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Consumer Adoption of Iot Enabled Digital Payment Systems

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Abstract
Industry 4.0 technologies are shifting rapidly, and IoT-integrated payment solutions such as smart devices and contactless systems have changed the way transactions are done in terms of convenience, security, and user experience. This research examines the impact of IoT-enabled technologies on digital payment adoption and consumer behavior and also to analyze the factors influencing consumer behavior intention towards IoT enabled digital payments, particularly perceived ease of use, consumer trust, and perceived risk, The research comprised a sample of 192 respondents, collected through a purposive sampling approach focusing on individuals experienced in digital payment system. The PES SEM model is used in the study to exhibit the effect of perceived ease of use, consumer trust, and perceived risk on consumer's usage behavioural intention regarding IoT-enabled digital payments. The findings exhibit that perceived ease of use has the most significant positive impact on usage behavioral intention, followed by trust and security. Perceived risk has a favorable but smaller effect, implying that although risk perceptions exist, they continue using digital payment systems due to increased familiarity and trust. The model shows that it is able to clarify significantly ($R^2 = 0.638$) and make accurate forecasts ($Q^2 = 0.617$). The findings add to the literature on adoption of technologies by showing that the Technology Acceptance Model (TAM) could be used in payment circumstances that use the Internet of Things (IoT).

Keywords: Internet of Things (IoT), Digital Payments, Consumer Behavior, Behavioral Intention, Trust and Security, Perceived Risk.

INTRODUCTION

In today's scenario, there exists a paradigm shift in digital payment systems due to technological developments and changing consumer demands. (Dodda, 2025). Digital payment systems are the most essential link connecting consumers, businesses, banks, and central authorities (Khando et al., 2022). The use of emerging technologies such as Internet of Things (IoT), block chain, and mobile solutions is transforming the way transactions are conducted (Chatterjee, 2025). Furthermore, the advent of the fourth industrial revolution (Industry 4.0) has enabled e-commerce platforms by connecting digital systems with physical and IoT devices. This integration enables improved communication and better organizational workflows.

The incorporation of Internet of Things (IoT) technology linked with digital payment systems has emerged as a significant driver of innovation and operational efficiency. IoT-enabled devices, including smartwatches, smartphones, laptops, connected vending machines, smart appliances and wireless payment interfaces, support consumers in completing transactions more quickly and easily by utilizing their real-time operational capabilities.. The IoT market is expected to witness a significant surge in revenue, predicted to reach US$1.18 trillion by 2026 worldwide 1

[1] https://www.statista.com/outlook/tmo/internet-of-things/worldwide?srsltid=AfmBOor-ALVoblrA_3DfjawyXroKNLkXqwevHUPE0acnRFet0_fCCwsw#revenue

This new technology simplifies transactions, making it easier to buy products, enhance security and compelling number of businesses to adopt digital payment solutions. The Covid-19 outbreak hastened the transition to contactless digital payments, emphasising the significance of IoT-enabled devices.(Talib & Salman, 2022). Today's consumers passionate about adoption of new technology in digital payment (Hidayat-Ur-Rehman et al. 2022). Moreover trust plays an important part in determining the success of digital payment systems and is a key determinant influencing the adoption of e payment services (Sahi et al., 2021) The IoT features, like biometric verification, encrypted communication contribute to building consumer confidence in digital payment systems, thereby strengthening the relationship between IoT integration and consumer trust. Additionally, IoT driven payment solutions contribute to user experience and influence behavioural intention by offering personalized and user friendly experience.

Therefore, the present study investigates the impact of IoT-enabled technologies on digital payment adoption and consumer behavior. This study further analyze the factors influencing consumer behavior intention towards IoT enabled digital payments, particularly perceived ease of use, consumer trust, and perceived risk,

OBJECTIVE

- To examine the effect of perceived ease of use on usage behavioural intention
- To analyse the impact of perceived risk on usage behavioural intention.
- To evaluate the role of trust and security in influencing usage behavioural intention**.**

HYPOTHESIS

H1: Perceived ease of use has a significant positive effect on usage behavioural intention.
H2: Perceived risk has a significant effect on usage behavioural intention.
H3: Trust and security have a significant positive effect on usage behavioural intention

RESEARCH METHODOLOGY

Descriptive research methods are employed to analyse the Consumer perception, trust and satisfaction of IoT enabled digital payment system and their influence on behaviour intention and usage patterns. The researcher gathered primary data through a structures questionnaire to analyse respondents' demographic variables, frequency of digital payment, awareness and adoption of IoT payment methods, benefits and perceived challenges associated with IoT technologies. The secondary data collection was done from various sources including books, articles, published and unpublished studies, reports from market research and government records, and websites. The research comprised a sample of 192 respondents, collected through a purposive sampling approach focusing on individuals experienced in digital payment system. The data was analysed using Partial Least Squares Structural Equation Modeling (PLS SEM).

LITERATURE REVIEW

The Internet of Things has led to the development of smart payments. This can be attributed to its various advantages like ease of access, increased productivity and privacy. IOT technology will impact digital payments in a big way. Adoption, privacy and data security are the issues which need to be addressed to realize its full potential. (Chatterjee, 2025).

A study among the consumers in Chennai regarding digital payments was conducted. The results of the study revealed that a notable number of respondents were unsure regarding trusting digital payments. Thus, highlighting the need for security and user confidence (K. Sivasubramaniyan et al., 2025)

(Bajaj et al., 2021) Studied the variables influencing consumers' usage of the Internet of Things in India. The results of the study highlighted privacy concerns, convenience and social impact as primary drivers of adoption. The study revealed trust in data security as a critical factor with respect to financial services.

AL Hogali conducted a study on the factors influencing customer trust and their impact on IOT technology adoption. The results revealed that product security was the most crucial factor influencing IOT adoption. To gain the trust of consumers, the industry has to ensure the safety of consumers' data. The usefulness and helpfulness of

such services also emerged as important factors. The study concluded that although trust is a significant factor for adoption of IOT technology, it alone will not ensure adoption. (AlHogail, 2018)
(Kleidermacher, 2020) In his study, he discusses the security issues with regard to IoT devices in consumer goods and stresses the necessity of uniform compliance in order to boost customer security and confidence.
(Monisha,2024) In her study identified important developments and obstacles for the shift from cash to digital payment which resulted in improved financial inclusion and greater convenience.
The results of the study on digital payment systems found privacy, security, and an absence of technical infrastructure as the main challenges of digital payment technology. The awareness regarding digital technologies. The study also discussed economic and awareness challenges. It was revealed that awareness about digital payment technologies was the most critical.
(Thirumagal et al., 2024) In their study, they discuss the transformation in payment systems in finance owing to the Internet of Things. Innovations powered by the Internet of Things are lowering transaction costs and lowering the risk of fraud. At the same time, they lead to speeding up of payment procedures. This results in increased operational efficiency and security.

(Yuan et al., 2023) In their study with 574 students from higher education in China studied the linkage of mobile payment with sustainable consumption behavior. Results indicate that perceived mobile payment usefulness and ease of use significantly influence sustainable consumption intentions.

Tripathi (2024) investigates the factors and challenges that encourage the use of digital payments. He identifies security and payment concerns, as well as regulatory frameworks, as major barriers to adoption.

Results of a study on smart wearables establish that apart from perceived usefulness and perceived ease of use, users value the aesthetic aspect of payment in smart wearable devices. Research has demonstrated that if the payment interface is aesthetically pleasing, users' perceptions of its usefulness and ease of use favourably influence their behavioral intention. (Hidayat-ur-Rehman et al., 2022)
(Luarn & Lin, 2005) in their study extended the TAM (Technology Adoption Model) to mobile banking by introducing the constructs of perceived credibility, perceived self-efficacy and perceived financial cost.
In another study on mobile payments, it was found that Perceived ease of use and perceived utility of Mobile payments are strongly impacted by mobile payment self-efficacy. These then influence attitudes towards it, which in turn influence mobile payment intentions. Concerns about privacy can affect intentions and attitudes towards mobile payments. (Bailey et al., 2017)

Literature Gaps and Research Needs
Despite existing studies in IoT and digital payments, significant research gaps remain. There exist very few empirical studies focusing on role of various factors driving the acceptance of usage of IoT for payments. This lack is particularly true in case of developing countries like India. Hence, a study was conducted to study the same.

DATA ANALYSIS AND INTERPRETATION
The study examines the relationship between Perceived ease of use (PE), Perceived Risk (PR) and Trust & Security Risk (TS) on Usage and Behavioural Intention (UBI), in IoT enabled digital payment system using structural equation modeling. The proposed model was tested using PLS-SEM.

To investigate the model fit, standardized root mean square residual (SRMR) is calculated. The SRMR value of 0.072 indicating a good model fit as it is below the recommended threshold of 0.08 and also suggests that the difference between observed and predicted correlation is minimal.

Composite reliability and Indicator reliability were examined to check the reliability. As per Table 1, Cronbach alpha for all the four construct is above 0.7 indicating high internal consistency and strong reliability among the items. The constructs are statistically reliable and stable for SEM analysis. All AVE values exceed **0.5**, confirming that the construct explain more than 50% of the variance of their indicators and therefore **adequate convergent**

validity is established. Although Cronbach's alpha for PR shows slightly lower, but its composite reliability and AVE values are strong, therefore confirms its adequacy.

Table 1: Reliability and Convergent Validity Test Summary

Construct	**Cronbach's Alpha**	**Composite Reliability (ρc)**	**rho_A**	Average variance extracted (AVE)
PE	0.872	0.876	0.907	0.663
PR	0.693	0.706	0.866	0.764
TS	0.868	0.872	0.919	0.791
UBI	0.829	0.843	0.901	0.754

Fornell – Lacker's criterion and Heterotrait – Monotrait Ratio (HTMT) is assessed to examine the discriminant validity. Table 2 shows the results of Fornell – Lacker's criterion where the diagonal elements are the square roots of the AVEs of the construct. It shows that each diagonal element is greater than its corresponding correlations with other constructs.

Table 2: Discriminant Validity (Fornell-Lacker's Criterion)

	PE	PR	TS	UBI
PE	0.814			
PR	0.644	0.874		
TS	0.652	0.553	0.889	
UBI	0.734	0.643	0.682	0.868

Furthermore, Table 3 shows the HTMT results, whereby the values are **below the threshold of 0.90**, indicating acceptable discriminant validity among the construct.

Table 3: Discriminate Validity (HTMT)

Relationship	**HTMT Value**
UBI – PE	0.862
UBI – PR	0.844
UBI - TS	0.799
PR-PE	0.829
TS-PE	0.748
Ts-PR	0.703

The PLS algorithm was administered to evaluate the Coefficient of Determination (R^2), The R^2 value for Usage Behavioral Intention is 0.638 indicates that 63.8% of the variance in UBI is explained by the independent variables (PE, PR and TS). The findings demonstrates good exploratory for predicting UBI. Perceived Ease of use demonstrates a moderate effect on user Behavioural intention ($f^2 = 0.195$), indicates that when the users perceive it as useful and beneficial. Then there is a greater likelihood of adoption .Further, Perceived Risk shows a small effect ($f^2 = 0.076$), indicates that even though users are aware of risk, they do not significantly discourage digital payment adoption. Trust and Security shows a small to medium effect ($f^2 = 0.195$), indicating that trust is an important factor in deciding user intention.

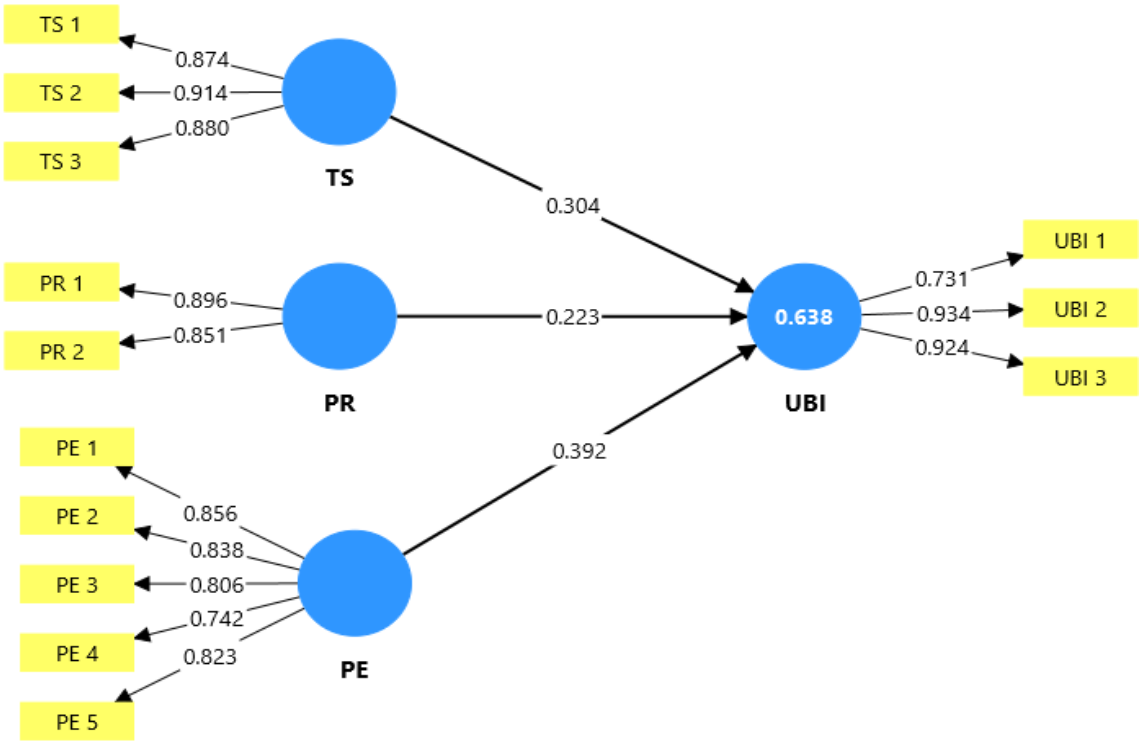

Table 4: Structural Model Evaluation: Path Coefficients

	Path coefficients	**Original sample (O)**	**Sample mean (M)**	**Standard deviation (STDEV)**	**T statistics (|O/STDEV|)**	**P vlaues**
PE -> UBI	0.392	0.392	0.394	0.076	5.147	0
PR -> UBI	0.223	0.223	0.224	0.079	2.828	0.005
TS -> UBI	0.304	0.304	0.302	0.069	4.392	0

The path coefficients shows the strength and direction of relationships between the independent variables and User Behavioral Intention (UBI). Perceived Ease of use (PE) shows a positive influence on UBI ($\beta = 0.392$, $t=5.147$, $p<0.05$)), suggesting that users are more likely to adopt the system when they perceive it as useful and beneficial in improving their performance. Therefore, Hypothesis 1 is accepted, Perceived ease of use has a significant positive effect on usage behavioural intention.

Perceived Risk (PR) has a positive but comparatively weaker effect on UBI ($\beta = 0.223$, $t=2.828$, $p<0.05$), implying that although risk perceptions exist, they continue using digital payment systems due to increased familiarity and trust. Therefore, Hypothesis 2 is accepted, Perceived risk has a significant effect on usage behavioural intention.

Trust/Security (TS) also has a positive impact on UBI ($\beta = 0.304$, $t=2.828$, $p<0.05$)), indicating that trust plays a significant role in shaping user behavioural intention. Therefore, Hypothesis 1 is accepted, Therefore, Hypothesis 3 is accepted, Trust and security have a significant positive effect on usage behavioural intention

Overall, all path coefficients are positive, indicating that PE, TS, and PR contribute to enhancing user behavioral intention, with perceived ease of use emerging as the strongest predictor, followed by Trust/Security and Perceived Risk.

In order to find the predictive relevance of the model, stone Geisser's Q^2 Value is calculated through blindfolding procedure. This helps in understanding the indicators in a reflective model correctly predict an endogenous

construct. Q^2 Value for Usage and Behavioural Intention was found to be 0.617, which is substantially greater than zero, indicating strong predictive relevance. This suggests that the model demonstrates a high level of predictive accuracy.

THEORETICAL AND MANAGERIAL IMPLICATIONS

The findings of the study contribute to the existing literature on digital payment and technology adoption. The study establishes technology adoption theories, such as the Technology Adoption Model (TAM), by confirming that perceived ease of use is the strongest factor that influences the usage behaviour model. The research findings offer valuable insights for individuals and organisations operating in the digital payments-IoT-enabled landscape.

The study examined the variables influencing consumers' usage of IoT-enabled digital payment systems. The results reveal that perceived ease of use emerged as having the strongest impact, significantly shaping user adoption and intention to use. This suggests that improving user friendliness, convenience, and efficiency of IoT-enabled payment systems could encourage adoption of these technologies. Organizations can achieve this by implementing features that enable faster transactions and provide smooth integration with IoT devices. Trust and security also emerged as important factors influencing consumers' decision for adoption, although not to the same extent as perceived ease of use. Companies can address this by enabling robust security measures, such as fraud detection, which would lead to building user confidence. The findings suggest that adopting user-centric strategies and security measures can build trust and encourage wider acceptance of IoT-enabled digital payment systems.

CONCLUSION

The study suggests the essential impact of IoT-enabled devices on the adoption of digital payments and customer behavioral intentions. The outcomes indicate that perceived ease of use is the most significant factor in consumer adoption of IoT-enabled digital payment systems. This means that making IoT devices user friendly, accessible, and convenient to use is essential for getting users more active. Trust and security are also very important for building consumer confidence. Perceived risk has a favorable but smaller effect, implying that although risk perceptions exist, they continue using digital payment systems due to increased familiarity and trust.

The research strengthens the theoretical framework of technology adoption by expanding the significance of the Technology Acceptance Model (TAM) across various IoT-based payment ecosystems. From a leader's perspective, businesses should focus on making interfaces that are easy to use, making sure that transaction settings are safe, and using IoT to provide personalized and quick payment experiences. To conclude, incorporating IoT to digital payments is not only ensuring that they function better, but it's also transforming the way that individuals behave, effectively accelerating through the transformation to a cashless and technologically oriented economy.

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