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# ASSESSMENT OF FACTORS INFLUENCING VENDORS' ADOPTION OF UNIFIED PAYMENTS INTERFACE (UPI)

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**Abstract**
The Unified Payments Interface (UPI) system has become the most technologically advanced payment system for Indian consumers and banking institutions. UPI was created to provide constant accessibility, high performance, intuitive navigation, and openness. Despite these positives and the exponential increase of internet and mobile devices users, UPI adoption has lagged behind projections. Understanding customers' perceptions of trust and knowledge and motivating them to adopt is essential for searching deeper into prevalent issues. Prior UPI studies mostly dealt with its operational dynamics. The elements that affect the decisions of Indian vendors in adopting UPI based on the Technology Acceptance Model (TAM) theory have been examined to draw conclusions about their adoption and influencing factors. A survey of vendors in Hyderabad, India, revealed that personal factors ("perceived risk", "perceived ease of use", "perceived usefulness") affected vendors' UPI acceptance. Technical knowledge does not moderate the association between personal variables and vendors' UPI adoption; however, the level of trust moderates this relationship. Consequently, UPI service providers would create UPI platforms that appeal to the widest possible audience. Improvements in user friendliness and safety measures can establish UPI as socially acceptable. This study demonstrates to researchers how TAM constructs may be usefully adapted to vendors' UPI adoption. As UPI is a relatively new technology in many domains, its adoption merits further research of its own. Since there is little academic research on UPI usage among vendors, this study adds a significant new contribution to the field.

**Keywords:** UPI; vendors adoption of UPI; TAM; ease of use; usefulness; perceived risk; trust

## 1. Introduction

The transfer and transaction of monetary payment or receipt through electronic means is termed as "digital payment". A financial transaction is considered as digital if it is confirmed by payers, receivers, or both via a digital mode. In order to increase financial inclusion, technological improvements have taken place in the digital realm, which have led to the widespread acceptance of digital payment systems (Sailaja & Rao, 2018; Tiwari et al., 2019). Numerous digital payment platforms have been launched to satisfy the wide range of consumer preferences in India. Debit cards, Aadhar Enabled Payment Services (AEPS), Unified Payments Interface (UPI), the point-of-sale system (POS), online banking, m-banking, etc., are examples of digital payment options. As of March, 2019, the number of digital payments made in India had reached nearly 30,000 million (RBI, 2019a). There were over 140 million transfers associated with real-time gross settlement (RTGS), Government security releasing, etc., while nearly 29,000 million transfers were associated with retail electronic payouts like credit/debit cards, retail electronic clearing, paper clearing, and prepaid payment instruments. In addition, as of financial year 2019, the cumulative number of digital payments in India was over ₹3200 trillion (RBI, 2019b). There was a total of nearly
₹390 trillion worth e-commerce transactions, while RTGS, government security releasing, and other similar transactions accounted for a total of over ₹2,800 trillion. The reach of

cashless economies could be gauged by the quantum of yearly digital transactions per individual. A dramatic rise has been witnessed in the annual rate of digital transactions for each Indian since 2014. From 2.37% in 2014 to 22.50% in 2019, the annualized rate of digital transactions in India has increased dramatically. As a result, the quantity and value of digital payments have increased over time in India. However, when comparing the number of annual digital transactions per head around the world, India ranks quite low (Bank for International Settlement, 2019). It is possible that India's large population and the widespread reluctance of its citizens to embrace digital payments are to blame for this dismal picture.

Developers have created two categories of payment applications, namely, Unified Payments Interface (UPI) and wallet applications (Daştan and Gürler, 2016). UPI-based apps enable IMPS (Immediate Payment Service), which uses the bank account data of the user and enables instantaneous money transfer, in contrast to wallets that utilize the funds saved in a company's app to make payouts. UPI-based apps have dominated the Indian market since the demonetization period ended (Suma Vally & Hema Divya, 2018). UPI transactions in India's non-metropolitan and rural areas increased by a staggering 650% in the year 2022, of 30 million transactions totaling nearly ₹52 billion, according to a report (Economic Times, 2022). Four primary distinctions are identified between these two types of mobile payment services (Kapur et al., 2020). First, UPI streamlines the sender and receiver ends of a peer-to- peer money transfer, whilst wallet necessitates two separate channels for the transfer of funds (from local bank to wallet, and finally from wallet to recipient). Second, UPI is analogous to internet banking via phones, whereas wallet payments necessitate KYC (know your customer) information. Third, companies that use wallet-based apps now see the benefits of adopting UPI. Wallets also have trouble with interoperability because the recipient of a wallet payment must also use a wallet from the same firm; in UPI, however, the recipient's bank account is directly credited. Despite the fact that the government's BHIM (Bharat Interface for Money) platform was the first to launch the notion of UPI-based payments, other businesses like Paytm, PhonePe, and Google Pay, too, are working hard to carve out a slice of that pie.

The prevalence of digital payment methods in India has increased since 2014. Banks and non-banks have contributed to this expansion by developing and distributing novel financial products and services and by introducing cutting-edge financial technologies. The digital payments architecture and ecosystem have played a significant role. Banks and non-banks are teaming up to provide a unique blend of reliability and creativity for Indian customers (RBI, 2019a). On the supply end of the spectrum, numerous payment options have been made available to the public. Retail consumers have pushed the adoption of digital payments due to their convenience, swiftness, openness, and safety. However, many factors, including the pricing structure of digital payment solutions, liquidity, knowledge, and so on, prevent Indian vendors, especially small vendors, from adopting these methods of payment. These claims made are supported by data from a CUTS International study, which found that only 49% of the retailers in Indian metropolitan areas embraced digital payments and 51% of retailers wanted to avoid using digital services (CUTS International, 2018a). There are varieties of reasons for the probability of non-adoption of digital payment services by small Indian businesses.

This study intends to explore the rationales behind the reluctance of Hyderabad's vendors in accepting digital payments. Hyderabad, being a tier-one city and being second most important IT hub of India, can provide extensive knowledge of components that affect the implementation of digital payment services across pan India. It further can aid national and international business vendors and service providers to customize their policies and strategies

according to the retail sector requirements. Hence, the present study objectives are (i) to discover the factors influencing the adoption of UPI among vendors; (ii) to assess the role of knowledge and trust in the acceptance of UPI, and (iii) to assess how gender and age of vendors' influence adoption of UPI.

## 2. Literature Review

As the digital revolution has progressed over the past two decades, it has also become increasingly associated with development goals in many countries of the world, most notably India (Kuci, 2005). This theory of progress is based on post-colonial techno-rationality (Philip, 2016), which argues that apart from resting in the informed, collective and nationalized acceptance of technology, the nucleus of modernization also represents technology in every citizen. Over the past few decades, state-driven advancements (e.g. construction of large dams after independence) are based on this theory. India's political ruling class of the early 2000s embraced these ideas, and a number of e-government projects were launched with the goal of becoming "paperless" (Haque, 2002).

The proposed initiatives were political because they were sold to the public as being far more than just efficiency upgrades (Thomas, 2009). Much like with demonetization, the rhetoric surrounding e-governance centered on bringing private-sector efficiency gains to public sector operations (Kuriyan& Ray, 2009; Nilekani, 2009). There has been success in the administrative aspects of e-governance and process management (Gupta, 2012), but the front- and-center interface between the government and its constituents has been more difficult to achieve. Although some urban Indians have embraced cashless transactions, the vast majority of Indians still lack access to a bank account, reinforcing longstanding disparities. India's current prime minister Modi's calls for technology-savvy people to coach their technically less aware people as a national service became a signature part of his messages (Modi, 2016). The most important effort to bring the population into the formal sector was followed by demonetization. Other scholars have indicated that diffusive processes and technological preferences are molded by food subsidies, taxes, and price-support solutions (Feder et al., 1985). Aadhaar, a country wide biometric identification scheme, was a significant forerunner in the technology acceptance landscape. Midway through 2016, a cutting-edge app called UPI was released to facilitate instant bank transfers (Tungare, 2019). UPI is employed for payment where a user's distinct UPI ID on his phone or tablet is required for the transaction. Merchant registration with the financial institutions is required for acceptance of UPI payments (Mohapatra, 2017).

A technical innovation's socio-technical acceptability has been the subject of prior research (Gao and Waechter, 2017; Park et al. 2016). Different theoretical models have been investigated in the past to try to link the acceptance to various fields, such as phone banking, m-commerce, e-commerce, etc., all of which have experienced a diverse technological intervention. Of the numerous theories created to investigate why and how people choose to adopt and use novel technologies, the Technology Adoption Model (TAM) has gained widespread acceptance (Chatterjee et al. 2021). A comprehensive literature review on how people interact with technology was conducted by Shaikh and Karjaluoto (2015). Perceived pleasure and subjective norm were cited as predictors of 'intention to use' alongside TAM variables. Social pressure and security-based parameters (threat and trust) are some major indicators influencing digital payment utilization, as reported by Dahlberg et al. (2015) and corroborated by Akgül (2021).

Prior literature exhibited various factors which influence merchants to adopt digital payment system globally. Majorly, competitive pressure, environmental factors, employees' IT knowledge, and customer pressure, perceived benefits, perceived security, perceived

compatibility, organizational readiness, organizational innovativeness and government support significantly enhance the adoption of mobile commerce adoption by small and medium enterprises (Chau et al., 2020; Iuga & Wainberg, 2023). Trust is also found by researchers as a significant component in influencing the adoption of mobile payments among merchants (Yeboah et al., 2020). Studies based in India showed that perceived usefulness, perceived trust, perceived experience, perceived security and cost, customer's pressures, competitor's pressures, and government support were the primary elements, which affected the implementation of m-commerce among Indian micro enterprises (Chitsimran et al., 2020; Tripathi et al., 2022). In addition, recent research showed that perceived experience acts as significant mediator and moderator on the impact of "perceived usefulness" and "perceived ease of use" on the merchants' mobile payment usage intention (Sinha & Singh, 2023).

Earlier studies based on small-scale vendors from India also showed various challenges, such as loss of faith on online payment apps, difficulty with customer care, risks associated with transaction, digital illiteracy, etc., which keep them away from using UPI based payment systems in their businesses (Bhatia et al., 2023). However, studies majorly are descriptive and did not provide the explanatory based analysis of street vendor's UPI adoption. One study from Jaipur (a two-tier city), India showed that perceived consumer demand to pay in digital medium and tax-payment behavior of the vendors significantly determine the adoption of digital payments of small-scale vendors (Ligon et al., 2019). In contrast, other study conducted in New Delhi showed that perceived privacy risk and security risks were not the significant factors for influencing adoption of mobile based payment systems, but digital literacy is a significant factor (Prasad et al., 2023). Moreover, while small scale vendors from Jaipur showed significant digital literacy (Ligon et al., 2019), another study from Kashmir showed poor language skills and low understanding of mobile payment apps prevailed among users (Mir & Wani, 2023). Therefore, there are existent research gaps in understanding the reasons behind low adoption of digital payments among small-scale street vendors in India. The uniqueness of the present investigation is the adoption of explanatory methodology to understand the determinants of adoption of UPI based payments by the local street vendors from a tier-one and one of the blooming IT hubs in India. Furthermore, studies based on small-scale street vendor in India are lacking, where moderation role of trust and technical knowledge on the adoption of UPI payment system has been tested. Therefore, the study can be immensely helpful to the mobile payment services as well as for the government to increase the adoption rate among small scale street vendors.

## 3. Theoretical Background

Davis' (1989) Technology Acceptance Model (TAM) concept is popular for evaluating the spread of new technologies in the IT sector (Paul et al., 2003). Beyond user perceptions of utility and ease of implementation, Lee and Jun (2007) posited that other factors influencing adoption decisions should be analyzed by TAM. While TAM had widespread support (Yang, 2005), its focus was on how beliefs about the convenience and utility of technology influenced its acceptance (Lai and Zainal, 2015; Luarn and Lin, 2005). Hence, novel payment systems like the UPI payments can benefit from this method of evaluation.

TAM is an established theory that explains why people intend to adopt new technologies. According to TAM, opinions about a new technology's perceptions of "ease of use" and "usefulness" affect how they feel about it and how they employ it. TAM was created with the intention of predicting the adoption of new technology by end-users, but is also anticipated to explicate and forecast behavior of users determined by basic measurements made "after a

very brief interaction with a system" as a model or in an adoption prior to trying it out (Hong et al., 2006). Empirical evidence has also confirmed the usefulness of TAM in post-adoption studies (Altay & Okumuş, 2022; Al-Okaily, 2024; Saif et al., 2024). In addition, TAM is promoted as a model driven by intention, meaning that actual technology utilization is predicted rather well from the intent to adopt a technological innovation (Hong et al., 2006). Hence, the constructs that affect the decisions of Indian vendors in adopting UPI based on the TAM theory have been examined in this research to draw conclusions about their adoption and influencing factors.

TAM is now commonly referenced in studies examining the best way to get people embrace new technologies (Lee et al., 2013). TAM explains the reasons behind the probability of a given system or technology being inappropriate or acceptable, allowing scholars and practitioners to initiate the necessary actions. While the TAM has been shown to be a tenable and reliable model for describing users' attitudes and adoption of a new technology (Davis and Venkatesh, 1996; Mathieson, 1991), many variants on the original model have since been modified and put to test (e.g., Lai, 2016; Venkatesh and Davis, 2000).

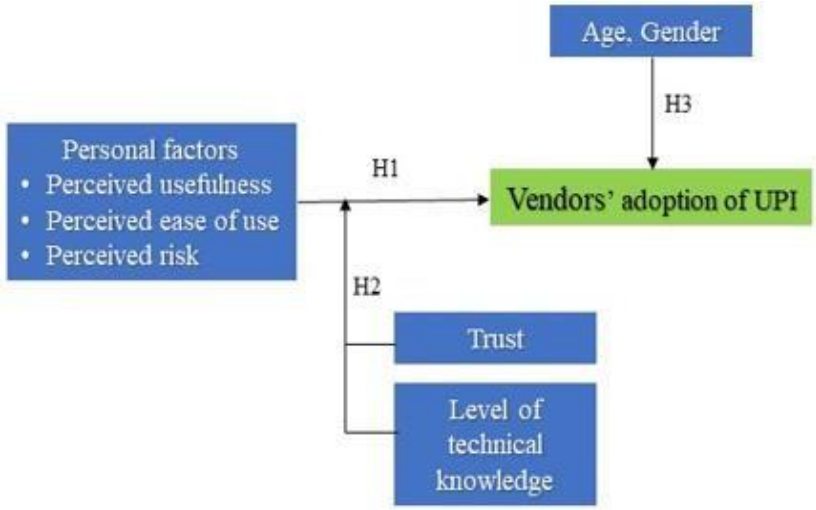


Figure 1: Conceptual model

### 3.1 Hypotheses development

#### 3.1.1 "Perceived usefulness", "perceived ease of use", "perceived risk" and vendors' adoption of UPI

Users' perceptions of usefulness of the system determine its adoption and influence their actions. In order to be considered successful, technology must provide the customer with something of value. If the system serves a purpose, its users will employ it regardless of how simple or complex the interface may be (Davis, 1989). Hartono (2008) reported that perceived usefulness of a solution is its perceived ability to enhance performance.

Davis (1989) defined that perceived ease of usage refers to a user's confidence that a solution will be simple to learn and use. Usage statistics and user feedback can also demonstrate the system's intuitiveness. A system's popularity is determined by its simple usage and effortless operation. It has been suggested (Le et al., 2020; Nguyen, 2020) that customers' impressions of a product's simple usage can have a positive impact on sales.

A consumer's perceived risk is the degree to which they anticipate experiencing difficulty or unforeseen consequences because of engaging in a private (personally identifiable) activity (Hartono, 2008). Consumers' perceptions of risk (Suleman, 2018) are well documented as a crucial consideration in any and all financial dealings (Bashir &Madhavaiah, 2015). Khanra et al. (2020) showed that security concerns of uses significantly moderate the relation

between the key variables and user's continuing usage of mobile payment system. Moreover, other studies based on consumer's UPI adoption stated that simplicity, interoperability, security significantly influence were vital factors (Pillai et al., 2019).
Thus, this hypothesis is suggested:
*Hypothesis 1: "Perceived usefulness, perceived ease of use and perceived risk influence vendors' adoption of UPI".*

### 3.1.2 Technical knowledge, trust, and vendor's adoption of UPI

The role of trust is very important because the customers' funds are transacted in UPI services. Therefore, it is of great significance to evaluate how trust moderates the relationship between perceptions of potential users and their willingness to adopt UPI. Trust, in this study, is proposed as a relationship moderator between Personal Factors (perceptions of risk, ease of use, and usefulness) and adoption of UPI, keeping in mind that trust lessens the necessity of understanding, controlling and monitoring the situation, facilitating the usage of the technology for the user with least effort and risk. According to Reichheld and Schefter (2000), vendors are more likely to do business with a company they feel they can trust if they have access to cutting-edge services and products. Trust is an emotional situation that motivates one to act trustingly toward another person, and it is predicated on past positive interactions between those people. Several studies in the field of technology acceptance have emphasized on the significance of trust as a tool to improve customer relationships, and the system's credibility and perceptions of safety (Liébana-Cabanillas et al., 2018). Vendors must be aware of how different technological developments, which might be used or rejected by users, affect users' confidence in the system and, in turn, their propensity to adopt new technologies (Ehrenhard et al., 2017; Morgan and Hunt, 1994). According to research conducted by Singh and Sinha (2020), the vast majority of vendors agree that trust is crucial to the success of contactless banking. However, the results also show that vendors have concerns about the security and confidentiality of the system, and that they believe these concerns impact the trust that vendors and clients have in providing and adopting UPI.
Knowledge was considered as a model construct in the conceptual scheme. The term "personal awareness" (Mahatanankoon& Vila-Ruiz, 2007; Molla & Licker, 2005) has been adapted to the current study's aims and it denotes the magnitude to which a potential user is familiar with the said technologies. One of the substantial obstacles preventing the government from achieving the required outcomes is a lack of awareness (Verdegem&Verleye, 2009).
Thus, this hypothesis is suggested:
*Hypothesis 2: The level of technical knowledge and trust will moderate the influence of personal factors on vendors' UPI adoption.*

### 3.1.3 Age, gender, and adoption of UPI

The influence of two demographic factors, age and gender, are considered. These traits may shed light on the reasoning behind a person's decision to make an effort to adopt or actually use UPI services. Since it is commonly assumed that seniors are more resistant to peer pressure, these factors are included as controls in order to evaluate the impact (Boonsiritomachai&Pitchayadejanant, 2017). Similarly, women are stereotyped as being more vulnerable to the views of others. In addition, people's opinions and beliefs about technology's usefulness tend to solidify the more time they spend with it (Singh et al., 2020; Tan and Lau, 2016). Consequently, the outcomes of researches investigating the components that shape individuals' intentions and actions may be affected by these confounding variables. Thus, the final proposed hypothesis is:
*Hypothesis 3: Adoption of UPI is independent of vendors' gender and age.*

## 4. Research Methodology

In this present research, a positivistic research philosophy was chosen as the study focusses to observe and analyze the personal factors of small-scale vendors and their adoption of UPI payment services. In addition, the study adopted a deductive research approach and quantitative research design.

A structured questionnaire was developed to carry out an extensive survey and gather data for empirical research. The study was conducted between a restricted time frame between December 2024 and May 2025, and thus is cross-sectional in nature.

The questionnaire comprised of two main sections. The first one comprises of the question items associated with the vendors' demographic data, such as gender, age, digital payment volume, educational qualifications and preferred UPI apps. The second section was prepared to assess the various factors that were hypothesized to influence adoption of UPI system. Personal factors were measured through three sub-factors, "perceived ease of use" comprising five items, "perceived usefulness" comprising three items and "perceived risk" comprising four items (Davis, 1989; Bashir &Madhavaiah, 2015; Khanra et al. 2020). In addition, the moderating variables, such as technical knowledge (2 items) (Boonsiritomachai&Pitchayadejanant, 2017; Singh et al., 2020) and trust (3 items) (Chauhan, 2015) were presented along with adoption of UPI (4 items) (Pillai et al., 2019; Tiwari et al., 2019) in the last section of the questionnaire. All items were rated as per the Likert scale (five points) where point 1 to point 5 were gradually designated as "strongly disagree" to "strongly agree". Partially filled or unfilled questionnaire were discarded prior to analysis. The original language was kept as English.

The population of Hyderabad as of 2024 is approximately 10,801,000 and data showed that UPI adoption rate has reached 87% in recent years in India (EY, 2019). Therefore, the target population can be assumed to be 93,96,870. The formula of Krejcie and Morgan (1970) was used to compute the size of the sample with a margin of error at 5%.

Consequently, it is necessary to obtain a sample size of at least 174 surveys or measurements to attain a 95% confidence level, ensuring that the true value lies within a ±5% margin of the observed value. A basic random sample selection technique was used to select a sample of 212 participants for the study. Primary data were gathered from respondents who owned shops in Hyderabad (India), using structured questionnaires. The primary data gathered from the sample population was evaluated using SPSS (v24.0). "Structural Equation Modelling" (SEM) was employed to investigate the impact of personal characteristics on vendors' adoption of UPI and to understand the moderating influence of technical knowledge and trust on the association between personal factors and adoption of UPI. For hypotheses testing, SmartPLS software (version 3.3.3) was employed and hypotheses were accepted only when p value is determined to be lower than 0.5 (95% confidence level).

Common method bias (CMV) was minimized through procedural measures like creating variables by a thorough literature review, preserving anonymity, giving respondents time to consider their answers, and using statistical techniques that measured the variance inflation factor (VIF) (Table 3) in conjunction with the model's measurement properties to offset the effects of CMV (Qalati et al., 2021; Lepistö et al., 2022). It was found through Harman's single-factor examination that a single element accounts for 19.685% of the total variance, confirming that the data is not influenced by CMV. Furthermore, no discernible differences were found when comparing the early and late participants' demographic and contextual factors, ruling out the likelihood of bias brought on by non-responses (Armstrong & Overton, 1977).

## 5. Results

### 5.1 Demographic features of vendors

Vendors' demographic details are depicted in Table 1. It is seen that most vendors (43.4%) were of the age group 31-40 years. Men constituted about 80% of the participants while women constituted the rest. Most of them (41.5%) earned ₹1001 to ₹5000 in digital payment form, followed by those (22.6%) earning below ₹1000. Most of them (40.6%) were graduates, followed by those who had passed high school (33.0%).

Table 1: Demographic details of respondents

| | **Frequency** | **Percent** |
|---|---|---|
| Age (years) | | |
| 20-30 | 45 | 21.2 |
| 31-40 | 92 | 43.4 |
| 41-50 | 64 | 30.2 |
| >50 | 11 | 5.2 |
| Gender | | |
| Male | 170 | 80.2 |
| Female | 42 | 19.8 |
| Digital payment volume (₹/day) | | |
| <1000 | 48 | 22.6 |
| 1001-5000 | 88 | 41.5 |
| 5001-10000 | 38 | 17.9 |
| >10000 | 38 | 17.9 |
| Educational qualification | | |
| Illiterate | 17 | 8.0 |
| Primary school | 39 | 18.4 |
| High school | 70 | 33.0 |
| Graduate | 86 | 40.6 |
| Total | 212 | 100.0 |

Most respondents used PhonePe (93.8%), followed by Gpay (76.4%), and Paytm (65.5%) (Table 2).

Table 2: UPI Brands

| | **No** | **Yes** |
|---|---|---|
| Gpay | 50 (23.58) | 162 (76.42) |
| PhonePe | 13 (6.13) | 199 (93.87) |
| Paytm | 73 (34.43) | 139 (65.57) |
| BHIM | 176 (83.02) | 36 (16.98) |
| Amazon Pay | 192 (90.57) | 20 (9.43) |
| Others | 206 (97.17) | 6 (2.83) |

### 5.2 SEM model

PLS-SEM is frequently used because it is robust when estimating the construct's reliability and validity to evaluate the association between several constructs (Sarstedt et al., 2017). The PLS algorithm aids in the measurement model's validation. Bootstrapping was used in the current study to evaluate the structural relationships between the key components, namely, Personal factors and Adoption of UPI, and the moderating function of trust and knowledge (Figure 3).

Cronbach's Alpha was utilized for ascertaining the measurement model's reliability, which was further corroborated through composite reliability (Figure 2). Cronbach's Alpha's values for all the items covered in Personal factors, Adoption of UPI, and Trust and knowledge were found to exceed the threshold value (0.7). Additionally, the composite reliability score and AVE value were both above 0.7. Table 3 shows the internal consistency of the items under each component as a result.

Table 3: "Construct Reliability" and "Construct Validity"

| | Loadings | Indicator reliability | VIF | Cronbach's Alpha | rho_A | Composite Reliability | AVE |
|---|---|---|---|---|---|---|---|
| **Personal factors** | | | | | | | |
| **"Perceived ease of use"** | | | | **0.787** | **0.792** | **0.856** | **0.545** |
| PF_PE_1 | 0.748 | 0.560 | 1.800 | | | | |
| PF_PE_2 | 0.809 | 0.654 | 2.127 | | | | |
| PF_PE_3 | 0.810 | 0.657 | 1.906 | | | | |
| PF_PE_4 | 0.673 | 0.453 | 1.382 | | | | |
| PF_PE_5 | 0.632 | 0.400 | 1.277 | | | | |
| **"Perceived usefulness"** | | | | **0.722** | **0.733** | **0.800** | **0.573** |
| PE_PU_2 | 0.664 | 0.440 | 1.155 | | | | |
| PE_PU_4 | 0.832 | 0.692 | 1.433 | | | | |
| PE_PU_5 | 0.765 | 0.585 | 1.305 | | | | |
| **"Perceived risk"** | | | | **0.744** | **0.775** | **0.837** | **0.565** |
| PE_PR_1 | 0.794 | 0.630 | 1.725 | | | | |
| PE_PR_2 | 0.843 | 0.710 | 1.820 | | | | |
| PE_PR_4 | 0.637 | 0.406 | 1.454 | | | | |
| PE_PR_5 | 0.716 | 0.513 | 1.445 | | | | |
| **Knowledge** | | | | **0.796** | **0.797** | **0.739** | **0.587** |
| K_2 | 0.785 | 0.616 | 1.031 | | | | |
| K_3 | 0.746 | 0.557 | 1.031 | | | | |
| **Trust** | | | | **0.766** | **0.760** | **0.774** | **0.534** |
| T_1 | 0.757 | 0.573 | 1.298 | | | | |
| T_2 | 0.698 | 0.487 | 1.072 | | | | |
| T_5 | 0.736 | 0.541 | 1.301 | | | | |
| **Adoption of UPI** | | | | **0.777** | **0.782** | **0.806** | **0.511** |
| AU_1 | 0.700 | 0.490 | 1.284 | | | | |
| AU_3 | 0.647 | 0.419 | 1.147 | | | | |
| AU_5 | 0.811 | 0.657 | 1.607 | | | | |
| AU_6 | 0.692 | 0.479 | 1.359 | | | | |

The Fornell-Larcker criterion was applied for evaluating discriminant validity (Table 5). According to the standard established by Henseler et al. (2009), discriminant validity was confirmed for all constructs. According to Franke and Sarstedt (2019), discriminant validity is assessed using the Heterotrait-Monotrait (HTMT) ratio, which must remain below 0.90. The acceptable value was determined to be lesser than all of the HTMT values, implying that the variables (Personal factors, Adoption of UPI, Trust and Knowledge) were perceived differently by participants. The HTMT values are depicted in Table 4.

Table 4: "Heterotrait-Monotrait (HTMT) Ratio"

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Adoption of UPI (1) | | | | | | |
| Knowledge (2) | 0.895 | | | | | |
| "Perceived ease of use" (3) | 0.535 | 0.317 | | | | |
| "Perceived risk" (4) | 0.257 | 0.273 | 0.285 | | | |
| "Perceived usefulness" (5) | 0.589 | 0.334 | 0.741 | 0.287 | | |
| Trust (6) | 0.658 | 0.402 | 0.763 | 0.303 | 0.751 | |

Table 5: "Fornell-Larcker Criterion"

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Adoption of UPI (1) | 0.715 | | | | | |
| Knowledge (2) | 0.402 | 0.766 | | | | |
| "Perceived ease of use" (3) | 0.397 | 0.133 | 0.738 | | | |
| "Perceived risk" (4) | -0.146 | 0.090 | -0.228 | 0.752 | | |
| "Perceived usefulness" (5) | 0.378 | 0.106 | 0.514 | -0.175 | 0.757 | |
| Trust (6) | 0.411 | 0.135 | 0.522 | -0.179 | 0.450 | 0.731 |

The fitness of the model was tested by estimating the $Q^2$ value, which was found to be above 0 (0.297), an acceptable value to confirm the model has a good fit. The predictive relevance ($Q^2$) of the model (Figure 4; Table 6). The overall model fit indices were also within the acceptable values.

Table 6: "Model summary and predictive relevance"

| | SSO | SSE | $Q^2$ (=1-SSE/SSO) |
|---|---|---|---|
| Adoption of UPI | 212.000 | 148.939 | 0.297 |

(SRMR=0.062, d_ULS=2.15, d_G=2.55, $\chi 2$=3682.39, NFI=0.910)

Table 7: "R square"

| Variables | R Square | R Square Adjusted |
|---|---|---|
| Adoption of UPI | 0.353 | 0.344 |
| Personal factors | 0.985 | 0.985 |

It was found that $R^2$ values for Adoption of UPI and Personal factors were 0.353 and 0.985 (Table 7), implying that Trust and Knowledge usefulness explain only 35% of the variation in adoption of UPI, while "Perceived Risk", "Perceived Ease of Use" and "Perceived Usefulness" explain 98% of the variation in personal components. The $F^2$ values in Table 8 indicate that the effect of Knowledge on acceptance of UPI is medium, while that of Personal factors and Trust is low. However, the Personal factors were substantially affected by "Perceived ease of use", "Perceived risk", and "Perceived usefulness".

Table 8: F square

| | Adoption of UPI | Personal factors |
|---|---|---|
| Knowledge | 0.185 | |
| Personal factors | 0.096 | |
| Trust | 0.037 | |
| "Perceived ease of use" | | 18.065 |
| "Perceived risk" | | 5.319 |
| "Perceived usefulness" | | 7.820 |

Applying the PLS algorithm function approach known as bootstrapping, the standardized beta values (β) of route coefficients are calculated (Table 9). Personal factors have a substantial influence on Adoption of UPI (β=0.361, p<0.01). Hence, *Hypothesis 1: Personal*

*factors ("perceived usefulness", "perceived ease of use" and "perceived risk") influence vendors' adoption of UPI* is accepted.

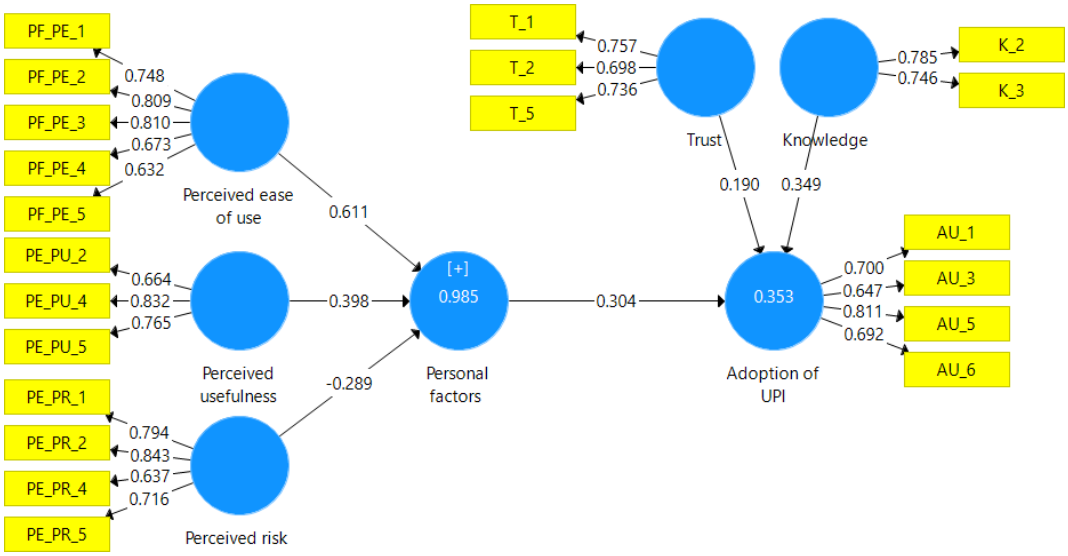


Figure 2: "Measurement model"

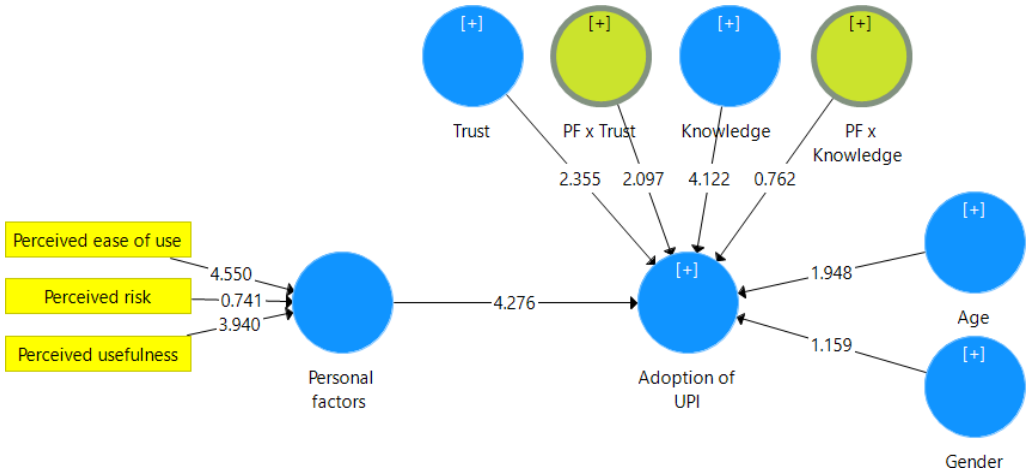


Figure 3:Structural model

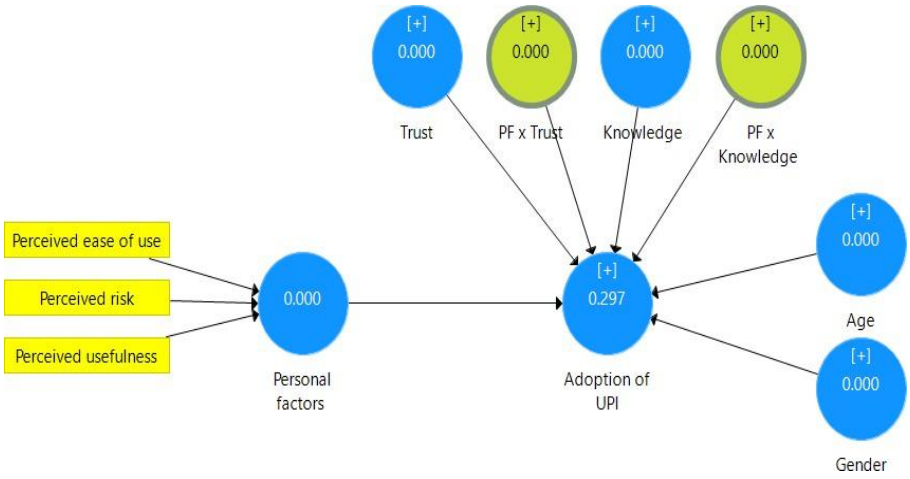


Figure 4: Predictive relevance

The moderating impact of level of technical knowledge and trust on the association between vendors' UPI usage and personal components was also empirically assessed by the bootstrapping approach. It is seen that technical knowledge does not moderate the association between personal factors and vendors' UPI adoption (β=0.052, p>0.05), whereas level of trust moderates the relationship between personal factors and vendors' UPI adoption (β=0.094, p<0.05). Therefore, *Hypothesis 2: The level of technical knowledge and trust will moderate the influence of personal factors on8vendors' UPI adoption* is partially accepted. Furthermore, age (β=0.096, p>0.01) and gender (β=0.063, p>0.01) do not possess a substantial influence on Adoption of UPI. Hence, *Hypothesis 3: Adoption of UPI is independent of vendors' gender and age* is accepted.

Table 9: Path coefficients

| | **Path coefficient (β)** | **t** | **p value** | **Decision** |
|---|---|---|---|---|
| Age -> Adoption of UPI | 0.096 | 1.948 | 0.052 | Positive and insignificant |
| Gender -> Adoption of UPI | 0.063 | 1.159 | 0.247 | Positive and insignificant |
| Knowledge -> Adoption of UPI | 0.354 | 4.122 | 0.000 | Positive and significant |
| PF × Knowledge -> Adoption of UPI | 0.052 | 0.762 | 0.447 | Positive and insignificant |
| PF × Trust -> Adoption of UPI | 0.094 | 2.097 | 0.037 | Positive and significant |
| Personal factors -> Adoption of UPI | 0.361 | 4.276 | 0.000 | Positive and significant |
| Trust -> Adoption of UPI | 0.208 | 2.355 | 0.019 | Positive and significant |

## 6. Discussion

Low-income vendors in India, many of whom operate out of makeshift stores, are increasingly using digital payment for transactions. Despite the importance of such businesses in the functioning of digital payment platforms, little academic attention is paid. Researchers of Information and Communication Technologies and human-computer interactions have been increasingly curious about the merits and demerits of online payment systems (e.g., Krishnan & Siegel, 2017), trust (Chauhan, 2015), privacy and safety (Ghosh, 2012), and other related topics. Much less effort has been put into understanding the lives of low-income vendors selling everything from food and drinks to electronic accessories. These businesses depend on digital payments for day-to-day operations, making them crucial participants in the digital payment ecosystems (Vashistha et al., 2019). Therefore, more study is required to comprehend the experiences of vendors.

Consumers' usage of mobile payment system has been widely researched. It was found that consumers viewed UPI as superior to alternative payment systems, particularly cash payment methods. Users appreciate the UPI payment system's efficacy, convenience, and promptness. This outcome is consistent with the outcomes of prior studies on mobile payment systems (Lovett et al., 2013) and Internet-based solutions (e.g., Kaur et al., 2020). Consumers use UPI to simplify their lives during the expedition of payments. Low complexities facilitate fast and simple payment for users. Using the UPI to pay for commodities, services, and other fund transactions is simple for users. According to previous studies, complex solutions are hard to operate and require additional work and time for task completion. Therefore, the complexity

of the UPI platform would frustrate its users and eventually violate the core principles of UPI. Usage of digital payment services exposes businesses to a minimum of four distinct kinds of risks, namely, information-oriented risks, finance-oriented risks, identity-oriented risks, and access-orientedrisks. Marginalized people might be put in danger due to potential frauds caused by failure of detection and avoidance of such vulnerabilities (Calo, 2011).

Based on TAM model, the present study showed that personal factors ("perceived risk", "perceived ease of use" and "perceived usefulness") of vendors notably influence their adoption of UPI. Similar result is obtained from another study on vendors' adoption from Jaipur city in India (Ligon et al., 2019). They showed that along with perceived customer's demand and demonetization, ease of use was one of the top reasons for merchants to adopt UPI system. In addition, a qualitative study on merchants in India demonstrated that operability and easy installation as well as creative usability to local people like tracking past expenses are significant factors which promote adoption of mobile based payments (Pal et al., 2020). Prior study based on vendors from New Delhi demonstrated that privacy risks and security were not significant factor to determine the behavioral intention among street vendors. However, the present study showed perceived risk to be a significant factor. Therefore, it showed that the street vendors from Hyderabad are more aware about the risks associated with digital payment-based apps and the FinTech companies providing such security are adopted by the vendors.

Furthermore, it was established by the present study that technical knowledge does not moderate the association between personal factors and vendors' UPI adoption; however, the level of trust moderates this relationship. In contrary to the present findings, an earlier study conducted on Vietnamese SMEs revealed that manager's IT knowledge posed as one of the significant determinants of m-commerce adoption (Chau et al., 2020). Such findings were also cited by Romanian SMEs where employee's IT knowledge is a significant factor for mobile commerce adoption (Iuga & Wainberg, 2023). However, in the present study conducted on the street vendors showed that technical knowledge did not moderate the association between and usage of mobile based payment system and personal components. This may be due to the fact that street vendors do not possess much knowledge on mobile payment system and they mostly use it in response to customer's demand. In addition, in support to the present study, earlier literature also supported the impact of trust in the usage of payment systems through mobile devices by vendors (Gupta et al., 2022; Tripathi et al., 2022). However, no other study showed that the level of trust moderates the influence of personal factors on the UPI adoption behavior. This study reveals that the adoption of UPI is independent of gender and age of vendors. However, earlier studies showed that men are more likely than women to use technologies, say, mobile banking and online banking (Akinci et al., 2004). Shin (2009) observed that gender's moderating influences in relation to technology use are significant. Men are thought to be more optimistic and less worried about technological advances (Whitley, 1997). Lee et al. (2010) reported that men intended to be technologically inventive, while women had more phobia towards technology. On the other hand, older users are typically hesitant to use technology for completing purchases because of their orientation for personal interactions and their disbeliefs about technology. Age has been found to moderate the relationship between technology usage and views (Yi et al., 2005). Older consumers possess concerns regarding technology while technology apprehension affects the magnitude of its acceptance in a differential manner (Demirci and Ersoy, 2008).

## 7. Conclusions

The components that influence the acceptance of UPI and recommendations of local vendors have not been explored much in the extant literature. Thus, a novel and integrated model was formulated on the lines of "Technology Acceptance Model" (TAM), merging the constructs of personal factors and UPI adoption. The hypothesis and research approach were evaluated using data gathered in Hyderabad which is second most significant IT hub of India. It was found that personal factors influenced vendors' adoption of UPI and adoption of UPI did not depend on vendors' gender and age. Technical knowledge did not moderate the association between personal variables and vendors' UPI adoption; however, the level of trust moderated this relationship. UPI service providers have to thoroughly analyze and incorporate customer needs and perceptions to enable successful adaptation. The current study contributes towards technology acceptance by analyzing the influence of two vital constructs, trust and knowledge level, on customers' decisions to adopt UPI, in addition to the more traditional behavioral attributes of perceptions of ease of usage, utility, and risk. UPI service providers will have a better grasp on what makes for an optimal user interface. Widespread customization of services is required to increase engagement of vendors.

Overall, this study's primary contribution is in the development and validation of an adoption model for UPI apps. Further, this research contributes to the TAM research by confirming the important moderating effect of the trust construct in the relationship between personal factors and adopting UPI apps, indicating that service providers of UPI apps need to provide features that enhance customer trust.Because of the inherent features of UPI, its adoption has many inherent risks. Several researchers have noted that users' trust of services is key in adoption decision-making with regard to Fintech services, such as UPI. The current study's yet another significant empirical finding is the confirmation that personal components ("perceived risk", "perceived ease of use" and "perceived usefulness") of vendors substantially affect their adoption of UPI, and that gender and age do not influence UPI adoption.

### 7.1 Limitations and Future Directions

The present research, like others, has limitations in terms of the sampling approach employed and only covers the city of Hyderabad (India). Further research needs to be carried out on a pan-India basis to make the results more generalizable. Future studies could include other antecedents that contribute in explaining adoption, such as attitudes, security, responsiveness and social influence and its impact on behavioral intention and actual usage. Future studies also could add new constructs like cultural dimensions and the geographic location of respondents.

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**Declarations**

**Author contributions**

Conceptualization:KPK; Literature review:KPK and VNS; Methodology: KPK; Data Collection: KPK and VNS; Analysis: KPK; Writing – Original Draft: KPK; Writing – Review and Editing: KPK and VNS; Supervision: VNS - Both Authors have read and approved the final manuscript

**Conflicting interests**

The authors declare that there is no conflict of interest.

**Data availability**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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No funding was received for conducting this study.

**Appendix**

Table A1 Measurement Items and Sources

| Construct | Item | | Source |
|---|---|---|---|
| Personal factors | | | |
| Perceived ease of use | PF_PE_1 | Learning to operate UPI App was easy | (Davis, 1989; Bashir &Madhavaiah, 2015). |
| | PF_PE_2 | Use of UPI App is easier to manage transaction on a daily basis | |
| | PF_PE_3 | Use of UPI App is clear and understandable | |
| | PF_PE_4 | UPI App is flexible to use | |
| | PF_PE_5 | It was easy for me to become skillful at using UPI App | |
| Perceived usefulness | PE_PU_1 | UPI App makes the online transactions quicker | (Davis, 1989; Bashir &Madhavaiah, 2015). |

| Construct | Item | | Source |
|---|---|---|---|
| | PE_PU_2 | Track of transactions is easy through UPI App | |
| | PE_PU_3 | UPI adoption resulted in efficient transaction of money | |
| | PE_PU_4 | Using UPI system improved the efficiency in daily work | |
| | PE_PU_5 | UPI App is useful in my store | |
| Perceived risk | PE_PR_1 | I am worried about using UPI payment | (Khanra et al. 2020) |
| | PE_PR_2 | I am not sure of secure payment through UPI | |
| | PE_PR_3 | There are chances of failure of an online transaction | |
| | PE_PR_4 | UPI App has an efficient cyber risk management | |
| | PE_PR_5 | Using UPI App puts the privacy at risk | |
| Adoption of UPI | | | |
| | AU_1 | I am likely to engage in UPI service | (Pillai et al., 2019; Tiwari et al., 2019) |
| | AU_2 | I am willing to spend time to learn steps of UPI payment | |
| | AU_3 | I would recommend the use of UPI to my fellow vendors | |
| | AU_4 | Cashback and scratch card rewards are motivating to adopt UPI | |
| | AU_5 | Payments through multiple UPI channel makes the transaction convenient | |
| | AU_6 | Instant transfer of money increases the suitability of UPI in store | |
| Trust | T_1 | UPI App is trustworthy | (Chauhan, 2015) |
| | T_2 | I have a clear conception of the functionality of the UPI | |
| | T_3 | UPI system is widely acknowledged by other vendors and consumers | |

| Construct | Item | | Source |
|---|---|---|---|
| | T_4 | I trust on the reliability of the transaction data | |
| | T_5 | UPI App is risk-free to use | |
| Knowledge | K_1 | My lack of technological knowledge limits the use of UPI methods | (Boonsiritomachai&Pitchayadejanant, 2017; Singh et al., 2020) |
| | K_2 | My customers have knowledge of UPI App | |
| | K_3 | I have the know-how to use UPI payment | |
| | K_4 | Cost per transaction for UPI is very low | |
| | K_5 | Large number of banks are live on UPI | |

Table A2 Variable/construct description

| Variable/Construct | Description |
|---|---|
| Personal factors | It refers to traits of an individual that have a positive or negative effect on the perception of a person while adopting a new product or service. |
| Perceived ease of use | It refers to an individual's confidence regarding easiness/simplicity of the product/service to use. |
| Perceived usefulness | It refers to an individual's perception regarding application/usability of the product/service for an adoption. |
| Perceived risk | It refers to an individual's perception regarding reliability, loss or negative effect before adoption of new service/product |
| Adoption of UPI | It refers to an action of an individual to use digital payment system based on trust and knowledge towards the service. |
| Trust | It refers to an emotional situation that motivates an individual to act with trust toward the adoption of a product or service based on past positive experiences. |
| Knowledge | It refers to the personal awareness of an individual regarding the product or service, or the available resources for the person's use. |