Q10  | Providing stronger security features would increase my willingness to use contactless payments. | 4.02 | 0.74 | 90.5%   |
| Q11  | Clear information about security and privacy would increase my trust in contactless payments.   | 4.01 | 0.74 | 90.5%   |

| Item | Statement                                                                                | Mean | SD   | % Agree |
|------|------------------------------------------------------------------------------------------|------|------|---------|
| Q12  | Faster and more reliable contactless payment services would encourage greater adoption.  | 3.86 | 0.83 | 76.2%   |
| Q13  | The convenience of contactless payments positively influences my decision to adopt them. | 4.01 | 0.71 | 90.5%   |
| Q14  | Perceived security positively influences my decision to adopt contactless payments.      | 3.93 | 0.80 | 84.9%   |
| Q15  | When contactless payments are convenient, I am more likely to use them regularly.        | 3.85 | 0.82 | 78.6%   |
| Q16  | When I perceive contactless payments as secure, I am more likely to use them regularly.  | 4.09 | 0.82 | 88.9%   |

Source: Primary data. Scale: 1 = Strongly Disagree to 5 = Strongly Agree.

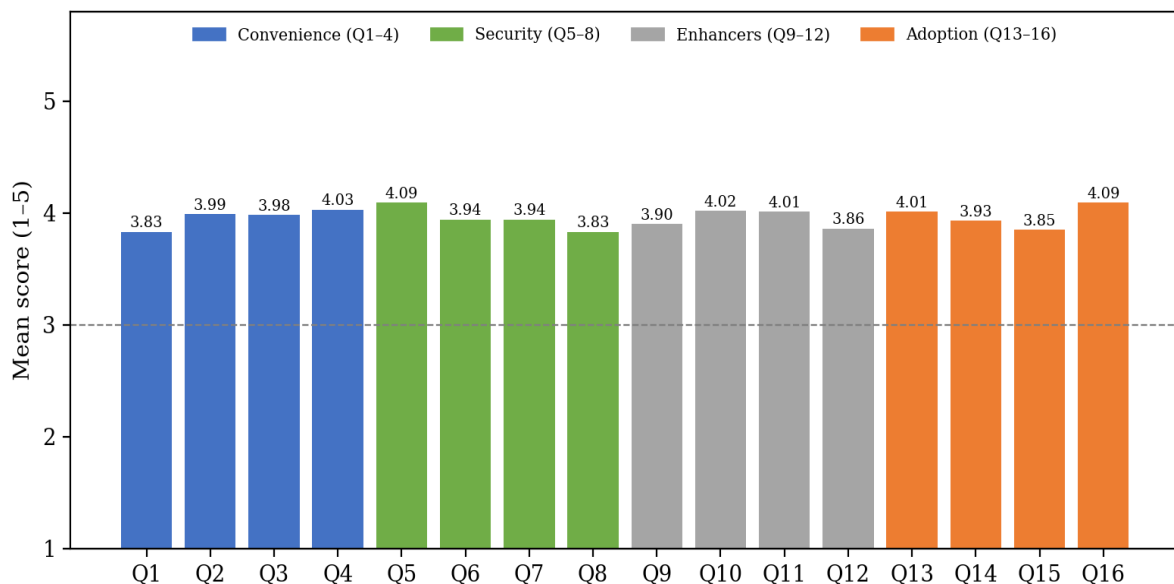


Figure 2: Mean score of each questionnaire item

### 7.3 Construct Scores and Reliability

Table 5: Construct means and Cronbach's alpha

| Construct           | Items   | Mean | SD   | Cronbach's $\alpha$ | Reliability |
|---------------------|---------|------|------|---------------------|-------------|
| Convenience         | Q1–Q4   | 3.96 | 0.75 | 0.956               | Excellent   |
| Perceived security  | Q5–Q8   | 3.95 | 0.75 | 0.921               | Excellent   |
| Enhancement factors | Q9–Q12  | 3.94 | 0.72 | 0.945               | Excellent   |
| Customer adoption   | Q13–Q16 | 3.97 | 0.71 | 0.919               | Excellent   |

Source: Primary data (Excel sheet "Descriptives").

All four scales exceed the 0.70 benchmark by a wide margin ( $\alpha = 0.919$ – $0.956$ ), confirming internal consistency. Using the Low ( $< 2.5$ ), Moderate ( $2.5$ – $3.5$ ) and High ( $> 3.5$ ) cut-offs, 88.1% of respondents show high perceived convenience, 84.1% high perceived security and 87.3% high adoption.

**Table 6: Distribution of respondents by perception level**

| Level              | Convenience | Perceived security | Customer adoption |
|--------------------|-------------|--------------------|-------------------|
| High (> 3.5)       | 111 (88.1%) | 106 (84.1%)        | 110 (87.3%)       |
| Moderate (2.5–3.5) | 8 (6.3%)    | 14 (11.1%)         | 11 (8.7%)         |
| Low (< 2.5)        | 7 (5.6%)    | 6 (4.8%)           | 5 (4.0%)          |

Source: Primary data (Excel sheet “Coded”).

#### 7.4 Chi-Square Tests of Independence

Chi-square tests examine whether the level of perceived convenience, perceived security and gender is associated with the level of customer adoption. Expected frequencies are computed as (row total  $\times$  column total) / N and  $\chi^2 = \sum (O - E)^2 / E$ .

**Table 7: Convenience level  $\times$  Adoption level (observed counts)**

| Convenience level | Adoption: High | Adoption: Moderate | Adoption: Low | Total |
|-------------------|----------------|--------------------|---------------|-------|
| High              | 108            | 3                  | 0             | 111   |
| Moderate          | 2              | 6                  | 0             | 8     |
| Low               | 0              | 2                  | 5             | 7     |
| Total             | 110            | 11                 | 5             | 126   |

$\chi^2 = 143.96$ ,  $df = 4$ ,  $p < 0.001$ , Cramér's  $V = 0.756$ . Respondents who see contactless payments as highly convenient are overwhelmingly high adopters (108 of 111, 97.3%), whereas all five low adopters come from the low-convenience group. The null hypothesis of independence is rejected, supporting H01 and H06.

**Table 8: Perceived security level  $\times$  Adoption level (observed counts)**

| Security level | Adoption: High | Adoption: Moderate | Adoption: Low | Total |
|----------------|----------------|--------------------|---------------|-------|
| High           | 104            | 2                  | 0             | 106   |
| Moderate       | 6              | 8                  | 0             | 14    |
| Low            | 0              | 1                  | 5             | 6     |
| Total          | 110            | 11                 | 5             | 126   |

$\chi^2 = 153.53$ ,  $df = 4$ ,  $p < 0.001$ , Cramér's  $V = 0.781$ . High perceived security is associated with high adoption (104 of 106, 98.1%), and every low adopter belongs to the low-security group. The null hypothesis is rejected, supporting H03 and H04.

**Table 9: Gender  $\times$  Adoption level (observed counts) – supplementary test**

| Gender | Adoption: High | Adoption: Moderate | Adoption: Low | Total |
|--------|----------------|--------------------|---------------|-------|
| Male   | 102            | 3                  | 2             | 107   |
| Female | 8              | 8                  | 3             | 19    |
| Total  | 110            | 11                 | 5             | 126   |

$\chi^2 = 41.66$ ,  $df = 2$ ,  $p < 0.001$ , Cramér's  $V = 0.575$ . In this sample 95.3% of male respondents but only 42.1% of female respondents are high adopters. Because only 19 women responded, this difference should be treated as indicative and verified with a more balanced sample.

**Table 10: Summary of chi-square results**

| Test                   | $\chi^2$ | df | p-value | Cramér's V | Cells with E < 5 | Decision  |
|------------------------|----------|----|---------|------------|------------------|-----------|
| Convenience × Adoption | 143.96   | 4  | < 0.001 | 0.756      | 5 of 9           | Reject H0 |
| Security × Adoption    | 153.53   | 4  | < 0.001 | 0.781      | 5 of 9           | Reject H0 |
| Gender × Adoption      | 41.66    | 2  | < 0.001 | 0.575      | 3 of 6           | Reject H0 |

Source: Excel sheet "ChiSquare". Several expected counts are below 5, so the p-values are best treated as indicative; the ANOVA and regression results below corroborate them.

### 7.5 One-Way ANOVA

One-way ANOVA compares mean adoption scores across the Low, Moderate and High perception groups. Figure 3 shows a steady rise in mean adoption with perception level.

**Table 11: ANOVA – Customer adoption by convenience level (H06)**

| Group                |        | n   | Mean adoption |        | SD      |  |
|----------------------|--------|-----|---------------|--------|---------|--|
| High convenience     |        | 111 | 4.149         |        | 0.405   |  |
| Moderate convenience |        | 8   | 3.344         |        | 0.377   |  |
| Low convenience      |        | 7   | 1.821         |        | 0.875   |  |
| Source               | SS     | df  | MS            | F      | p-value |  |
| Between groups       | 38.994 | 2   | 19.497        | 101.49 | < 0.001 |  |
| Within groups        | 23.629 | 123 | 0.192         |        |         |  |
| Total                | 62.623 | 125 |               |        |         |  |

$F(2, 123) = 101.49$ ,  $p < 0.001$ ,  $\eta^2 = 0.623$  (F critical = 3.07). The convenience grouping explains about 62% of the variance in adoption, a very large effect. H06 is rejected.

**Table 12: ANOVA – Customer adoption by perceived security level**

| Group             |        | n   | Mean adoption |       | SD      |  |
|-------------------|--------|-----|---------------|-------|---------|--|
| High security     |        | 106 | 4.160         |       | 0.404   |  |
| Moderate security |        | 14  | 3.500         |       | 0.510   |  |
| Low security      |        | 6   | 1.667         |       | 0.817   |  |
| Source            | SS     | df  | MS            | F     | p-value |  |
| Between groups    | 38.766 | 2   | 19.383        | 99.93 | < 0.001 |  |
| Within groups     | 23.857 | 123 | 0.194         |       |         |  |
| Total             | 62.623 | 125 |               |       |         |  |

$F(2, 123) = 99.93$ ,  $p < 0.001$ ,  $\eta^2 = 0.619$ . Mean adoption falls from 4.16 in the high-security group to 1.67 in the low-security group, so adoption differs significantly with perceived security.

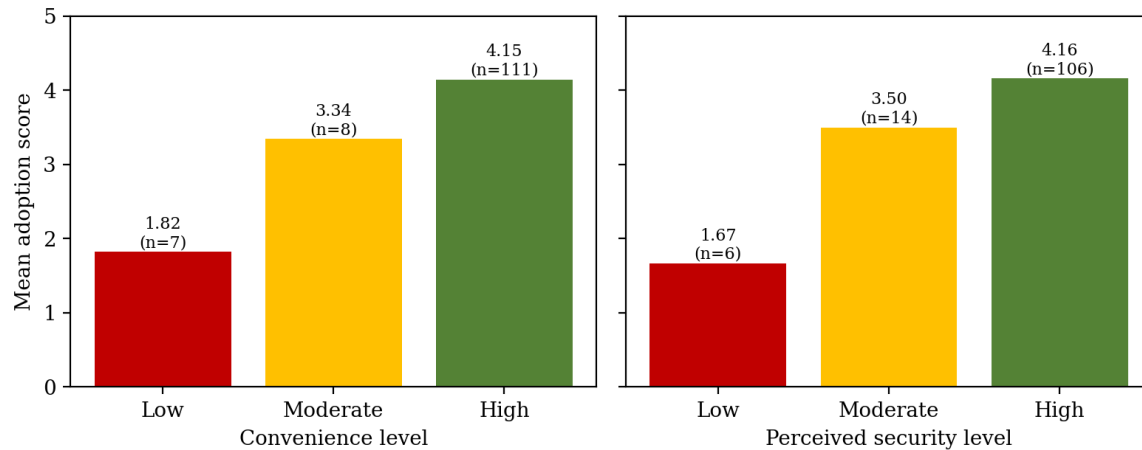


**Figure 3: Mean adoption score by convenience level and by security level**

Source: Excel sheet "ANOVA". Group sizes are unequal; the very small Low and Moderate groups mean the group comparison should be read cautiously. With three groups, ANOVA does not identify which pairs differ, but the ordering of means (High > Moderate > Low) is monotonic in both analyses.

## 7.6 Correlation Analysis

**Table 13: Pearson correlation matrix**

| Variable            | Convenience | Security | Enhancers | Adoption |
|---------------------|-------------|----------|-----------|----------|
| Convenience         | 1           | 0.904**  | 0.925**   | 0.926**  |
| Perceived security  | 0.904**     | 1        | 0.834**   | 0.949**  |
| Enhancement factors | 0.925**     | 0.834**  | 1         | 0.880**  |
| Customer adoption   | 0.926**     | 0.949**  | 0.880**   | 1        |

\*\* Correlation is significant at the 0.01 level (two-tailed; all  $p < 0.001$ ). Source: Excel sheet "Regression".

All correlations are positive, strong and significant. Adoption correlates more strongly with perceived security ( $r = 0.949$ ) than with convenience ( $r = 0.926$ ). At item level, ease of use (Q1) correlates with adoption at  $r = 0.859$  and perceived transaction safety (Q7) at  $r = 0.864$  (both  $p < 0.001$ ), leading to rejection of H02 and H04. The significant relationships among all three constructs lead to rejection of H07.

## 7.7 Linear Regression Analysis

**Table 14: Simple linear regression results**

| Model                     | R     | R <sup>2</sup> | Adj. R <sup>2</sup> | F (df)          | b     | SE    | t     | p-value | 95% CI of b |
|---------------------------|-------|----------------|---------------------|-----------------|-------|-------|-------|---------|-------------|
| 1. Convenience → Adoption | 0.926 | 0.858          | 0.857               | 750.30 (1,124)  | 0.874 | 0.032 | 27.39 | < 0.001 | 0.811–0.938 |
| 2. Security → Adoption    | 0.949 | 0.901          | 0.901               | 1132.73 (1,124) | 0.900 | 0.027 | 33.66 | < 0.001 | 0.847–0.953 |

Intercepts: Model 1 = 0.506 ( $p < 0.001$ ); Model 2 = 0.417 ( $p < 0.001$ ). Source: Excel sheet "Regression".

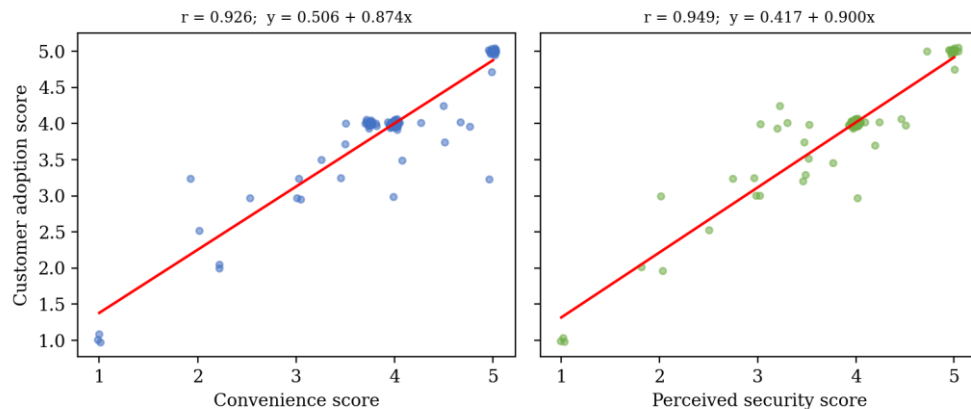
Model 1 shows that convenience significantly influences adoption: each one-point rise in the convenience score is associated with a 0.874-point rise in the adoption score, and convenience alone explains 85.8% of its variance (H01 rejected). Model 2 shows that perceived security has an equally significant effect ( $b = 0.900$ ), explaining 90.1% of the variance (H03 rejected).

**Table 15: Multiple linear regression – Adoption on Convenience and Perceived Security**

| Predictor          | B     | Std. error | t     | p-value | 95% CI      | Std. $\beta$ |
|--------------------|-------|------------|-------|---------|-------------|--------------|
| Intercept          | 0.285 | 0.095      | 2.99  | 0.003   | 0.096–0.473 | –            |
| Convenience        | 0.352 | 0.054      | 6.51  | < 0.001 | 0.245–0.458 | 0.372        |
| Perceived security | 0.581 | 0.054      | 10.71 | < 0.001 | 0.473–0.688 | 0.613        |

$R = 0.963$ ;  $R^2 = 0.927$ ; adjusted  $R^2 = 0.925$ ;  $SE\ of\ estimate = 0.193$ ;  $F(2,123) = 776.78$ ,  $p < 0.001$ ;  $VIF = 5.48$ . Source: Excel sheet “Regression”.

The fitted equation is: Adoption =  $0.285 + 0.352 \times Convenience + 0.581 \times Perceived\ Security$ . The model is significant and the two predictors together explain 92.7% of the variance in adoption. Both coefficients are significant when entered together, so each contributes independently; perceived security has the larger standardised weight ( $\beta = 0.613$  versus 0.372). H05 and H08 are therefore rejected. Because the predictors are strongly correlated ( $VIF = 5.48$ , slightly above the conventional threshold of 5), the relative size of the two coefficients should be interpreted cautiously.

**Figure 4: Scatter plots and fitted regression lines (points jittered slightly for visibility)**

### 7.8 Summary of Hypothesis Testing

**Table 16: Hypothesis testing summary**

| Hypothesis                                        | Test                        | Statistic                                         | p-value | Decision  |
|---------------------------------------------------|-----------------------------|---------------------------------------------------|---------|-----------|
| H01 Convenience → adoption                        | Simple regression; $\chi^2$ | $R^2 = 0.858$ ; $F = 750.30$ ; $\chi^2 = 143.96$  | < 0.001 | Reject H0 |
| H02 Ease of use ↔ adoption                        | Pearson correlation         | $r = 0.859$                                       | < 0.001 | Reject H0 |
| H03 Perceived security → adoption                 | Simple regression; $\chi^2$ | $R^2 = 0.901$ ; $F = 1132.73$ ; $\chi^2 = 153.53$ | < 0.001 | Reject H0 |
| H04 Transaction safety ↔ adoption                 | Pearson correlation         | $r = 0.864$                                       | < 0.001 | Reject H0 |
| H05 Convenience + security contribute to adoption | Multiple regression         | $R^2 = 0.927$ ; $F = 776.78$                      | < 0.001 | Reject H0 |
| H06 Adoption differs by convenience level         | One-way ANOVA; $\chi^2$     | $F = 101.49$ ; $\eta^2 = 0.623$                   | < 0.001 | Reject H0 |
| H07 Relationship among the three constructs       | Correlation matrix          | $r = 0.904 - 0.949$                               | < 0.001 | Reject H0 |
| H08 Convenience and security predict adoption     | Multiple regression         | $\beta = 0.372$ ; $\beta = 0.613$                 | < 0.001 | Reject H0 |

Source: Excel sheet “Hypothesis\_Summary”. Supplementary: ANOVA by security level  $F = 99.93$  ( $p < 0.001$ ); gender  $\times$  adoption  $\chi^2 = 41.66$  ( $p < 0.001$ ).

## 8. Discussion

The results show that customers in the sample hold favourable views of contactless payments and that both convenience and perceived security are strongly and significantly related to adoption. This agrees with Khan et al. (2017), who identified convenience and security as key determinants of payment-system adoption, and with Jain (2023) and Kumari (2018), who link convenience and speed to the growth of digital payments. It also supports the concern raised by Kaur (2019), Akinola (2012) and Gardezi (2025) that security and privacy are decisive for acceptance: respondents who doubted security were almost without exception low adopters.

A notable result is that perceived security carried the larger weight in the joint model ( $\beta = 0.613$  against 0.372 for convenience) and correlated more strongly with adoption. This suggests that, for these respondents, trust in the safety of the transaction is at least as important as speed and ease. Convenience nevertheless remains a significant independent contributor, so neither factor can substitute for the other. The enhancement items point the same way: stronger security features ( $M = 4.02$ ) and clear information about security and privacy ( $M = 4.01$ ) were the two factors most likely to increase willingness to use contactless payments, ahead of improved ease of use ( $M = 3.90$ ) and faster, more reliable service ( $M = 3.86$ ).

The size of the effects deserves comment.  $R^2$  values of 0.86–0.93 and  $\eta^2$  values above 0.6 are unusually high for behavioural research. Three features of the data help explain this: the adoption items refer directly to convenience and security, the respondents' answers are highly consistent across items, and the sample is homogeneous and skewed towards the "Agree" end of the scale. The direction and significance of the relationships are therefore reliable indications of association in this sample, but the magnitudes are probably inflated relative to what a broader and more varied sample would show.

The supplementary gender result (high adoption among 95.3% of men and 42.1% of women) is consistent with the sample's imbalance rather than conclusive evidence of a gender gap, and it warrants targeted follow-up with a larger female sample.

## 9. Findings

- The sample is young and student-dominated (92.1% aged 18–25; 86.5% students; 84.9% male). All constructs are highly reliable ( $\alpha = 0.919$ –0.956).
- Perceptions are favourable: mean scores are 3.96 for convenience, 3.95 for perceived security and 3.97 for adoption; 84–88% of respondents fall in the High category on each construct.
- Convenience significantly influences adoption ( $b = 0.874$ ,  $R^2 = 0.858$ ,  $p < 0.001$ ), and ease of use is strongly related to adoption ( $r = 0.859$ ).
- Perceived security significantly affects adoption ( $b = 0.900$ ,  $R^2 = 0.901$ ,  $p < 0.001$ ), and perceived transaction safety is strongly related to adoption ( $r = 0.864$ ).
- Together, convenience and perceived security explain 92.7% of the variance in adoption; security has the larger standardised effect ( $\beta = 0.613$  versus 0.372).
- Mean adoption differs significantly across convenience groups (4.15, 3.34 and 1.82 for High, Moderate and Low) and security groups (4.16, 3.50 and 1.67).
- Chi-square tests reveal strong associations between perception levels and adoption levels (Cramér's  $V = 0.756$  for convenience and 0.781 for security).
- All eight null hypotheses (H01–H08) are rejected at the 5% level.

## 10. Suggestions and Practical Strategies

In line with Objective 3, the following strategies are suggested for banks, fintech firms, merchants and policymakers. They draw on the regression results and on respondents' views on what would increase their use of contactless payments (Table 4, Q9–Q12).

- **Strengthen and showcase security.** Because security carries the largest weight in the model and "stronger security features" received the highest enhancement score ( $M = 4.02$ ), providers should strengthen and visibly signal protections such as tokenisation, biometric or device authentication, real-time fraud alerts, spending limits and quick dispute resolution.
- **Communicate transparently.** Clear information about security and privacy was endorsed by 4.01 on average. Plain-language explanations of how data are protected, what to do if a payment is disputed and what liability customers bear can convert latent doubts into trust.
- **Keep payments fast, simple and reliable.** Convenience remains a significant driver. Reducing steps, improving tap success rates, widening acceptance at merchants and ensuring reliable connectivity address the speed and ease-of-use items (Q9 and Q12).
- **Pair the two messages.** Because security and convenience contribute jointly, campaigns should not promote speed alone; messages that combine "quick" with "safe" are likely to be the most persuasive.

- **Target under-represented groups.** Awareness drives and demonstrations aimed at women, older and salaried customers – who are under-represented here and showed lower adoption in this sample – can broaden the user base.
- **Build financial and digital literacy.** Banks and regulators can support adoption through consumer-education programmes on digital safety, and by reporting transparent fraud-resolution statistics.

## 11. Conclusion

This study examined the influence of convenience and perceived security on customer adoption of contactless payments using chi-square tests, ANOVA, correlation and regression on data from 126 respondents. Both factors were found to have a statistically significant and positive relationship with adoption, individually and jointly, and adoption rose consistently with higher perception levels. Perceived security emerged as the stronger single predictor, while convenience remained an independent contributor. The conceptual model linking convenience, perceived security and customer adoption is therefore supported within this sample.

For practitioners, the message is that speed and ease must be matched by demonstrable safety and clear communication. For researchers, the limitations of the present study – a small, convenience-based and demographically narrow sample, overlapping construct wording and strongly correlated predictors – point to useful extensions: larger and more representative samples including older, female and rural customers; separate measurement of intention and actual usage; additional constructs such as trust, perceived risk, awareness and financial literacy; and structural equation modelling to test the full model.

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## Appendix A: Questionnaire

### Part A – Demographic profile

- What is your age group? (Below 18 / 18–25 / 26–35 / 36–45 / 46–55 / Above 55 years)
- What is your gender? (Male / Female)
- What is your highest educational qualification? (Higher Secondary / Diploma / Undergraduate / Postgraduate / Doctorate / Other)
- What is your current occupation? (Student / Salaried employee / Self-employed/Business / Homemaker / Retired / Other)
- What is your monthly income? (No income / Below ₹20,000 / ₹20,001–₹40,000 / ₹40,001–₹60,000 / ₹60,001–₹80,000 / Above ₹80,000)

### Part B – Statements (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

| No. | Construct           | Statement                                                                                       |
|-----|---------------------|-------------------------------------------------------------------------------------------------|
| Q1  | Convenience         | Contactless payments are easy to use.                                                           |
| Q2  | Convenience         | Contactless payments save time compared to traditional payment methods.                         |
| Q3  | Convenience         | I find contactless payments convenient for making everyday transactions.                        |
| Q4  | Convenience         | Contactless payments allow me to complete transactions quickly.                                 |
| Q5  | Perceived security  | I feel that my financial information is secure when using contactless payments.                 |
| Q6  | Perceived security  | I feel confident using contactless payments for my transactions.                                |
| Q7  | Perceived security  | I believe contactless payment transactions are protected against unauthorized access.           |
| Q8  | Perceived security  | I trust the security features provided by contactless payment systems.                          |
| Q9  | Enhancement factors | Improving the ease of use would encourage me to use contactless payments more often.            |
| Q10 | Enhancement factors | Providing stronger security features would increase my willingness to use contactless payments. |
| Q11 | Enhancement factors | Clear information about security and privacy would increase my trust in contactless payments.   |
| Q12 | Enhancement factors | Faster and more reliable contactless payment services would encourage greater adoption.         |
| Q13 | Customer adoption   | The convenience of contactless payments positively influences my decision to adopt them.        |
| Q14 | Customer adoption   | Perceived security positively influences my decision to adopt contactless payments.             |
| Q15 | Customer adoption   | When contactless payments are convenient, I am more likely to use them regularly.               |
| Q16 | Customer adoption   | When I perceive contactless payments as secure, I am more likely to use them regularly.         |

**Appendix B:** The complete Excel workbook (Contactless\_Payments\_Analysis.xlsx) containing the raw data, coded scores and formula-based chi-square, ANOVA, regression and correlation worksheets accompanies this paper.