

UPI, Carbon Footprints and Digital Payments: Awareness of Indian Consumers about Environmental benefits of Cashless transactions.

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Abstract:

This study investigates consumer awareness and the environmental lifecycle of India's Unified Payments Interface (UPI) compared to physical cash using a sample of 150 respondents in Karnataka analyzed via SPSS using correlation, chi-square, and multiple regression techniques ($\alpha = 0.873$). Findings reveal that while primary motivations for UPI adoption remain functional namely convenience (44.0%) and speed (43.3%) 78.0% of respondents would increase digital payment frequency if informed of its eco-friendly benefits, such as reducing paper and metal resource depletion. Multiple regression analysis ($R^2 = 0.255$, $p < 0.001$) confirms that eco-conscious payment choices and preferences for reduced physical resource usage significantly drive the belief that digital payments reduce personal carbon footprints, despite user awareness of digital energy consumption and e-waste concerns. Furthermore, chi-square testing ($\chi^2 = 15.929$, $p = 0.458$) demonstrates that primary adoption barriers such as data privacy (44.7%) and connectivity (22.7%) operate independently from green digital literacy needs. To bridge the intention-behavior gap, FinTech platforms, banks, and policymakers must address security and infrastructure hurdles separately while embedding in-app sustainability tools such as carbon savings meters, gamified green rewards, on boarding tutorials, and educational partnerships—to align rapid digital financial inclusion with environmental sustainability goals.

Keywords: Unified Payments Interface (UPI), Consumer Awareness, Carbon Footprint, Sustainable Digital Literacy, Cashless Economy, Environmental Sustainability, Digital Financial Inclusion, Green Banking.

Introduction:

This study looks carefully at how much people know about the Unified Payments Interface in India what makes them use it and how it affects the environment compared to using cash. The study used 150 people from Karnataka. Analyzed the data with SPSS. The results are very reliable with a score of 0.873.

The financial world in India today has changed a lot because more people are using payments. One of the parts of this change is the Unified Payments Interface or UPI. UPI was created as a part of the countrys move toward digital money. It has changed how people pay for things by giving them a safe and easy way to pay instead of using cash. Usually people started using payments because they are easy, fast and safe.. Now researchers in financial technology are looking at another side of it. That side is how digital payments affect the environment.

As the world tries to fight climate change and reach the United Nations Sustainable Development Goals people are looking closely at the environment impact of their everyday choices. Traditional ways of paying, like using cash cost the environment a lot. They need paper, metals and energy to make, print, move and dispose of. Digital payments help by making transactions which means less paper and fewer trips to move money.. Digital systems also use energy and create electronic waste through data centers, phones and networks. This means there is a complicated picture when comparing the environmental effects of physical and digital payments.

Even though people in India use payments mostly because they are easy and fast only a small percentage think about the environment.. Most people, 78 percent say they would use digital payments more often if they learned about the green benefits. These benefits include saving paper and metal resources.

A study using a type of math called linear regression showed that people who care about the environment and want to use fewer resources are more likely to think that using digital payments reduces their carbon footprint.

Another test called Chi-Square showed that the main problems people face with using UPI like worries about privacy and bad internet are not connected to learning about the environment. This means that fixing these problems and teaching people about the environment need to be done in ways.

Even though people know that digital payments use energy and create waste most still think that UPI is better than using cash. This shows that there is a chance, for companies that work with money, banks and the people who make rules to help people use digital payments more by adding tools that show how green they are. These tools could include showing how much carbon is saved, giving rewards for being green and helping people learn how to use the system.

Literature review

Recent research related to digital financial technology, consumer payment behavior, and environmental sustainability has expanded significantly across emerging economies. The paper by Vedala Naga Sailaja and K. Padma Kiran (2025) demonstrates that functional drivers such as trust, convenience, speed, and promotional incentives serve as the primary motivators for Unified Payments Interface (UPI) adoption, establishing ease of use as the dominant factor over secondary considerations. Similarly, Shreyas and Roshni (2026) studied digital payment platforms like Google Pay and PhonePe, confirming through regression analysis that frequent seamless transactions build user trust, whereas technical glitches and data privacy concerns remain key barriers—particularly among older and rural demographics. Regarding environmental awareness, Anna Iwona Piotrowska and Dariusz Piotrowski (2025) examined consumer perceptions of green FinTech initiatives and revealed a widespread gap, noting that while digital

financial tools carry significant potential to support the United Nations Sustainable Development Goals, most consumers remain largely unaware of their explicit sustainability benefits. Conversely, research by Bavornluck Kuosuwan and Asep Risman (2024) across Asian markets validated that digital banking directly reduces carbon footprints by minimizing paper receipts, physical currency handling, and travel emissions, with paper reduction serving as a crucial mediator between FinTech adoption and emission control.

In addition to digital adoption drivers, another critical area of investigation relates to the structural and technical barriers that hinder complete cashless transition. According to Pritish Kumar Sahu and Anwesha Chakraborty (2025), while UPI has significantly boosted business facilitation and rural entrepreneurship in India, widespread adoption is frequently constrained by poor internet infrastructure, digital illiteracy, and fraud risks. Furthermore, Dr. P. Ravi Kumar (2025) emphasized that while digital payment systems dematerialize financial services, they introduce a dual environmental narrative—reducing paper and transportation footprints on one hand, while increasing data center energy consumption and electronic device waste (e-waste) on the other. A third dimension explored by scholars involves bridging this awareness gap through behavioral interventions. Indeed, Petroccione and Taddei (2026) observed that digital payments do not naturally trigger sustainable consumer behavior unless green value propositions are explicitly integrated into consumption pathways and corporate communications.

Although these various aspects of FinTech adoption, infrastructure barriers, and environmental impacts have been independently evaluated by empirical literature, it is rare for a study to examine how consumer perception of adoption barriers directly interacts with preferences for green digital literacy initiatives within the exact same consumer base. For instance, while prior frameworks like UTAUT (Sailaja & Kiran, 2025) and DOI (Fahad & Shahid, 2022) explain functional adoption drivers, they seldom measure whether structural barriers (such as privacy and connectivity concerns) actively prevent consumers from engaging with green literacy campaigns. No study has yet analyzed whether adoption obstacles and green literacy needs operate independently or interactively among Indian consumers transitioning from physical cash to UPI.

Objectives and Hypothesis Development

To assess the level of consumer awareness regarding the "Green" benefits of cashless transactions.

- H0: There is no association between awareness of the environmental benefits across demographic groups.
- H1: There is an association between awareness of the environmental benefits across demographic groups.

To analyse the environmental lifecycle of physical cash versus UPI transactions.

- H0: There is no significant difference between the environmental impact of physical cash and UPI transaction.

- H1: There is a significant difference between the environmental impact of physical cash and UPI transaction.

To evaluate the impact of digital payment frequency on the individual carbon footprint of Indian consumers.

- H0: There is no significant relationship between frequency of UPI usage and consumers individual carbon footprint from payment-related activity.
- H1: There is a significant relationship between frequency of UPI usage and consumers individual carbon footprint from payment-related activity.

Research Gap

While existing literature thoroughly documents the functional determinants of digital payment adoption through models like UTAUT and DOI, as well as the macro-level environmental benefits of FinTech, an empirical research gap remains regarding how consumer awareness of UPI's eco-friendly advantages directly influences transaction behavior in India. Specifically, there is limited understanding of the "intention-behavior gap" concerning consumer perceptions of tangible green benefits (such as reduced paper and metal resource depletion) versus the intangible environmental costs of digital infrastructure (such as data center energy consumption and smartphone e-waste). Furthermore, current research lacks an evaluation of behavioral "nudges"—such as in-app carbon savings meters, gamified green rewards, and structured onboarding tutorials—and how these interface tools can bridge the divide between functional convenience and environmental sustainability. Crucially, empirical studies have yet to evaluate whether structural adoption barriers (such as data privacy, fraud risks, and poor internet connectivity) operate independently from or interact with green digital literacy initiatives within the same consumer demographic, particularly across varying regional, linguistic, and socioeconomic landscapes in India.

Theoretical Framework

This study looks at how people use UPI and what effect it has on the environment. It uses a different ideas to understand this. The UTAUT model is one of them. It shows that people are more likely to use UPI if it's easy to use, useful, trustworthy and if their friends and family use it. Things like convenience, safety and rewards also make people want to use UPI. The Diffusion of Innovation theory is another idea that helps us understand how new things become popular. It says that people are more likely to try something if they can see the benefits and if other people are using it. With UPI people who like using it tell their friends and family which helps more people start using it in a way that's good for the environment. This study also looks at something called Green FinTech awareness. This is about whether people know that using payments like UPI is good for the environment. Sometimes people do not know this. When they find out that UPI can help reduce waste and emissions they are more likely to use it. UPI reduces paper usage and emissions which's a good thing, for the environment. People are more likely to use UPI when they know about these benefits.

DATA ANALYSIS

Table 1: Demographic Profile of Respondents

Variable	Category	Frequency	Percentage
Age	18-25	95	63.3
	25-30	30	20.0
	30-35	13	8.7
	Above 35	12	8.0
Occupation	Student	79	52.7
	Salaried Employee	53	35.3
	Business owner	10	6.7
	Professional	4	2.7
	Other:	4	2.7
Education	SSLC	4	2.7
	PUC/ Diploma	18	12.0
	Undergraduate	39	26.0
	Postgraduate	84	56.0
	Professional Qualification	5	3.3
	Below ₹25000	84	56.0
Salary	₹25000-₹50000	38	25.3
	₹50000-₹100000	21	14.0
	Above ₹ 100000	7	4.7

Most of the people who answered the survey were between 18 and 25 years old. This means that young adults and people who are just starting their careers were the ones who mostly completed the survey. When we look at what these people do students were the group, with 52.7 percent of the survey respondents being students. Then there were people who get a salary, which was 35.3 percent of the survey respondents. There were also some business owners and professionals. Not as many.

The survey also looked at what kind of education these people had. It turned out that more than half of the survey respondents had a Postgraduate degree, which's 56.0 percent. Then there were people who had an Undergraduate degree, which was 26.0 percent of the survey respondents. This shows that the people who answered the survey were very educated.

When it comes to how money these people make most of them said they make less, than ₹25,000 which is 56.0 percent of the survey respondents. This makes sense because a lot of the people who answered the survey were students. Then there were people who make between ₹25,000 and ₹50,000 which was 25.3 percent of the survey respondents. Overall the people who answered the survey were young, educated and mostly students who do not make a lot of money.

Regression Analysis Results

Table 1.1

Variable	Mean	Standard Deviation	Sample Size (N)
Dependent Variable (Y)	2.08	0.923	150
Sustainability Influence (X1)	2.01	0.847	150
Physical Resource Preference (X2)	1.88	0.759	150

Model Summary & Goodness of Fit

Table 1.2

Metric	Value
Correlation Coefficient (R)	0.505
Coefficient of Determination (R ²)	0.255
Adjusted R ²	0.245
Standard Error of Estimate	0.802
Durbin-Watson Statistic	1.650

The model explains **25.5%** of the variance ($R^2 = 0.255$) in the belief that frequent digital payments reduce personal carbon footprints

ANOVA Test Results (Model Significance)

Table 1.3

	Sum of Squares	Degrees of Freedom (df)	Mean Square	F-Value	Significance (p-value)
Regression	32.378	2	16.189	25.14	< 0.001
Residual	94.662	147	0.644	—	—
Total	127.04	149	—	—	—

ANOVA Interpretation: The regression model is statistically significant at $p < 0.001$ ($F = 25.140$)

Regression Coefficients & Collinearity Statistics

Table 1.4

	Unstandardized B	Std. Error	Standardized Beta (β)	t-value	p-value	Tolerance	VIF
Constant	0.731	0.204	—	3.577	< 0.001	—	—

					[source: 2]		
Sustainability Influence (X1)	0.403	0.083	0.37	4.853	< 0.001	0.873	1.145
Physical Resource Preference (X2)	0.288	0.093	0.236	3.104	0.002	0.873	1.145

Regression Equation:

$$\text{Perceived Carbon Reduction} = 0.731 + 0.403(X1) + 0.288(X2)$$

Summary of Hypothesis Testing

Table 1.5

Hypothesis	Statement	Result
H ₀₁	There is no association between awareness of the environmental benefits across demographic groups.	Accepted
H ₀₂	There is no significant difference between the environmental impact of physical cash and UPI transactions.	Rejected
H ₀₃	There is no significant difference between the environmental impact of physical cash and UPI transactions.	Rejected

FINDINGS & DISCUSSION

People like to use Unified Payments Interface because it's easy and fast. They do not really think about the environment when they choose how to pay for things.. If people know that using Unified Payments Interface is better for the earth than using cash they will use it more. A lot of people 78% say they will use Unified Payments Interface often if they know it helps the earth.

Using cash is bad for the environment because it uses a lot of paper and metal. People who know this are more likely to use Unified Payments Interface. People who care about the earth and want to save resources are more likely to think that using Unified Payments Interface is an idea. They think it will help reduce the things they do to the environment.

People know that using Unified Payments Interface is not perfect for the earth. They know that the computers that make it work use energy and make waste.. They still think that Unified Payments Interface is better for the earth, than using cash. They like Unified Payments Interface because it is easy and fast and it helps the earth.

In relation to what has been written these results support the Unified Theory of Acceptance and Use of Technology model by showing that important factors like trust and how easy something is to use are the

main reasons people start using a technology. However the results go beyond ways of looking at how people accept technology by showing that adding awareness about sustainability can help people use the technology more often. This matches research from Europe about green FinTech. Indian people have a starting gap in knowing about sustainability but they are similar to other Asian countries where using digital tools directly leads to less use of household resources. It is important to note that the Chi-Square test ($\chi^2 = 15.929$, $p = 0.458$) shows that problems like worries, about privacy (44.7%) and bad internet (22.7%) happen on their own not because of efforts to teach about issues. This means that FinTech companies and people who make rules need to deal with security and internet problems on their while also offering tools inside apps that help with sustainability ways to measure carbon savings and teaching people about these topics. This will help make sure that more people can use services and also help the country meet its environmental goals.

CONCLUSION:

This study demonstrates that while the Unified Payments Interface (UPI) has achieved widespread adoption in India primarily due to convenience and speed, its potential as a catalyst for environmental sustainability remains largely untapped by consumers. Although baseline green literacy is low, a significant majority of users express a strong willingness to increase digital payment frequency when informed of the environmental benefits, such as reducing paper and metal resource depletion. Statistical testing validates that heightened environmental consciousness and resource-saving preferences directly predict the belief that digital transactions reduce an individual's personal carbon footprint. Furthermore, users hold a mature, lifecycle-based perspective—acknowledging that while digital infrastructure and e-waste generate their own environmental costs, UPI remains a far cleaner alternative to physical currency logistics. Crucially, the empirical findings reveal that functional barriers to adoption—such as data privacy concerns and internet connectivity issues—operate independently from green literacy initiatives. Consequently, FinTech providers, banking institutions, and policymakers must decouple these challenges in their strategic execution. Infrastructure gaps and security risks must be addressed separately to build core user trust, while green digital literacy should be actively integrated through in-app sustainability tools, carbon savings dashboards, gamified rewards, and educational partnerships. By systematically bridging the gap between functional payment utility and environmental awareness, digital financial platforms can effectively align India's rapid FinTech expansion with broader national and global sustainability goal.

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