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Sustainable Digital Payments: Examining Unified Payment Interfaces (UPI) Adoption Among Generation X

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Abstract
Growth in the Indian economy and rising standards of living have made space for new technologies in Indians life, contributing to the evolution of a variety of technology-based solution. Digital payments, like UPI are helping to ease the liquidity shortage as mobile payments has become the most common payment method for digital transactions in India, for peer-to-peer transactions. However, for generation X, adopting new technology might be challenging, in urban areas of India, where digital transactions are on the rise. Additionally, sustainability is relatively a new trend in the financial world and is also essential for now a days for persistent concerns regarding climate change. Sustainable financing promotes the adoption of environmentally friendly practices, including the utilization of non-harmful technology, transitioning customers to digital platforms through awareness initiatives, and investing in projects that foster sustainability. The present paper investigates the determinants influencing the adoption of Unified Payments Interface (UPI) among the generation X, also known as midlife/ pre-senior/ prime age in India. The study uses extended UTAUT model where we have also tried to identify, whether the individuals are aware that digital payment can lead to low carbon footprint (LCF). The study used a structured questionnaire to collect responses and used smartPLS to established relationship amongst latent variable. Findings reveals that Social Influence (SI) has a significant positive impact on Behavioural intention, but does not transmit into actual use behaviour and there is no moderating effect of low carbon footprint between behavioural intention and use behaviour of Gen X leading to no significant influence to transform behavioural intention into its actual use.
Keywords: *Unified Payment Interface (UPI), sustainability, Low carbon footprints (LCF)*

INTRODUCTION:

The growth of digital payment systems has revolutionised financial transactions, with Unified payment Interfaces (UPI) significantly facilitating smooth, real-time payments (NPCI, 2022; Lavanya & Rajkumar, 2024) contributing to economic development (Agarwal et al., 2024). Digital transformation involves implementing new technology, such as fintech, to enhance operational efficiency and customer satisfaction (Agarwal et al., 2024). India is revolutionizing its innovative solutions that enhance the utilization of non-cash payment methods (Malik et al., 2023) such as the Unified payments interface (UPI), has become a revolutionary instrument that has substantially changed how financial transactions that are carried out (RBI, 2016) while younger generations have rapidly adopted UPI, generation X (born between 1965 and 1980) has exhibited diverse adoption patterns influenced by differences in technological exposure, risk perception, and financial practices (Dev et al., 2024; Chawla & Joshi, 2020). Understanding the variables affecting UPI adoption within Generation X is important for advancing digital sustainability (RBI, 2023). While previous studies has focused much on the younger, tech savvy generations such as, Millennials and Generation Z, this study aims to investigate the impact of UPI payments on Generation X, an age group traditionally regarded as less prone (inclined) to digital adoption (KPMG, 2020).

Generation X, also known as "Latchkey Generation" or "MTV generation" has witnessed the shift from traditional banking to digital financial services (PwC, 2019). However, the Covid-19 pandemic has caused a major change in the digital payment situation. As a result of social distancing measures and the decreased availability of cash-based transactions, older adults, particularly Generation X, are being forced to adjust to this new technologies (Santosha et al., 2021) UPI. This study aims to determine the level of UPI acceptance within this group by looking into aspects such as convenience of use, security concerns, and the impact of digital literacy on payment preferences and also awareness towards low carbon footprint of digital payment.

The National Payments Corporation of India (NPCI) developed the Unified Payments Interface (UPI), an innovative digital payment system in the year 2016 that enables instant, real-time and cashless transactions using mobile platforms providing it a convenient and effective payment solution (KPMG, 2020; George et al., 2023) with an interface to transfer funds across bank accounts quickly, securely and in an interoperable manner (Philip B, 2019) creates a virtual payment address (VPA) linked to the customer's bank account (George et al., 2023) also used for paying bills and recharge securely and send and receive money through smartphones or other devices without having prior knowledge of banking processes (Bagla M, 2022). **UPI** is a system that integrates several bank accounts into a single mobile app from any participant bank, agreeing for a variety of financial capabilities. (Thomas & Chatterjee, 2017) instantly transfer funds across multiple banks by using virtual addresses such as customername@sbi.com and customername@axis.com (Thomas & Chatterjee, 2017; Haridas K, 2014)

Technology adoption is affected by various aspects, such as perceived ease of use, utility, security, and trust (Davis, 1989). The unified theory of Acceptance and Use of Technology 2 (UTAUT2) model, developed by Venkatesh, Thong, and Xu (2012), provides a strong framework for analysing technology adoption in consumer contexts. Unlike the original UTAUT model, UTAUT2 incorporates new constructs- Hedonic motivation, Price Value, and Habit to better describe individual consumer adoption behaviour (Venkatesh et al., 2012). Applying UTAUT2 to generation X's UPI adoption assists in identifying the major behavioural drivers influencing their shift from cash-based to digital transactions (Sharma & Bansal, 2021)

1.1 Importance of studying Generation X's Adoption Behaviour

Millennials and Generation Z have quickly adopted UPI, generation X remains a significant cohort that requires tailored interventions to promote digital payment acceptance (Chauhan & Shingari, 2021) This age group includes working professionals, small business owners, and retirees, are financially engaged but typically unwilling to accept recent advances in financial technology due to worries about fraud, transaction failures, and digital security (Gupta & Arora, 2022). Further they restrict themselves to transit to digital payments due to their traditional financial habits of debit/credit cards or cash transactions (Chawla & Joshi, 2020).

According to an NPCI (2023) report, UPI transactions in India exceeded 12 billion each month, however a sizable section of Generation X continues to prefer traditional banking methods. According to the studies, establishing trust, strengthening digital literacy, and providing financial incentives can dramatically increase UPI usage among this demographic (Sharma & Bansal, 2021).

1.2 Sustainability and Digital Payment:

Adoption of digital payments contributes to social, economic, and environmental sustainability by reducing cash dependency, increasing financial transparency, and encourage sustainable banking practices (world Bank, 2023). However, addressing concerns regarding privacy, security and user experience is critical for the long-term viability of UPI adoption among generation X (Chauhan & Shingari, 2021) further digital payments play an important role in ensuring seamless access to banking services, especially in semi-urban and rural areas where generation X is more familiar with traditional banking techniques (RBI, 2023).

Objective:

1. To study the key factors influencing generation X's adoption of UPI.
2. To study the awareness level of Generation X regarding the impact of digital payments in reducing carbon footprints.

2. LITERATURE REVIEW:

The growing trend of cashless transactions has positioned Unified payment Interfaces (UPI) as a significant driver of digital payments in India (NPCI, 2023). It allows seamless, real-time transactions, removing the need for traditional cash handling and cutting transaction costs (RBI, 2023). While younger generations have widely used UPI, Generation X (born between 1965 and 1980) has varying levels of acceptability based on trust, security, and computer literacy (Gupta & Arora, 2022). Furthermore, the environmental benefits of UPI, such as lowering the carbon footprint associated with cash production and paper receipts, remains less explored in academic research (Sharma & Bansal, 2021).

The United Theory of Acceptance and Use of Technology 2 (UTAUT2) model, introduced by Venkatesh, Thong, and Xu (2012), provides a structured way to analyse consumer adoption behaviour in technology driven situations. UTAUT2 is an extension of the original UTAUT model by adding hedonic

motivation, price value, and habit, which makes it suitable for analysing Generation X's adoption of UPI in the context of eco-awareness and financial technology (Venkatesh et al., 2012).

2.1 UTAUT2 constructs and their impact on UPI Adoption among generation X

The UTAUT2 model id consists of seven key constructs that influence technology adoption: performance expectancy, Effort expectancy, Social influence, Facilitating conditions, Hedonic motivation, Price value, and Habit (Venkatesh et al., 2012). Each of these factors has a significant impact on how Generation X understands and incorporates UPI into their regular financial operations, as well as their awareness on environmental impact by adopting to UPI. (Gupta & Arora, 2022; Sharma & Bansal, 2021; Venkatesh , Thong, & Xu, 2012).

2.1.1 Performance Expectancy:

Performance expectancy is the degree to which a person expects that utilizing a system would enable him/her to improve work performance (Venkkatesh etal., 2003) it measures the degree to which it influences the population's behavioural intention to use and adopt digital technologies (Lavanya & Rajkumar, 2024). However age, gender and location might theoretically affect performance standards (Ayaz & Yanartas, 2020). Studies shows that Generation X favours convenience and efficiency in financial transactions but is concerned about digital security (Sharma & Bansal, 2021). Additionally, limited awareness about how UPI minimises environmental effects, such as reducing the need for paper receipts and checks, may influence their decision to accept or reject digital payments (Chauhan & Shingari, 2021).

H1: Performance Expectancy (PE) has a significant positive influence on Generation X's adoption of UPI.

2.1.2 Effort Expectancy

Effort Expectancy (EE) is defined as "the degree of ease (Venkatesh et al., 2003), simplicity (Lavanya & Rajkumar, 2024) convenience (Ayaz & Yanartas, 2020) associated with the use of a system". When customers find technology easier to use, more accessible, and simple to run, it is considered at ease, technology is more beneficial and acceptable, the more comfortable it is to use (Gupta & Sahu, 2022). Generation X often experiences technical challenges, such as complicated UPI signup procedures or difficulty rememberin security credentials (Gupta & Arora, 2022). According to studies, simplified UPI interfaces, improved customer service, and user education initiatives can boost generation X adoption rates (Chawla & Joshi, 2020). Further, if users believe that switching to digital payments takes less wor than processin cash-based transactions, they are more inclined to use UPI (RBI, 2023).

H2: Effort Expectancy (EE) has a significant positive influence on Generation X's adoption of UPI.

2.1.3 Social Influence

Venatesh et al. (2003) define social influence as the impact of family, friends, and society influences on an individual's technology adoption. According to studies, generation X is impacted by suggestions from younger family members, specifically millennials and Generation Z, who use UPI (Sharma & Bansal, 2021). Moreover, eco-conciousness is gaining ground in society, and social influence might help shape perceptions of UPI as an environmentally sustainable payment mechanism (World Bank, 2023).

H3: Social Influence (SI) has a significant positive influence on Generation X's adoption of UPI.

2.1.4 Facilitating Conditions

Facilitating factors include the availability of smartphones, internet connectivity, digital literacy, and customer support, which play a vital role in UPI acceptance (Venkatesh et al., 2012). According to research, Generation X users are more likely to use UPI if they have access to reliable digital infrastructure and technical support (Gupta & Arora, 2022; Chawla & Joshi, 2020; Chauhan & Shingari, 2021; Venkatesh, Thong & Xu, 2012). Raisin awareness about digital transactions minimise currency dependency and improve sustainability couls also help to accelerate adoption (Chauhan & Shingari, 2021).

H4: Facilitating Conditions (FC) have a significant positive influence on Generation X's adoption of UPI.

2.1.5 Hedonic Motivation

Hedonic motivation refers to the enjoyment and satisfaction derived from using a technology (Venkatesh et al., 2012) unlike younger users who may be attracted to UPI's cashback rewards and enhanced(point base) payment experiences, Generation X tends to focus more on functionality and security rather than enjoyment (Gupta & Arora, 2022). However, environmental benefits- such as a reduced carbon footprints due to fewer physical banking visits and paper transactions- may operate as a motivation factor for the adoption of digital payments (World Bank, 2023).

H5: Hedonic Motivation (HM) has a significant positive influence on Generation X's adoption of UPI.

2.1.6 Price Value

Price value indicates the cost-benefit analysis that users perform when selectin whether to accept a technology (Venatesh et al., 2012). UPI transactions are usually free or have low fees, main them more financially advantageous than traditional banking systems (NPCI, 2023). Further, the unstated environmental costs of cash transactions such as the electricity used by ATMs and the fuel used for cash logistics may highlight UPI's price value in terms of sustainability (RBI, 2023).

H6: Price Value (PV) has a significant positive influence on Generation X's adoption of UPI.

2.1.7 Habit

Habit is a major factor in deciding whether Generation X would continue to use UPI on a regular basis (Venkatesh et al., 2012). Studies show that those who have adopted UPI as a habit are more likely to continue doing so as long as they think it's reliable and safe (Chawla & Joshi, 2020). Also, users who are aware of the long-term ecological impact of digital payments may be more likely to adopt them regularly keeping sustainability in mind (Chauhan & Shingari, 2021).

H7: Habit (H) has a significant positive influence on Generation X's adoption of UPI.

2.1.8 Personal innovativeness

H6: **Personal innovativeness (PI)** has a significant positive influence on Generation X's adoption of UPI.

2.2 Environmental Awareness and Digital Payments:

Digital payments like UPI minimize carbon emissions and reduce dependency on paper-based transactions, can significantly contribute to environmental sustainability (Digital India, 2023; NPCI, 2023; World Bank, 2023). Traditional cash transactions require physical currency production, cash transportation, and ATM operations, all of which consume energy and generate a substantial carbon footprint (BIS, 2022). On the other hand, UPI transactions reduce need deforestation, fuel consumption, and operational energy use by reducing the need for paper receipts, chequebooks, and in-person bank visits (World Bank, 2023). Despite these advantages, there is still a lack of knowledge about how digital payments affect the environment, especially among Generation X, who frequently put convenience and security ahead of sustainability (Gupta & Arora, 2022).

Adoption of sustainable payment methods can be increased by promoting environmentally conscious financial behaviour through digital literacy initiatives and policy-driven incentives (Chawla & Joshi, 2020). As per world Economic Forum, 2023 advance developed economies such as Netherlands and Sweden, have included environmental sustainability into their financial laws and are pushing digital transactions as a more environmentally friendly option. In India, although the digital India program has increased the use of UPI, more efforts are required to inform consumers of its advantages for the environment (NPCI, 2023). Increasing Generation X's understanding of the role od digital payments in promoting sustainability can facilitate persistent adoption an support global climate objectives (RBI, 2023).

H8: Awareness of Low Carbon Footprint (LCF) has a significant positive influence on Generation X's adoption of UPI.

2.3 How Digital Payments Contribute to Environmental Sustainability

2.3.1 Reduce Paper Use

Digital payments eradicate the need for printed receipts, paper checks, and manual account statements, lowering the demand for paper production (Sharma & Bansal, 2021). According to an NPCI report (2023), UPI transactions in India have saved millions of paper receipts each year, reducing cutting down of trees. The usage of digital invoices and e-statements in banking promotes more sustainable financial practices (Gupta & Arora, 2022).

2.3.2 Low Carbon Emission from cash Transportation

Traditional banking systems require physical currency transit between banks, ATMs, and companies, which uses fossil fuels and emits greenhouse gases (BIS, 2022). Digital transactions, on the other hand, reduce the carbon footprint associated with cash handling by allowing for rapid, swift transfers with low energy use (Chawla & Joshi, 2020).

2.3.3 The Use of Energy in Banking

Studies show that, despite the apparent environmental advantages, there is still a lack of knowledge about the environmentally friendly features of digital payments, particularly among Generation X (Gupta & Arora, 2022). According to Chawla and Joshi (2020), a lot of users view digital payments mainly as a practical financial tool, ignoring their potential to reduce environmental harm. This might be resolved

with the help of policy-driven incentives, corporate sustainability programs, and financial literacy efforts (RBI, 2023).

2.3.4 The role of Government Initiative and Policy

As part of the Digital India plan, the Indian government has aggressively pushed cashless transactions, emphasizing their advantages for economic transparency and financial inclusion (NPCI, 2023). Policies emphasizing the advantages of digital payments for the environment, however, are still lacking (Chauhan & Shingari, 2021). Sweden and the Netherlands are two examples of nations that have effectively included sustainability narratives into their cashless economy policies, showing that digital payments can be presented as an environmentally responsible option (World Bank, 2023).

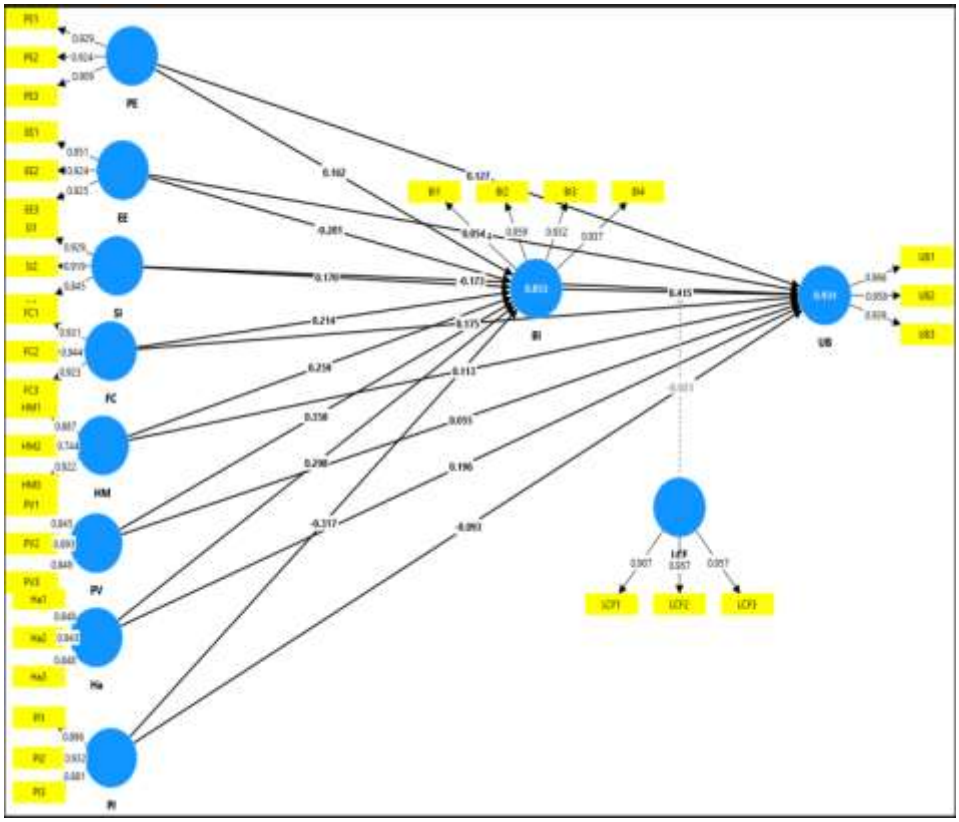

Figure 1 Final Analysis of Structural Model

3 RESEARCH METHODOLOGY:

3.1 Research Design:

This study attempts to find the factors that influence Generation X preferences to adopt UPI and awareness towards the low carbon footprints using UPI. Using a quantitative research methodology, this study examines the variables affecting Generation X's adoption of the Unified Payments Interface (UPI), taking into account both eco-awareness and technology adoption. Key drivers like performance expectancy, effort expectancy, social influence, enabling conditions, hedonic motivation, price value, and habit can be systematically investigated using the UTAUT2 model (Venkatesh, Thong, & Xu, 2012) as the theoretical framework.

3.2 Data Collection and Analysis:

The structured questionnaire was distributed, and responses were collected from 228 Generation X respondents (born between 1965 and 1980) in the Anand district of Gujarat, India. The survey was conducted online and the questionnaire included likert-scale questions (Strongly Disagree to Strongly Agree) to measure respondents' perceptions of UPI adoption and eco-awareness regarding digital payments. A non-probability purposive sample strategy was utilized to identify Generation X respondents who use or are aware of UPI. The sample was taken from urban, semi-urban, and rural areas, ensuring a diverse view of digital payment uptake across demographic and socioeconomic backgrounds. The collected data were analyzed using Smart PLS, is commonly utilized for analyzing technology adoption models and complex linkages in behavioral research (Hair et al., 2017; Sarstedt et al., 2019).

Research Gap

Despite the rapid adoption of Unified Payment Interfaces (UPI) in India, limited research has focused on the adoption behavior of Generation X (born between 1965 and 1980). Many studies on digital payment adoption primarily emphasize younger generations, such as Millennials and Generation Z, who are considered digital natives (Gupta & Arora, 2020). Further research is necessary to fully understand the unique behavioral patterns and adoption difficulties exhibited by Generation X (Singh & Srivastava, 2021). Although the UTAUT2 model has been widely applied in research on technology adoption (Venkatesh, Thong, & Xu, 2012), little is known about how it impacts Generation X's adoption of UPI. Previous studies have mostly focused on Performance Expectancy (PE), Effort Expectancy (EE), and Social Influence (SI) (Thakur, 2023). However, there has not been much research done on how eco-awareness elements like Low Carbon Footprints (LCF) affect the adoption of UPI. The influence of Price Value (PV) and Personal Innovativeness (PI) on the adoption of digital payments in this age group also remains under examined (Patel & Sharma, 2022).

Thus, this study addresses these gaps by incorporating behavioral, economic, and eco-awareness factors into the UTAUT2 framework, providing novel insights into the adoption behavior of Generation X towards UPI in Anand district, Gujarat, India.

4. RESULTS AND ANALYSIS

The following **Table 1** presents key statistical measures for the constructs used in the study. The constructs include Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Condition (FC), Hedonic Motivation (HM), Habit (Ha), Personal Innovativeness (PI), Price Value (PV), Low Carbon Footprints (LCF), Behavioral Intention (BI), and Use Behavior (UB).). The statistical measures include Factor Loadings, Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE).

Table 1 Measurement Model

Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)	Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
PE1	0.929	0.910	0.944	0.848	Ha1	0.848	0.829	0.897	0.744
PE2	0.924				Ha2	0.943			
PE3	0.909				Ha3	0.848			
EE1	0.951	0.926	0.953	0.871	PI1	0.896	0.887	0.930	0.816
EE2	0.924				PI2	0.932			
EE3	0.925				PI3	0.881			
SI1	0.929	0.880	0926	0.807	BI1	0.944	0.959	0.970	0.889
SI2	0.919				BI2	0.959			
SI3	0.845				BI3	0.932			
FC1	0.931	0.925	0.952	0.870	BI4	0.937			
FC2	0.944				UB1	0.966	0.951	0.968	0.911
FC3	0.923				UB2	0.958			
HM 1	0.887	0.818	0.890	0.730	UB3	0.939			
HM 2	0.744				LCF 1	0.907	0.934	0.958	0.884
HM 3	0.922				LCF 2	0.957			
PV1	0.845	0.829	0.897	0.744	LCF 3	0.957			
PV2	0.893				LCF x BI				
PV3	0.849								

The findings verify that every construct satisfies the necessary requirements for validity and reliability. The items utilized for each construct are internally consistent, as indicated by the Cronbach's Alpha values, which are all over the suggested cutoff of 0.7. Composite Reliability values exceed 0.7 for all constructs, further ensuring the reliability of the measurement model. Additionally, AVE values are well above 0.5, confirming that each construct explains a significant portion of its indicators' variance. The high reliability and validity suggest that the questionnaire items used effectively measure the intended constructs, ensuring that the findings derived from these variables can be interpreted with confidence.
The structural model's results are presented in the **Table 2**, and the findings highlight the strength and significance of the suggested model's construct relationships.

Table 2 Direct effects and Moderating effects

Path	Path Co-efficient	T values	P values
BI -> UB	0.415	7.356	0.000
EE -> BI	-0.201	2.573	0.010
EE -> UB	0.054	0.800	0.424
FC -> BI	0.214	3.340	0.001
FC -> UB	0.175	2.862	0.004
HM -> BI	0.259	3.205	0.001
HM -> UB	0.113	2.596	0.009
Ha -> BI	0.298	7.240	0.000
Ha -> UB	0.196	3.791	0.000
LCF -> UB	0.142	2.362	0.018
PE -> BI	0.162	1.723	0.085
PE -> UB	0.127	1.624	0.104
PI -> BI	-0.317	5.580	0.000
PI -> UB	-0.093	2.436	0.015
PV -> BI	0.358	6.562	0.000
PV -> UB	0.055	1.095	0.273
SI -> BI	0.17	3.508	0.000
SI -> UB	-0.173	4.606	0.000
LCF x BI -> UB	-0.023	1.486	0.137

Facilitating Conditions (FC) had a favourable impact on BI (0.214, $p = 0.001$, $t = 3.340$), indicating that users are more likely to use UPI when they have adequate resources and support. Hedonic Motivation (HM) has a significant influence on BI (0.259, $p = 0.001$, $t = 3.205$), indicating that the enjoyment of using UPI is important for adoption. Habit (Ha) has a significant positive effect on BI (0.298, $p < 0.001$, $t = 7.240$), indicating that prior experience and habitual usage influence intention. Price Value (PV) has a positive influence on BI (0.358, $p < 0.001$, $t = 6.562$), suggesting that users who consider UPI as cost-effective are more likely to use it. Social influence (SI) had a favorable impact on BI (0.170, $p < 0.001$, $t = 3.508$), indicating that recommendations from peers, relatives, or colleagues have a substantial role in adoption of UPI.
Effort Expectancy (EE) has a negative effect on Behavioral Intention (BI) (-0.201, $p = 0.010$, $t = 2.573$), indicating that users' intention to use UPI declines as they consider it to be less user-friendly. Performance Expectancy (PE) exhibits a modest and non-significant connection with BI (0.162, $p = 0.085$, $t = 1.723$), indicating that perceived usefulness does not significantly
influence the adoption intention of Generation X.
Surprisingly, Personal Innovativeness (PI) had a negative impact on BI (-0.317, $p < 0.001$, $t = 5.580$), indicating that highly innovative individuals may have concerns regarding UPI adoption due to unfulfilled expectations.
Behavioural Intention (BI) significantly impacts Use Behaviour (UB) (0.415, $p < 0.001$, $t = 7.356$), indicating that high intention to use UPI leads to adoption. Facilitating Conditions (FC) have a favourable impact on UB (0.175, $p = 0.004$, $t = 2.862$), demonstrating that users with sufficient resources and assistance are more likely to engage with UPI. Hedonic Motivation (HM) (0.113, $p = 0.009$, $t = 2.596$)

indicates that regular use of UPI is influenced by enjoyment. Habit (Ha) supports this impact (0.196, $p < 0.001$, $t = 3.791$), implying that established routines promote continuous usage.
However, Effort Expectancy (EE) (0.054, $p = 0.424$, $t = 0.800$) and Performance Expectancy (PE) (0.127, $p = 0.104$, $t = 1.624$) had no significant direct effects on UB, implying that ease of use and perceived performance gains are insufficient to drive actual adoption. Price Value (PV) similarly has an insignificant connection with UB (0.055, $p = 0.273$, $t = 1.095$), indicating that cost efficiency has no direct impact on usage behaviour. Interestingly, Personal Innovativeness (PI) has a negative effect on UB (-0.093, $p = 0.015$, $t = 2.436$), implying that more innovative people are less likely to utilize UPI frequently. Social Influence (SI) had an unexpected negative impact on UB (-0.173, $p < 0.001$, $t = 4.606$), indicating that external pressure may sometimes inhibit actual usage while positively promoting intention. Finally, the moderating influence of latent construct flexibility.
Table 3 shows the total indirect effects of all the constructs on use behavior of Generation X

Table 3: Total Indirect Effects

Path	Path co-efficient (β)	T Values	P values
EE -> UB	0.037	2.257	0.024
FC -> UB	0.032	2.741	0.006
HM -> UB	0.038	2.802	0.005
Ha -> UB	0.022	5.493	0.000
PE -> UB	0.042	1.597	0.110
PI -> UB	0.030	4.417	0.000
PV -> UB	0.028	5.262	0.000
SI -> UB	0.022	3.235	0.001

The data indicate that habit (Ha) and price value (PV) have the most powerful positive indirect effects on use behavior, highlighting their significance. Facilitating conditions (FC), hedonic motivation (HM), and social influence (SI) all have a favorable and significant contribution, although performance expectancy (PE) has no significant indirect impact on use behavior, meaning it does not play a substantial role in influencing users indirectly but effort expectancy (EE) has a tiny but considerable negative impact indicates that as the perceived efforts increases it reduces the likelihood of users adopting the UPI as digital platform.

The Fornell-Larcker Table

The Fornell-Larcker Criterion is a statistical test used to ensure that each construct in your model is unique and measures something distinct from the other constructs (Fornell & Larcker, 1981). The diagonal values in the Fornell-Larcker table represent the square root of the Average Variance Extracted (AVE) for each construct (Fornell & Larcker, 1981; Hair et al., 2017; Henseler et al., 2009). Table 3 represent the Fornell-Larcer Table.
Table 5 Fornell-Larcker Table

	BI	EE	FC	HM	Ha	LCF	PE	PI	PV	SI	UB
BI	0.943										
EE	0.750	0.933									
FC	0.775	0.879	0.932								
HM	0.741	0.613	0.613	0.855							
Ha	0.808	0.623	0.671	0.741	0.881						
LCF	0.863	0.763	0.827	0.665	0.808	0.940					
PE	0.820	0.925	0.915	0.668	0.712	0.830	0.921				

PI	0.530	0.384	0.435	0.810	0.724	0.578	0.453	0.903			
PV	0.836	0.697	0.651	0.803	0.802	0.848	0.744	0.698	0.863		
SI	0.827	0.826	0.791	0.671	0.743	0.834	0.823	0.482	0.775	0.898	
UB	0.927	0.813	0.854	0.744	0.827	0.889	0.883	0.553	0.828	0.811	0.954

The Fornell-Larcker Criterion validates the discriminant validity of all constructs in the model. Each construct's square root of AVE is greater than its correlation with other constructs, indicates that each construct is more effective at explaining variation in its own questions or items (indicators) in the model. Key constructs such as Behavioral Intention (BI) and Use Behavior (UB) had the highest AVE values (0.943 and 0.954, respectively), indicating strong construct validity. Overall, the research verifies the structural model's ability to clearly express construct relationships, resulting in trustworthy and meaningful insights for hypothesis testing and interpretation.

Heterotrait-monotrait ratio (HTMT) - Matrix

Table 6 Heterotrait-monotrait ratio (HTMT) - Matrix

BI	EE	FC	HM	Ha	LCF	PE	PI	PV	SI	UB	LCF x BI
BI											
EE	0.793										
FC	0.822	0.949									
HM	0.812	0.657	0.671								
Ha	0.887	0.691	0.742	0.872							
LCF	0.911	0.819	0.889	0.721	0.900						
PE	0.877	**1.008**	**0.996**	0.733	0.798	0.900					
PI	0.574	0.419	0.478	0.938	0.843	0.635	0.503				
PV	0.931	0.776	0.727	0.948	0.954	0.952	0.842	0.819			
SI	0.898	0.912	0.873	0.766	0.856	0.920	0.917	0.548	0.896		
UB	0.970	0.865	0.910	0.802	0.910	0.943	0.949	0.603	0.925	0.885	
LCF x BI	0.467	0.610	0.605	0.209	0.256	0.556	0.578	0.073	0.388	0.573	0.504

The Heterotrait-Monotrait Ratio (HTMT) is a widely used metric to determine discriminant validity (Henseler, Ringle, & Sarstedt, 2015; Voorhees et al., 2016; Hair et al., 2021). The HTMT approach, developed by Henseler, Ringle, and Sarstedt (2015), provides a more reliable and thorough assessment than older methods such as the Fornell-Larcker criterion.

The HTMT analysis for Generation X's adoption of Unified Payment Interfaces (UPI) reveals strong correlations between most constructs, such as Behavioral Intention (BI) and Use Behavior (UB) (0.970), Effort Expectancy (EE) and Performance Expectancy (PE) (1.008), and Low Carbon Footprints (LCF) and Habit (Ha) (0.900). These high correlations indicate good convergent validity, reflecting a strong connection in Generation X 's intention to use UPI and their actual use, as well as between the ease of using UPI, its performance expectations, and environmentally sustainable aspects.

In contrast, discriminant validity could be an issue when values become close to or surpass the 0.9 threshold (Henseler, Ringle, & Sarstedt, 2015; Voorhees et al., 2016) as in the cases of EE and PE (1.008) and Facilitating Conditions (FC) and PE (0.996). This suggests that Generation X would perceive parallels between UPI's efforts or ease of use, performance, and availability of the resources required to use it efficiently.

5 CONCLUSION

The results confirm the validity and reliability of the measurement model, guaranteeing accurate and consistent measurement of the constructs. The high Composite Reliability and Cronbach's Alpha values (above 0.7) show good internal consistency, and the AVE values (above 0.5) confirm that each construct accounts for a sizable amount of the variance in its indicators.

The findings provide valuable insights into the factors influencing Generation X's adoption of UPI. Facilitating Conditions (FC), Hedonic Motivation (HM), Habit (Ha), and Price Value (PV) emerge as strong positive predictors of Behavioral Intention (BI), emphasizing that users are more inclined to adopt UPI when they have the necessary resources, enjoy using it, and perceive it as cost-effective. Social

Influence (SI) also positively impacts BI, highlighting the role of peer recommendations in shaping intention. Effort Expectancy (EE), on the other hand, has a negative effect on BI, suggesting that adoption is discouraged by projected difficulties with UPI. Performance Expectancy (PE) surprisingly had little effect on BI, indicating that Generation X adoption is not significantly influenced by its perceived benefit Higher intent transfers into actual usage, as BI predicts UB with high accuracy. Additionally, FC, HM, and Ha significantly contribute to UB, suggesting that external support, enjoyment, and habitual usage sustain adoption. However, UB is not directly impacted by EE, PE, or PV, suggesting that cost effectiveness, perceived performance, and simplicity of use are not enough to encourage sustained use. Remarkably, SI had a negative impact on UB, suggesting that although social pressure could promote initial intention, prolonged usage is not always the result. Overall, the studies finds that habit formation, perceived affordability, and facilitating conditions are in driving UPI adoption among Generation X.

When the square root of AVE is greater than inter-construct correlations, the model is said to have strong validity and is hence more reliable. The Fornell-Larcker Criterion confirms the discriminant validity of all constructs ensuring that each construct directly measures the desired idea. Notably, Behavioral Intention (BI) and Use Behavior (UB) exhibit the highest AVE values (0.943 and 0.954, respectively), signifying robust construct validity.

Since there is a significant correlation between intention and actual usage, as seen by high correlations between measures like Behavioral Intention (BI) and Use Behavior (UB) (0.970), the HTMT analysis reveals strong convergent validity in Generation X's adoption of UPI.

Likewise, the correlations between Low Carbon Footprints (LCF) and Habit (Ha) (0.900) and Effort Expectancy (EE) and Performance Expectancy (PE) (1.008) strengthen the link between sustainability considerations, performance expectations, and ease of use.

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