

Understanding the Dynamics of Cashless Payment System: The Effects of Technology Advancement, Security Concerns, and Competition on Merchant Adoption in Hyderabad, India

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Abstract

This study examined the impact of technology advancement, security concerns, and competition on the adoption of Cashless Payment Systems (CPS) by merchants in Hyderabad City, India using a descriptive research design. A semi-structured questionnaire was administered to business heads, and the data was analyzed using frequency tables, means, correlation, and multiple regression analysis. The study findings revealed that technology advancement, security concerns, and competition significantly influence the process of adoption of CPS. The study recommends that entrepreneurs nationwide recognize CPS, as an opportunity to show case their unique and distinctiveness to capture market share. In light of limited cash availability, digital transactions, classified by the RBI as 'prepaid payment instruments,' are becoming increasingly important, driving more merchants to embrace digital money for better transparency, scalability, accountability and sustainability.

Keywords: *Cashless Payments, Consumer behaviour, Digital transactions, Security, Technology, Innovation, Adoption.*

Introduction

Payment and settlement systems are crucial components of a nation's financial structure, both domestically and internationally. As technology advances, cashless payment methods have emerged, enhancing the efficiency and effectiveness of transactions and trade. Historically, barter trade was the earliest form of transaction, but its challenges led to the development of various forms of money. Today, Cashless Payment Systems (CPS) offers a superior alternative to traditional monetary exchange, potentially boosting operations across various sectors if implemented correctly. Cashless payments are defined by Ng, D. et al. (2021) as cashless payments as “*payment transactions that are made using digital payment instruments and digital interfaces, typically involving telecommunication and the Internet, resulting in the diminished use or displacement of physical cash*”. Since the late 1980s, cash usage for purchases in western has declined compared to Less Developed Countries, transitioning from cash to cashless economies to support development (Humphrey, 2004). In a cashless society, consumers are able to perform retail transactions using a variety of electronic methods, including online payments, mobile phones, personal digital assistants (PDAs), smart cards, and other digital payment systems like debit and credit cards (Mishra et al., 2022). Businesses globally are adapting to this trend by transforming their models to incorporate digital innovations, while banks locally are investing in digital technologies, such as social banking on platforms like Facebook, Whatsapp to enhance customer convenience for account management and transactions.

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Recent advancements in technology have greatly impacted payment and settlement systems, which can be examined in two main categories. The first category involves modifying existing payment methods to operate on new technology-driven platforms. For example, card payment systems, with their widespread acceptance, fall into this category (Mugo, 2014). The adaptation of card payments for online use has facilitated their global reach. The second category focuses on entirely new payment channels made possible by technological innovations, such as internet and mobile-based solutions like E-Payment applications, Unified Payments Interface (UPI), and Internet banking, which have become key tools for conducting transactions (Vinitha & Vasantha, 2017). This should help lower the similarity percentage. Let me know if you need further revisions! In the future, mobile phones may eliminate the need for cash liquidity, card payments, loyalty cards, cheques, transfers, and coupons, transforming the traditional checkout experience. Cashless payments offer several advantages for businesses, including an expanded customer base, transparency in taxation, financial inclusiveness, improved cash flow, cost reductions, enhanced customer service, and a competitive edge (Sahu & Singh 2017). By providing a diverse range of payment options, CPS enhance convenience for transactions and foster competition among businesses to offer comprehensive payment solutions (Gal, 2003).

In India, the penetration of mobile services, money transfer services has grown significantly, with projections showing further expansion by 2025. Cashless payment methods, especially payment cards, offer security and convenience, benefiting both merchants and consumers (Sahu & Singh 2017). With over 1.5 billion credit cards in circulation globally and acceptance in more than 23 million locations, the emergence of wireless networks has greatly enhanced transaction convenience and efficiency, especially in industries such as hospitality. In 2020, a survey revealed that 79% of Indian households were using mobile payment apps like phonepay, Paytm and Googlepay, with 54% utilizing UPI platform. India is a global leader in digital payments, accounts for 46% of all digital transactions worldwide. UPI alone represents 80% of India's digital payment activities. In 2022, India boasted the highest number of digital banking users globally, totaling approximately 295.5 million. Additionally, in January 2024, India had 751.5 million internet users, reflecting a 52.4% penetration rate. Each month, Indians conduct 10-12 billion cashless payments, highlighting the country's significant shift towards digital financial transactions (Kaur & Pathak, 2023).

Research Problem

As money traditionally serves as medium of exchange, and store of value, the shift to a cashless economy challenges these conventional roles of cash. While a cashless economy significantly reduces cash transactions, it does not eliminate them entirely (Daniel, Swartz, & Fermar, 2004). Despite the global rise in non-cash transactions, cash remains common for low-value transactions due to its cost-effectiveness and relative transparency issues (Gensler, 2013). This study aims to investigate how technological advancements, competition and security concerns that affect the adoption of CPS in Hyderabad. Specifically, it will examine how these factors influence the transform from traditional cash transactions to electronic payments, considering role played by various stakeholders such as payment network providers, financial institutions, merchants, and customers (Sreenu, 2020).

Need of the Study

This study aims to provide stakeholders across various sectors valuable insights to support the effective implementation of CPS. This study will identify various challenges associated with these systems, offering guidance to the government, particularly in light of new regulations for cashless public transport fare systems. This information will enable a smoother transition to a cashless economy by highlighting potential benefits and obstacles. The study's findings will be beneficial to current and potential users by demonstrating the convenience and cost-efficiency of CPS while identifying common pitfalls. Providers of CPS, including mobile platforms, businesses and banking companies, will gain insights into market needs and areas for improvement, including fraud prevention, which will aid in product development and market strategy. Additionally, academics and scholars will find the research valuable for advancing their understanding of CPS and identifying areas for future research.

Objectives of the Study

- To identify the important factors that affect the adoption of CPS by the merchants in Hyderabad.
- To determine whether the technology advancement, security concerns and competition affect on the adoption of cashless payment system by merchants in Hyderabad.
- To provide operational and policy recommendations aimed at accelerating the adoption of CPS by merchants, contributing to the achievement of a cashless economy.

Research Methodology

Research Design

The majority of the study employed a descriptive research design to outline the characteristics of a specific population. This approach focuses on subjects with similar observable traits and involves collecting data at a single point in time. Descriptive surveys involve gathering information through interviews or questionnaires administered to a sample of individuals. A portion of the study was applied with causal design to establish the predictors of merchant adoption in cashless transactions (Abduramhaman, 2023).

Population & Sampling

The study focused on all registered merchants in Hyderabad, totaling approximately thirty thousand businesses. The study focused on registered merchants in Hyderabad to ensure that the research targeted businesses with formal recognition and established operations within the city's commercial ecosystem (Directorate of Economics & Statistics). A total of 379 merchants were selected adopting probability sampling method, aligning with Cooper and Schindler's (2008) and Krejcie and Morgan (1970) guideline of 10 to 20 percent of the population. Study employed Stratified random sampling, with 48 firms chosen from each of the eight administrative divisions of Hyderabad.

The sample size was determined using a standard table for random sample sizes, with a 95% confidence allowing $\pm 5\%$ as margin of error. The current method ensured representative sample by encompassing a wide geographic area and a range of firm characteristics and environments. By giving each firm an equal chance of selection, this approach aimed to provide unbiased results that could be generalized to whole population.

Data Collection

Primary data collected through structured questionnaires distributed via email and drop-and-pick methods to business managers or their representatives during January and February 2024. The questionnaire consists of open and closed-ended questions to meet the study's objectives. They were organized into two sections: Section A collected demographic information, while Section B evaluated the effects of technology advancement, security concerns, and competition on the adoption of CPS in Hyderabad, India.

A total of 400 questionnaires were distributed, with an anticipated 5% non-response rate. However, 208 responses were received promptly, resulting in a response rate of 54.88%. The questionnaires were piloted to ensure validity and reliability before the main data collection. The reliability of the instrument, as measured by Cronbach's Alpha, was 0.63, which is considered acceptable. Respondents were assured that their information would be used exclusively for research purposes (Saunders et al., 2016).

Data Analysis

Given that some variables in the study were related to perceptions, descriptive statistics are suitable for data analysis. Descriptive design was chosen because they not only facilitate data collection but also involve

measurement, classification, analysis, comparison, and interpretation. This approach offers a comprehensive description of the current state of affairs. (Rahman, 2017).

Data on the adoption of CPS was collected to identify the key factors influencing their use in Hyderabad. The data was managed and entered into SPSS, where it was coded numerically and organized in a pre-designed spreadsheet. Similar information was categorized and grouped to summarize the results using descriptive statistics, such as measures of central tendency (mean) and measures of dispersion (standard deviation). These statistics helped in assessing the relative importance of key factors among both dependent and independent variables. Before performing regression analysis, Pearson's correlation was used to assess the relationships between the independent and dependent variables. The correlation coefficient reveals both the strength and direction of these relationships. To identify if a significant relationship exists between two quantitative variables, multiple linear regression is employed (Bougie & Sekaran, 2019). Multiple linear regression was utilized to develop a model that forecasts research output based on independent variables such as technological advancement, security concerns, and competition, as detailed in the conceptual model.

$$Y = a + bx_1 + cx_2 + dx_3 + e$$

Where: Y = Adoption of cashless payment systems

a = Y-intercept (a constant term),

b, c, d = Slopes;

x₁, x₂, x₃ are independent variables,

Whereas X₁ = technology advancement,

X₂ = security concerns,

X₃ = competition; and

e = Error

Limitations of the Study

Due to time constraints and financial limits, the study concentrated on a sample of merchants in Hyderabad city, India, to assess the impact of technology advancement, security concerns, and competition on the adoption of CPS. Some merchants were hesitant to complete the questionnaires due to concerns about the study's intentions, particularly regarding the disclosure of their enterprise details. This issue was mitigated by clarifying that the data would be used solely for research purposes. Identifying enterprises using CPS was another challenge, and some data, like annual revenue figures, was difficult to obtain, affecting the study's conclusiveness. The sample size may limit confidence in the results and their generalizability, and the study was restricted to three factors, such as technology advancement, security concerns, and competition, overlooking other potential influences like government regulations, telecom service providers, and bankers' promotions.

Literature Review

The adoption of CPS has been a significant area of study, reflecting the growing importance of these systems in modern economies. The evolution of payment systems, marked by various innovations, has led to the widespread adoption of digital and cashless transactions, which play a crucial role in shaping market economies. Boeschoten (1998) identified transaction size as a critical determinant in choosing payment instruments, arguing that the use of cash aligns with rational decision-making. This perspective is consistent with Kaburia's (2004) findings, which indicate that the absence of appropriate e-payment options presents a major obstacle to the expansion of e-commerce, especially in developing countries such as

India. Economic growth is another significant driver of cashless payment adoption. Newstead (2012) showed that there is a favorable connection between economic growth and e-payment systems, highlighting that automated teller machines (ATMs) play a significant role in this growth. India's stride to cashless economy after the demonetization policy was explored by Shankar and Datta (2018), who found that the policy significantly catalyzed the adoption of digital payment systems (DPS). Factors influencing adoption in India include trust, perceived usefulness, government policies, and promotional incentives, as discussed by Kumari and Khanna (2019), Rathore (2016), Sharma and Kukreja (2018), and Jaiswal et.al (2022).

Despite the evident benefits of cashless transactions, such as increased GDP, financial inclusion, and reduced shadow economy, several challenges hinder their widespread adoption. Security concerns, technological infrastructure, and user literacy are significant barriers, as highlighted by Srouji (2020). Nair et.al (2023) also pointed out that while cashless transactions can lead to economic benefits, challenges such as cybersecurity and the digital divide must be addressed to realize these benefits fully.

Hence, the adoption of CPS is influenced by a complex interplay of factors, including transaction size, economic growth, business image, security concerns, and government policies (Sivathanu, 2019). While substantial progress has been made, particularly in developed economies, developing regions continue to face challenges that need to be addressed to fully harness the benefits of CPS.

Theories Relevance for Adoption of cps

Diffusion of Innovation (DOI) Theory: Developed by E.M. Rogers in 1962, this theory is a fundamental social science framework that describes how new ideas, behaviors, or products gain traction and disseminate within particular populations or social systems over time. According to Rogers, diffusion results in people within a social system adopting a new idea, behavior, or product, which they perceive as innovative. Adoption means *that individuals start doing something differently, such as purchasing or using a new product or adopting a new behavior*. A critical aspect of this theory is that *diffusion only occurs if the idea, behavior, or product is perceived as new by the adopter* (Rogers, 1995). This theory explains how technology advancements, security concerns, and competition influence the adoption of new innovations, like CPS. It highlights that technological improvements drive adoption, while security concerns and competition can either facilitate or hinder this process. This theory provides a framework for understanding the spread of CPS in society.

The process of adopting innovations, such as CPS, does not occur uniformly across a social system. Rather, it happens gradually, with some individuals embracing the innovation earlier than others. Studies indicate that early adopters often have unique characteristics compared to those who adopt later. Therefore, when promoting an innovation like cashless payments to a specific group, it is crucial to identify the traits and factors that may either support or hinder its acceptance within that group. This insight is essential for evaluating the elements that encourage the adoption of CPS across various industries, thereby facilitating their broader acceptance. The diffusion of innovations theory by Rogers provides a framework for understanding how CPS are adopted over time. According to this theory, the adoption process occurs in stages- knowledge, persuasion, decision, implementation, and confirmation.

Developer-Based Theory (DBT): This theory emphasizes that the primary drivers of innovation adoption are the inherent technical qualities of the technology itself. According to DBT, the success of an innovation is largely determined by how well it enhances efficiency, effectiveness, and overall design compared to existing alternatives. This perspective suggests that innovations that offer substantial improvements over current technologies will naturally gain acceptance and replace older, less effective options.

A key aspect of DBT is its focus on the role of developers or architects who create these superior technologies. The theory holds that the creators of advanced innovations are pivotal in driving their adoption, as they are responsible for ensuring that the technology meets high standards of performance and usability. The assumption here is deterministic: if a technological product is demonstrably superior in terms of its features, performance, or overall user experience, it will inevitably become the preferred choice over inferior alternatives. In practical terms, DBT suggests that for an innovation to achieve widespread adoption, it must exhibit clear and measurable advantages over existing solutions. This could involve

improvements in speed, functionality, ease of use, or other key performance indicators. For example, in the field of instructional technology, a new educational tool that offers significantly better learning outcomes or user experience compared to existing tools is likely to see rapid adoption.

In the context of CPS, Development Based Theory implies that these systems will be more readily adopted if they are perceived as offering clear benefits over traditional cash transactions. This could include faster transaction times, enhanced security, greater convenience, or additional features that make the payment process more efficient. When CPS demonstrate these superior qualities, users are more likely to transition from cash-based methods to digital payment options.

Unified Theory of Acceptance and Use of Technology (UTAUT): The UTAUT was introduced by Venkatesh and Morris in 2003 as a comprehensive model to understand and predict user adoption of information systems. The model integrates elements from several previous technology acceptance theories to provide a unified explanation of how users decide to engage with new technologies. The UTAUT framework focuses on four primary constructs; Performance Expectancy refers to how much a user believes that utilizing a technology will lead to improved performance, such as enhanced efficiency or productivity. Effort Expectancy pertains to the perceived ease of use of the technology, reflecting how much effort the user anticipates needing to invest in learning and operating the system. Social Influence involves the extent to which users feel that significant others, like colleagues or supervisors, think they should adopt the technology, with social pressures and norms playing a crucial role. Facilitating Conditions examine the user's perception of the resources and support available to effectively use the technology, including infrastructure, training, and assistance.

UTAUT asserts that these four constructs have a direct impact on a user's intention to use technology, which subsequently affects their actual usage behavior. Additionally, the model indicates that this relationship is moderated by four factors: gender, age, experience, and the voluntariness of use. These moderating factors help explain variations in technology adoption across different demographic groups and contexts (Venkatesh & Morris, 2003). UTAUT has become a widely used framework in technology adoption research and has been applied across various industries and technologies, making it a versatile tool for understanding the dynamics of technology acceptance.

Theories such as DOI, DBT, and UTAUT provide valuable frameworks for understanding the factors driving this adoption and the challenges that must be addressed to fully leverage the benefits of a cashless economy. The adoption of CPS is influenced by a combination of technological advancements, competition, and security concerns.

- *Technology Advancement*: The rise of CPS and digital wallets has made cash increasingly redundant. Technological advancements have revolutionized payment systems, enabling transactions without the need for physical cash. Innovations such as online payments, unmanned vending machines, and mobile payment solutions have made cashless transactions more convenient and efficient (Nichols, 2013). Educating stakeholders about these technological advancements is crucial for increasing the acceptability of cashless payment modes.
- *Competition*: The convenience of conducting cashless transactions across various platforms, such as online websites, convenience stores, quick-service restaurants, has led consumers to seek similar payment options everywhere. To remain competitive and increase profitability, businesses must provide flexible and efficient payment systems that meet consumer demands.
- *Security Concerns*: Security is a significant concern influencing the adoption of CPS. Excessive use of cash is associated with leakages, corruption, and money laundering. The government has introduced regulations to promote CPS in all sectors to reduce corruption and financial losses (Gal, 2003). Additionally, the risk of robbery and fraud has led many businesses to prefer secure electronic payment methods, including bank cards, UPI, Net banking over cash transactions. These systems are not only convenient and cheaper but also provide a safer mode of transaction.

Conceptual Framework

This study examined independent variables that significantly influence the dependent variable, adoption of CPS. The key factors analyzed include Technology advancement, Security concerns, and Competition. The overall framework of this investigation is illustrated in Figure 3.1. According to the literature review, there is a positive relationship between Technology (T), Security concerns (S), and Competition (C) with the adoption of CPS.

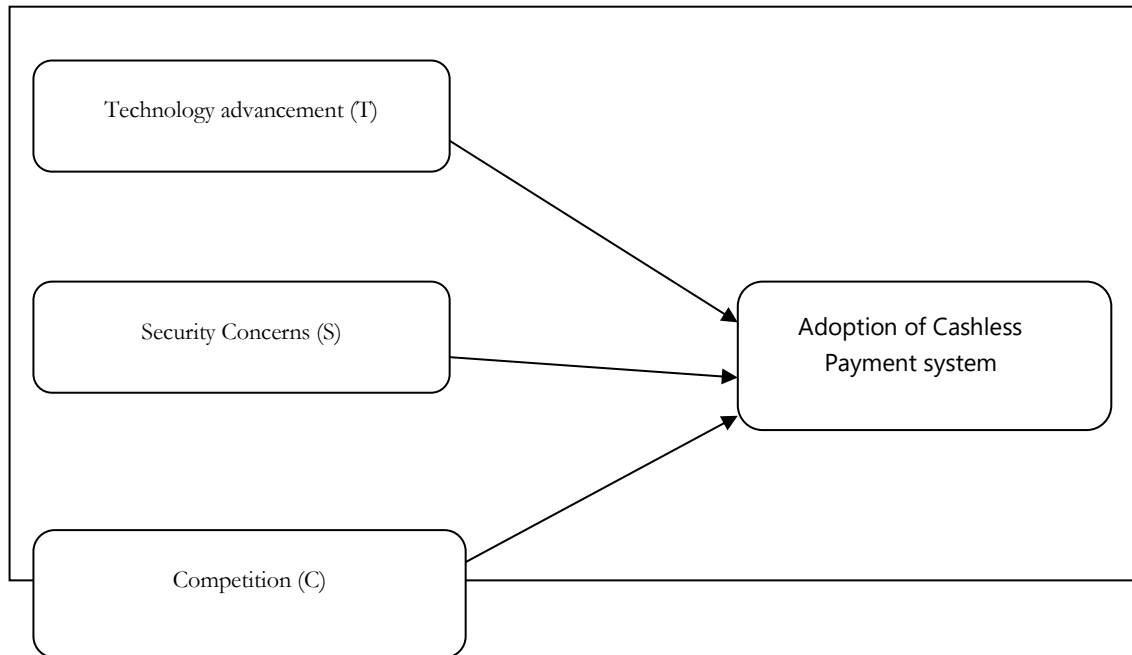


Figure 3.1. Conceptual Frame

Data Analysis

The study was to examine the impact of technology advancement, security concerns, and competition on merchants' adoption of CPS in Hyderabad. Questions were specifically directed to management-level individuals, as they are typically responsible for implementation of payment systems. The researcher distributed 379 questionnaires to various merchants in Hyderabad. Out of these, 208 were completed and returned within the two-week period, resulting in a response rate of 54.88%. The study continued for an additional month.

The data collected was carefully checked for completeness and consistency prior to being analyzed through both descriptive and inferential statistical methods. This analysis employed tables and percentages to display the response rate and provide detailed information on the variables investigated in the study. The findings are organized into three sections: Section 4.1 provides a demographic analysis with simple frequencies and percentages; Section 4.2 presents the findings related to security, technology advancement, and competition parameters affecting CPS; and Section 4.3 reveals the results of correlation and regression analyses.

Table 4.1. Demographic profile of Respondents

Sl.No	Variable	Parameters	Frequency	%
1	Whether merchant adopted cashless paymentssystem	Yes	79	37.80%
		No	129	62.20%
2	Gender	Male	121	58%
		Female	87	42%
3	Respondent's age group	<35 years	123	59%
		>35 years	85	41%
4	Total employees	>5 Workers	73	35%
		5 to 10 Workers	60	28.70%
		10 to 15 Workers	42	20.11%
		Above 15workers	34	16.19%
5	Business existence since	<1 Year	51	24.32%
		1 to 2 years	58	28%
		2 to 5 years	38	18.45%
		5 to 9 years	31	15%
		>10 years	30	14.23%
6	Total revenue per year (Rs.)	<1,000,000	49	23.51%
		1,000,000 to 5,000,000	58	28.11%
		10,00,000 to 15,00,000	46	21.98%
		15,000,000	39	18.87%
		>15,000,000	16	7.53%
7	Business that deal with	Goods	109	52.59%
		Services	99	47.41%
8	Educationlevelof merchant	Primary	55	26.37%
		Secondary	82	39.49%
		College	39	18.20%
		University	32	15.24%
9	Dominant players in cashless transactions	Male Customers	45	56.73%
		Female Customers	34	43.27%
10	Total cashless transactions recorded each day	Up to 50	26	33.43%
		50 to100	29	36.91%
		100 to150	15	19.22%
		Over 150	9	10.44%
11	Average Value of a cashless transaction in Rs.	1 to 100	20	25.53%
		100 to 500	24	29.79%

	500 to 1000	17	21.19%
	1000 to 2500	8	10.29%
	2500 to 5000	7	8.99%
	Over 5000	3	4.21%

Source: Developed from study (2023-24)

According to the data presented in Table 4.1, the study found that 37.8% of merchants had adopted a cashless payment system. Among the respondents, 58% were male, and 59% were under the age of 35. Approximately 35% of the merchants employed fewer than five workers, 28.7% had 5 to 10 employees, 20.11% had 10 to 15 employees, and 16.19% had a workforce exceeding 15 employees. The study also revealed that 24.32% of the businesses were less than a year old, 28% had been operating for 1 to 2 years, 18.5% for 2 to 5 years, 15% for 5 to 9 years, and 14.23% had been in business for more than 10 years.

Additionally, the study results showed that 23.51% of merchants had an annual revenue of less than Rs. 1 million, 28.11% had revenues between Rs. 1-5 million, 21.98% had revenues between Rs. 5-15 million, 18.87% had revenues between Rs. 10-15 million, and 7.53% had revenues exceeding Rs. 15 million. Among the merchants, 52.59% were involved in goods sales, while 47.41% were engaged in services. The data also revealed that 26.37% of merchants had completed primary education, 39.49% had secondary education, 18.90% had college education, and 15.24% had university education.

The study found that 56.73% of female customers preferred CPS compared to 43.27% of male customers. In terms of daily cashless transactions, 33.43% of merchants recorded 0 to 50 transactions per day, 36.91% had 50 to 100 transactions, 19.22% had 100 to 150 transactions, and 10.44% had over 150 transactions daily. Regarding transaction values, 25.53% of single cashless transactions were valued between Rs. 1 to 100, 29.79% were between Rs. 100 to 500, 21.19% were between Rs. 500 to 1000, 10.29% were between Rs. 1000 to 2500, 8.99% were between Rs. 2500 to 5000, and 4.21% exceeded Rs. 5000.

Factors Affecting Adoption of Cashless Payment System

The different factors were classified into three categories based on their relation to variables such as security, technology, and competition. The respondents' data was then analyzed and presented as follows.

The data from Table 4.2 highlights security as the most significant concern affecting the adoption of CPS, with a mean score of 4.72. This indicates that both businesses and users view the protection of financial transactions as a critical barrier, although there's some variability in the intensity of these concerns (standard deviation of 1.41). The volume of transactions, with a mean of 4.29, also raises significant security apprehensions, particularly for larger exchanges. Possibility of phishing is less pronounced (mean of 2.78), and there's more consistency in views on this issue (standard deviation of 0.69). The nature of product (mean of 2.61) and Government regulatory framework (mean of 1.81) are perceived as less significant factors, with government regulations being the least impactful, as evidenced by a low standard deviation of 0.39. Overall, while security concerns are paramount, other factors like transaction size and potential internal conspiracies also influence the adoption of CPS, though to a lesser extent.

Table 4.2. Security Related Factors

Sl.No	Security related factors	Mean	Standard Deviation
1	Security concerns	4.72	1.41
2	Volume of transactions	4.29	1.25
3	Possibility of Phishing	2.78	0.69
4	Nature of product	2.61	0.60
5	Government Regulatory framework	1.81	0.39

Source: Developed from study (2023-24)

From Table 4.3, there are eight factors that affect the use of CPS. The data shows that technological progress, with a mean of 4.72, is the most crucial factor for adopting CPS, highlighting the importance of cutting-edge technology. Widespread acceptance is also significant, with a mean of 4.59, indicating that widespread international use encourages local adoption. The volume of transactions (mean of 4.28) and ease of record keeping (mean of 4.01) are moderately important, suggesting that higher transaction volumes and efficient management are key considerations. Availability of currency (mean of 3.63) and Ease of use (mean of 3.11) also influence adoption but to a lesser extent. Meanwhile, economic growth (mean of 2.74) and online trading (mean of 2.47) are seen as the least impactful factors, with respondents agreeing on their minimal influence. Overall, technological advancement and global acceptance are pivotal, while other factors play a smaller, though still relevant, role.

Table 4.3. Technologyrelated Factors

Sl. No.	Technologyrelated factors	Mean	Standard Deviation
1.	Technological progress	4.72	1.50
2.	Widespread acceptance	4.59	1.39
3.	Volume of transactions	4.28	1.29
4.	Ease of record keeping	4.01	1.30
5.	Availability of currency	3.63	1.11
6.	Ease of use	3.11	0.80
7.	Economic growth	2.74	0.72
8.	Online trading	2.47	0.61

Source: Developed from study (2023-24)

From the analysis of competition issues affecting the adoption of CPS presented in Table 4.4, there are seven factors that affect the use of CPS. The data from Table 4.4 shows that Competitors are the most significant factor influencing the adoption of CPS, with a mean of 4.42, indicating that businesses see managing cash costs as a key driver. Suppliers' needs (mean of 3.72) and influence from service providers (mean of 3.51) also play important roles, reflecting external pressures to adopt CPS. Customer expectations (mean of 3.29) and cost of cash handling (mean of 3.09) have moderate impacts, suggesting they are factors but not primary drivers. Strategies to market expansion (mean of 2.78) and the image of the business (mean of 2.23) are less influential, showing that market expansion and brand image concerns are not major considerations in adopting CPS. Overall, cost and external pressures are the main drivers, while competitive factors and market strategies are secondary.

Table 4.4. Competition Related Factors

Sl. No.	Competition related factors	Mean	Standard Deviation
1.	Competitors	4.42	1.29
2.	Suppliers needs	3.72	1.30
3.	Influence from service providers	3.51	0.89
4.	Customer expectations	3.29	0.81
5.	Cost of Cash handling	3.09	0.83
6.	Market expansion	2.78	0.72
7.	Reputation of the business	2.23	0.49

Source: Developed from study (2023-24)

Correlation Analysis on The Factors Affecting the Adoption of Cps

Correlation analysis is an essential preliminary step before regression analysis, as it reveals the strength and direction of relationships between variables. This process is crucial for determining whether the independent variables are meaningfully related to the dependent variable and to each other, which is fundamental for building an effective regression model. Pearson correlation analysis was conducted to explore the relationships between the variables under study—Use of CPS as Dependent variable, and Independent variables, such as Technology (I), Security Concerns (S), and Competition (C). The findings, detailed in Table 4.5, provide insights into these relationships and guide the subsequent regression analysis. To proceed with regression analysis, a minimum correlation threshold of 0.4 is generally required to ensure meaningful relationships between variables. The current study meets this requirement, as the variables exhibit correlations at or above this threshold, allowing for a valid and effective regression model to be developed.

Table 4.5. Correlation Between Dependent Variable and Independent Variables

	Cashless payment System	Technology advancement	Security concerns	Competition
Cashless Payment System	1.000			
Technology advancement	.765	1.000		
Security concerns	.623	.450	1.000	
Competition	.569	.515	.217	1.000

Source: Developed from study (2023-24)

The correlation matrix in Table 4.5 reveals that technological factors have the strongest influence on the use of CPS, with a high positive correlation of 0.765. This indicates that advancements in technology significantly boost the adoption of CPS. Security concerns also play a substantial role, showing a moderate positive correlation of 0.623, suggesting that addressing security issues can enhance the adoption of CPS. Competition is moderately correlated with the use of CPS (0.569), implying that competitive pressures contribute to their adoption, though not as strongly as technology or security. Additionally, technology and security concerns have a moderate positive relationship (0.450), indicating that improvements in technology may help address security concerns. The correlation between technology and competition (0.515) shows that technological advancements can influence competitive dynamics. However, security concerns and competition have a weak correlation (0.217), suggesting that these factors operate relatively independently. Thus, technology is the most influential factor, with security and competition also impacting adoption but to a lesser extent.

Regression Analysis

According to Table 4.6, the R^2 , i.e., coefficient of determination is 0.682, indicating that technology advancement security concerns, and competition, together contribute to 68.2% of the variation in the adoptions of CPS, leaving 31.8% unexplained by the variables. The P-value of 0.000 suggests that the adoption of CPS is significant at the 5% level.

Table 4.6. Regression Model Summary

R	R Square	Adjusted R Square	Std Error of the Estimate	Change statistics				
				R Square Change	F Change	df1	df2	Sig.F Change
.826	.682	.664	.914	.756	10.81	3	85	.000

Predictors: (constant), technology advancement, security concerns and competition

Source: Developed from study (2023-24)

The regression analysis results reveal that the model, which includes technology advancement, security concerns, and competition as predictors, significantly explains the use of CPS. According to the table 4.6, the R value of 0.826 indicates a strong positive correlation between the predictors and the adoption of CPS. The Adjusted R Square of 0.664, which accounts for the number of predictors, suggests that about 66.4% variability is explained by the model, providing a robust fit. The standard error of the estimate, 0.914, indicates the average deviation of observed values from the predicted values. The F statistic of 10.81, with a significance level of 0.000, validate that the regression model is statistically significant and provides a good fit for the data.

Table 4.7. ANOVA

	SumOf Squares	Df	Mean square	F	Sig
Regression	62.612	3	10.312	30.081	.000(a)
Residual	31.286	85	.3428		
Total	93.898	91			

Predictor Variables: (Constant), Technology, security concerns and Competition

Dependent Variable: Adoption of CPS Source: Developed from study (2023-24)

Table 4.7 shows the ANOVA values, with an F value of 30.081 indicating that the overall regression model is significant, thus demonstrating its explanatory power (P-value = 0.00 < 0.05). This suggests that the predictor variables, technology advancement, security concerns, and competition are significantly impact the response variable, which is the Adoption of CPS. Therefore, there is a significant relationship between the predictor variables and the response variables.

$$Y = -0.528 + 0.813x_1 + 0.619x_2 + 0.559x_3$$

Table 4.8. Coefficients of Regression

		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
(Constant)		-.528	0.611		-0.864	.379
Technology Advancement	x1	.813	0.121	.523	6.719	.000
Security concerns	x2	.619	0.201	.468	3.084	.013
Competition	x3	.559	0.159	.489	3.515	.001

Dependent variable: Adoption of cashless payment system

Source: Developed from study (2023-24)

From Table 4.8 above, the regression analysis reveals that all three independent variables-Technology, Security concerns, and Competition have positive and statistically significant effects on the Use of CPS. Among these, Technology has the most substantial influence, with an unstandardized coefficient of 0.813 and a standardized Beta of 0.523, indicating that advancements in technology significantly boost the adoption of cashless payment methods. Security concerns, with a coefficient of 0.619 and a Beta of 0.468, similarly contribute to the adoption of these systems, although slightly less than the other factors. The p-values for all variables are below 0.05, Competition also plays a crucial role, with a coefficient of 0.559 and a Beta of 0.489 showing that increased competition encourages more widespread use of cashless

payments. confirming that these factors are statistically significant predictors of cashless payment system usage.

Data Interpretation & Findings

From the interpretation of the demographic data on the adoption of CPS, several inferences can be drawn:

Adoption Rates and Challenges: Despite the growing trend towards digital payments, a significant majority of merchants (62.2%) have not yet adopted CPS. This suggests potential barriers such as lack of awareness, technological challenges, or financial constraints that may be hindering wider adoption.

Demographic Influence: Younger merchants (under 35 years) and male merchants are more likely to be involved in the adoption of CPS. This may indicate that younger generations are more open to embracing new technologies, while gender dynamics could reflect differing access to resources or decision-making power in business operations.

Business Size and Longevity: Smaller businesses, particularly those with fewer than 10 workers, are the most common in this sample, which may reflect the broader structure of the market. However, the fact that newer businesses (under 2 years) form a significant portion suggests that these businesses might either be more adaptable to new payment technologies or may face early challenges that affect their longevity and growth.

Revenue and Education Impact: Businesses with moderate annual revenues (Rs. 1,000,000 to Rs. 5,000,000) are the most prevalent among those surveyed, possibly indicating that businesses of this size have sufficient resources to invest in and benefit from CPS. Additionally, higher levels of education among merchants are associated with a greater likelihood of adopting these systems, suggesting that education plays a key role in understanding and implementing new technologies.

Transaction Patterns: The majority of cashless transactions are relatively low in value (Rs. 100-500), and businesses report a moderate number of transactions per day, which may reflect the typical customer base and the types of goods or services offered. The dominance of male customers in cashless transactions may indicate gender-specific preferences or differences in purchasing power and behavior.

Sectoral Differences: The near-equal split between goods and service-oriented businesses suggests that both sectors are engaging with CPS, though the specific needs and challenges may vary. Service businesses might need different kinds of support or incentives compared to those dealing in goods.

The data reveals that there is clear movement towards cashless payment adoption, the data highlights various demographic, educational, and business-related factors that influence this transitions. Addressing these factors through targeted interventions could enhance the adoption rate and improve the overall efficiency of cashless transactions in the market.

The regression analysis of factors such as technology advancement, security concerns, and competition indicates that these independent variables have a significant relationship with the dependent variable, adoption of CPS. Among these, technology exhibits the strongest correlation, followed by security concerns and competition. The coefficient of determination (R^2) is 0.682, suggesting that these three factors account for 68.2% of the variation in the use of CPS, with 31.8% of the variation remaining unexplained. The F-value of 30.081 and a p-value of 0.000 signify that the overall regression model is statistically significant, affirming that these predictor variables have a considerable effect on the adoption of CPS.

Conclusion

The study on the adoption of CPS reveals a complex interplay of demographic, technological, educational, and business-related factors. While there is a noticeable trend towards digital payments, significant barriers still exist, particularly among smaller and less established businesses. Younger and more educated merchants

are more likely to adopt these systems, highlighting the importance of targeted education and awareness initiatives. The analysis also underscores the critical role of technology, security, and competition in driving adoption, with technology being the most influential factor. To accelerate the adoption of CPS, interventions must address these barriers and leverage the identified demographic and business trends. Enhancing technological accessibility, improving security measures, and fostering a competitive environment are essential to increasing the efficiency and prevalence of cashless transactions. This approach will not only support merchants in overcoming existing challenges but also contribute to a more robust and inclusive digital payment ecosystem.

Recommendations

The study indicates that CPS is particularly favored by young individuals and new entrepreneurs. It is advised that service providers create cashless payment solutions that encourage broader acceptance. Government regulations were seen as the least impactful factor in the adoption of cashless payment systems (CPS). As a result, it is advised that the government formulate policies and enforcement strategies to promote the use of CPS, including the implementation of cashless fare systems. Most transactions were of low value, with a majority of users being male. Given that fraud concerns were mentioned as a barrier to high-value cashless transactions, it is recommended that the government invest in legislation to combat cybercrime in line with global standards. Mobile payments are the most favored among various cashless payment systems (CPS) due to their convenience. It is suggested that CPS providers improve the convenience of other payment methods to boost their acceptance and usage. Entrepreneurs across Hyderabad should understand that providing cashless payment services offers both a distinct challenge and a significant opportunity. Consequently, they should devise strategies to gain market share and align with global trends.

Further Research

The factors influencing the adoption of CPS are diverse and extensive, making it challenging to address them all within a single report. This study is limited to examining only three specific factors. With additional time and resources, a broader study encompassing more factors across various areas of Hyderabad could be undertaken. Employing different statistical approaches in future research might also provide more comprehensive insights.

Future research could explore whether there is a correlation between the use of CPS and economic growth. If such a connection exists, further analysis could determine how it varies across different sectors of the economy, aiding in the development of well-informed policies. Additionally, research could investigate how CPS impact the efficiency of various government departments. While this study focuses solely on technology, security, and competition, further studies could examine other factors influencing the use of CPS and evaluate their significance.

Future research should focus on examining the barriers to the adoption of CPS in rural areas and small towns. Understanding the obstacles is crucial for developing strategies and policy frameworks that facilitate the transition towards a cashless economy. This research could explore factors such as limited technological infrastructure, low financial literacy, and resistance to change within these communities. By identifying and addressing these specific challenges, policymakers and service providers can create tailored solutions that promote the adoption of CPS and support economic development in less urbanized regions.

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