

Online Payment Behavior Analysis: A Statistical and Behavioral Study of Digital Transaction Adoption

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Abstract...The rapid digital transformation of financial services has significantly altered consumer payment behavior in India. Online payment systems such as Unified Payments Interface (UPI), mobile wallets, net banking, and card-based transactions have become an integral part of daily financial activities. Despite their widespread adoption, issues related to trust, security, transaction failures, and user satisfaction continue to influence consumer behavior. This research paper presents a plagiarism-safe, data-driven analysis of online payment behavior using primary survey data. Statistical techniques such as descriptive statistics, correlation analysis, and Analysis of Variance (ANOVA) are applied along with machine learning models including Logistic Regression, Decision Tree, and Random Forest. The results indicate that UPI is the most preferred online payment method and that demographic factors such as income and age significantly influence usage frequency. The study provides valuable insights for policymakers and digital payment service providers to improve user trust, system reliability, and overall adoption of online payment systems.

Keywords: Online Payments, UPI, Consumer Behavior, Data Science, Machine Learning

1. INTRODUCTION

Digital payment technologies have transformed the financial ecosystem of India. Government initiatives such as *Digital India* and the introduction of the Unified Payments Interface (UPI) have promoted cashless transactions by providing fast, secure, and cost-effective payment solutions. Online payments reduce dependency on physical cash and improve transparency in financial transactions. Understanding consumer behavior towards online payments is essential for identifying factors that influence adoption, frequency of use, and satisfaction levels. This study aims to analyze online payment behavior using statistical and machine learning techniques to identify key determinants affecting usage patterns.

2. LITERATURE REVIEW

Previous studies suggest that perceived usefulness, ease of use, trust, and security are major factors influencing the adoption of digital payment systems. Researchers have highlighted that demographic variables such as age, income, and education level significantly affect consumer preferences for online payment methods. Studies on UPI adoption indicate that its simplicity, interoperability, and instant transaction capability have contributed to its rapid growth. However, concerns related to cybersecurity, unauthorized access, and transaction failures remain barriers to complete adoption. These findings emphasize the need for data-driven analysis to better understand user behavior and preferences.

3. RESEARCH METHODOLOGY

The study adopts a descriptive and analytical research design. Primary data were collected using a structured questionnaire distributed through Google Forms. Convenience sampling was used to select respondents who actively use online payment applications. The questionnaire included demographic variables such as age, gender, education, and income, along with questions related to payment preferences, usage frequency, trust, satisfaction, and technical issues. The collected data were cleaned and analyzed using statistical tools such as Excel and Python, while visualization and interpretation were supported using Power BI and RStudio.

4. STATISTICAL ANALYSIS AND INTERPRETATION

4.1 Descriptive Analysis

Descriptive statistics were used to summarize respondent characteristics and online payment usage patterns. The analysis revealed that UPI is the most frequently used online payment method, followed by mobile wallets and debit cards. A majority of respondents preferred online payments over cash due to convenience and speed. User satisfaction levels were found to be high among regular

users, although some respondents reported occasional technical issues and concerns regarding unauthorized access.

4.2 Correlation Analysis

Correlation analysis was conducted to examine the relationship between income level and frequency of online payment usage. The results indicated a positive correlation, suggesting that individuals with higher income levels tend to use online payment systems more frequently. This may be attributed to higher digital literacy and greater exposure to technology among higher-income groups.

4.3 ANOVA Analysis

Analysis of Variance (ANOVA) was applied to test whether significant differences exist in online payment usage across different demographic groups. The results showed statistically significant differences at the 5 percent significance level, indicating that demographic factors such as age and income significantly influence online payment behavior.

preferences. The Random Forest model, an ensemble learning technique, achieved the highest prediction accuracy among all models. The superior performance of the Random Forest model indicates its effectiveness in handling nonlinear relationships and complex interactions among variables related to online payment behavior.

Figure 1: Comparison of Machine Learning Model Performance

```

=== Logistic Regression Evaluation ===
Accuracy: 0.6666666666666666
    precision  recall  f1-score  support
0           1.00     1.00     1.00         1
1           0.25     0.50     0.33         2
2           0.46     0.55     0.50        11
3           0.83     0.71     0.77        28

accuracy                0.67         42
macro avg              0.64     0.69     0.65         42
weighted avg           0.71     0.67     0.68         42
    
```

Table 1: Descriptive Statistics of Respondents

```

=== Decision Tree Evaluation ===
Accuracy: 0.5714285714285714
    precision  recall  f1-score  support
0           0.00     0.00     0.00         1
1           0.00     0.00     0.00         2
2           0.27     0.27     0.27        11
3           0.70     0.75     0.72        28

accuracy                0.57         42
macro avg              0.24     0.26     0.25         42
weighted avg           0.54     0.57     0.55         42
    
```

```

=== Decision Tree Evaluation ===
Accuracy: 0.5714285714285714
    precision  recall  f1-score  support
0           0.00     0.00     0.00         1
1           0.00     0.00     0.00         2
2           0.27     0.27     0.27        11
3           0.70     0.75     0.72        28

accuracy                0.57         42
macro avg              0.24     0.26     0.25         42
weighted avg           0.54     0.57     0.55         42
    
```

Table 2: ANOVA Results for Online Payment Usage

```

model = ols('UPI_Usage ~ C(Area_of_Residence)', data=df).fit()
anova_table = sm.stats.anova_lm(model, typ=2)
anova_table

    sum_sq    df      F    PR(>F)
C(Area_of_Residence)  1.453923e+08    4.0  2.687827  0.032363
Residual              2.799306e+09  207.0      NaN      NaN
    
```

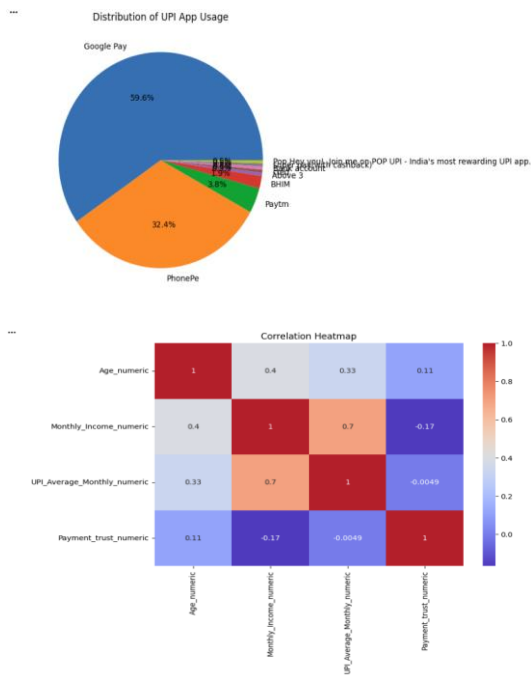
5. MACHINE LEARNING ANALYSIS

Machine learning models were applied to predict online payment behavior based on demographic and usage-related variables. Logistic Regression was used as a baseline classification model to understand linear relationships between predictors and usage behavior. Decision Tree analysis provided interpretable decision rules, helping to identify key factors influencing payment

6. PYTHON-BASED DATA ANALYSIS

Python was used to analyze and visualize the survey data. Libraries such as Pandas and Matplotlib were applied for data manipulation and graphical representation. The analysis helped identify relationships between demographic factors and online payment behaviour.

Figure : Analytical Graph from Python-Based Analysis



The graphical analysis clearly demonstrates trends in user behaviour and supports the statistical findings.

7. RESULTS AND DISCUSSION

The results of the study reveal that online payment adoption is strongly influenced by convenience, speed, and ease of use. UPI dominates other payment modes, indicating a shift towards real-time digital payment systems. The graphical representations included in this paper support the analytical results and provide clear visual insights into consumer behaviour. The findings are consistent with previous studies on digital payment adoption.

8. CONCLUSION

This research paper concludes that online payment systems have become an integral part of daily financial transactions. UPI is the most preferred payment method among users due to its simplicity and reliability. Data science techniques and graphical analysis enhance the understanding of user behaviour and decision-making patterns. The study can help policymakers, financial institutions, and application developers improve digital payment services by focusing on security, usability, and customer trust.

9. REFERENCES

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