

Heuristic Exploration of Vital Parameters for Cash Transactions through Mobiles in the Coastal Hinterland of India [†]

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Abstract: The people of India sought digital modes of payment during the demonetization period in India (2016); with the increasing growth of the internet, electronic commerce (e-commerce) websites have become imperative for securely accessing payment gateways, encouraging the growth of digital payment processes and payment app development. During the pandemic, there was an exponential increase in mobile payments using smartphones. The usage of mobiles and their market penetration with government schemes such as ‘Digital India’ accelerated the use of mobile payments by a large percentage of customers in the coastal hinterland (Manipal) of India. This study aimed to analyze the critical factors influencing digital payments in the university town of Manipal. From the literature, 13 regressors were shortlisted, and their effect was measured against a behavioral intention to use mobile payments. A structured and validated questionnaire is used as a research tool for data collection that is analyzed using structural equation modeling. The structure equation modeling included using smart partial least squares (SPLS), in which path coefficients, t-statistics, and consistency tests were conducted. The investigation found that ease of use, social influence, perceived behavioral control, rewards and offers, credibility, compatibility, perceived cost, impact on the environment, and government schemes have a positive influence on m-payments. Social influence has a strong influence on m-payments and is a direct enabler of technology acceptance. The critical factors were identified by using smart PLS as being ease of use and social influence, which were identified as the critical factors concerning m-payments.

Keywords: heuristic exploration; coastal hinterland; mobile transactions; social impact; digital payments; structure equation modeling



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1. Introduction

Computer and communication systems are expanding at a tremendous rate. Nowadays, there is at least one area in every occupation that relies quite heavily on these systems. The term digitalization refers to using digitalized modes of transactions [1]. The first form of digitalization in India was introduced in the form of Automated Teller Machines (ATMs) in 1987 [2]. Mobile payment (also known as m-payment) usually refers to the cashless mode of payment or transaction made through mobile payment applications. It is necessary to opt for mobile payment to harness the massive potential lying dormant in computer and communication systems. When the possibility of utilizing high-end computer and communication systems is coupled with advanced end-to-end encryption of data, mobile payments can be made more secure, and people can be encouraged to opt for this mode

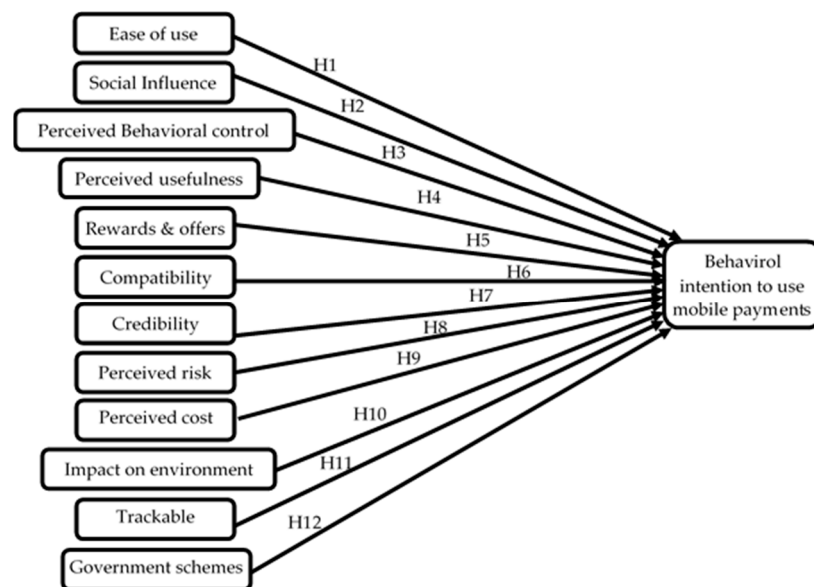
of payment. There has been increasing growth in the usage of internet access and mobile phones in recent years, which has led to the introduction of m-payments. Mobile penetration has been on the rise in the last couple of years. Therefore, high-speed internet services are available at nominal rates, and people perform transactions seamlessly and securely through m-payments. Government initiatives play an important role in promoting the use of mobile payments [3]. 'Digital India' is one of the first initiatives undertaken by the government to encourage people to opt for mobile payments, and it acted as a catalyst for increasing the use of this mode of payment. Popular mobile applications used for payment in India are PayTM, Google Pay, PhonePe, Mobikwik, and BHIM [4]. The modes of payment systems that were in use at some point time in India changed from the barter system (goods and services were exchanged for other goods and services in return) to an ATM (a system that has revolutionized the procedure of withdrawing money from the bank) [5]. Then, net-banking (transactions from one bank to another on a net-banking website or application provided by the bank is solely designed for banking) came, followed by the Unified Payments Interface (UPI), a payment mode designed by the National Payments Corporation of India that performs seamless transactions from one bank account to another through mobile devices, which all are regulated by the Reserve Bank of India [6].

Various theories have been postulated in the past, predicting the acceptance of this technology. The literature review is classified into economic theory, modernization theory, theory of reasoned action, technology acceptance model, social cognitive theory, Igbaria's model, and the Unified Theory of Acceptance and Use of Technology.

Economic theory: Some portions of the fascination and financial aspects guarantee that it professes to depict approaches that improve people's and groups' lives [7]. People who have knowledge of m-payments and their advantages will contribute to modern world economics. The adoption of modern beliefs for better economic growth explains the modernization theory [8]. **Technology Acceptance Model (TAM):** In 1989, Fred and Richard developed a model to foresee the social expectation of an individual playing out a role in undertaking the 'Theory of Reasoned Action.' The model predicts the acceptability of a tool and identifies the modifications to be made to the system to further enhance user acceptance [9]. **Unified Theory of Acceptance and Use of Technology (UTAUT):** The proposed model was based on applied and experimental likenesses crosswise over eight conspicuous contending innovation acknowledgment models [7,10]. UTAUT comprises four builds [11]. **Facilitating conditions:** How much the client trusts that the conditions are satisfactory for the viable utilization of the framework, including hierarchical preparation and foundation sufficiency. **Social influence:** The degree to which a user perceives that others who are essential to the user believe that the user should use the system. **Effort expectancy:** How much the client sees the framework as simple to utilize. This build includes scaling things from TAM. **Performance expectancy:** This dimension reflects the degree to which an individual thinks that the utilization of another innovation would improve their work. This build is incorporated as being apparent convenience in the TAM. Based on the literature review discussed, 13 regressors were shortlisted, and their effect was measured against a behavioral intention to use mobile payments, as presented in Table 1. From this, the following conceptual framework was developed, and the respective hypothesis for each factor was postulated, as depicted in Figure 1.

Table 1. Selection of the independent factors.

Factors	Source
Rewards and offers	Economic theory [7]
Ease of use	Technology acceptance model [9]
Perceived usefulness	Theory of planned behavior [12]
Perceived behavioral control	Theory of reasoned action [13]
Social influence	Modernization theory [14]
Perceived risk	
Perceived cost	
Impact on environment	
Trackable	Social cognitive theory [15–17]
Government schemes	
Compatibility	Compatibility is always a concern with the adoption of technology [18]
Credibility	Credibility is always a concern when financial institutions are involved [19]

**Figure 1.** The conceptual model of the investigation.

The operational definitions of the variables are given in this section, highlighting their relationships in terms of the present study. Ease of use: m-payments can be used to make a payment at any time from anywhere without physically going to the bank, provided that an individual has an internet connection on their device. For any innovation to succeed, individuals need to shape their propensity to use it and improve upon their current behaviors, and changing human behaviors does not occur on its own [16]. For an innovation to be accepted, it should be usable with basic knowledge. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H1: *Serious effect exists with ease of use and behavioral intention while making mobile payments.*

Social influence: Customers start using technology because somebody in their social circle has been using it. It often happens that the benefits of technology are realized when people around us start using it. In this modern world, younger generations are more comfortable with the latest technology, and thus, older generations often change their attitude toward technology due to general interactions with younger generations. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H2: *Serious effect exists with social influence and behavioral intention while making mobile payments.*

Perceived behavioral control: The introduction of new technology is always dependent on the availability of existing technology in the market. If older technology is available only to a small number of people, there is a chance that new technology will not be accessible. In the case of m-payments, the availability of mobile internet was essential for people to adapt to the payment system. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H3: *Far-reaching effect exists with perceived behavioral control and behavioral intention while making mobile payments.*

Perceived usefulness relates to the extent to which the effort of doing work is reduced with the adoption of new technology. The adoption of technology should increase the efficiency of work with reduced effort. For ordinary people, technology is of no use if it does not reduce the effort required when performing activities, and the technology will ultimately fail in terms of reaching people if this is not the case. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H4: *Serious effects exist with perceived usefulness and behavioral intention while making mobile payments.*

Rewards and offers: Everybody feels happy when they are rewarded. In this capital market, due to healthy competition between rival companies, consumers benefit from better prices or rewards associated with a product or service. Ultimately, the marketing strategies used by the company affect behavioral intentions when performing tasks. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H5: *Severe effect exists with rewards and offers and behavioral intention while making mobile payments.*

Compatibility refers to how well the innovation is compatible with a person's lifestyle. If the innovation is easily compatible with the existing product people are using without any significant upgrade, chances are there that people will adapt to it. The conjecture is about having no significant relationship between the parameter and m-payment.

H6: *Severe effect exists with compatibility and behavioral intention while making mobile payments.*

Credibility: Credibility applies to all companies involved in the payment market. Nowadays, companies are trying to be virtual, utilizing remote access and web platforms to reduce operating costs and provide better service to customers. Recently, no human interaction has been required when using a new service, leading to trust issues for some older generations. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H7: *There is a severe effect between credibility and behavioral intention to use mobile payment.*

Perceived risk: In the digital world, all of our data are stored in the cloud, increasing the number of threats in terms of privacy. Companies spend the right amount of money on network security to keep these data away from hackers. The adoption of innovative technologies will always involve risking personal information. People decide if the use of technology is worth the risk involved, thus affecting behavioral intention. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H8: *Serious effect exists with perceived risk and behavioral intention while making mobile payments.*

Perceived cost: The adoption of technology always involves some cost associated with it. The cost associated can be the initial cost or operating cost. If the cost involved is high, people always consider whether using technology is of good value or not. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H9: *Momentous effect exists with perceived cost and behavioral intention while making mobile payments.*

Impact on the environment: Recently, people have started to realize the importance of natural resources and the problem of their carbon footprint. People are trying their best to ensure that the Earth returns to a healthy state. Every small step contributing to reducing their carbon footprint plays a significant role. The modern age is a paperless age. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H10: *Momentous effect exists with the impact on the environment and behavioral intention while making mobile payments.*

Trackable: In the case of Digital India, most payment transactions are made electronically. To curb black money, the government has put up some strict regulations regarding the number of free cash transactions. Additionally, the government monitors any transactions above INR 50,000/-; thus, such transactions lack anonymity. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H11: *Severe effects exist with trackable and behavioral intention while making mobile payments.*

Government schemes: For the success of any innovation, government policies towards it play a significant role. Digital India is one of the initiatives taken by the government to support mobile payments for a cashless society. The conjecture concerns a lack of significant relationships between the parameters and m-payments.

H12: *Severe effect exists with government schemes and behavioral intention while making mobile payments.*

Demographic factors: Researchers suggest that people's age, gender, and level of education affect mobile payment usage. Generally, m-payments are used by younger generations that have some basic knowledge of phone usage.

2. Methodology

Market research is a means of exploring or performing fact-finding about markets or customers. It is highly useful as it provides data that can be further identified and analyzed for market requirements. Statistical and analytical methods are used to obtain results and derive conclusions. The following steps are used to conduct market research.

2.1. Formulation of a Questionnaire

A survey cannot be successful without a well-designed questionnaire. In a survey, the researcher tries to gather information with the help of the questions provided. A questionnaire is a very convenient way of collecting information from participants within a specific time. A questionnaire was constructed in accordance with all the factors pertaining to the study. The survey consists of 27 questions that are spread across two parts: Part A and Part B. Part A consists of 6 questions and deals with demographic factors such as gender, age, and educational qualifications. It also includes questions that the respondents could answer based on their opinions or preferences. Questions in this part follow a multiple-choice format. Part B consists of 21 questions that follow the Likert scale. Here, the questions are answered by ticking the feedback that best portrays how the respondent

feels about the statement, where 1—strongly disagree; 2—disagree; 3—neither agree nor disagree; 4—agree; and 5—strongly agree. The questions were formulated in such a way that they allowed people to judge the factors that influence mobile payment. The survey includes an introduction to the project and the reason for conducting the survey. It asks the respondent to kindly cooperate and do what is required. Respondents' viewpoints were collected at the closure of the survey in a suggestion box. After the construction of the questionnaire, it was validated by an expert in the research domain. After the validation, two suggestions were incorporated into the questionnaire. Questions were rephrased in the form of statements, and some of the questions were converted from the third person to the first person.

2.2. Pilot Study

A pilot study was conducted with a sample size of 30, which included students, teachers, shopkeepers, and delivery boys. It was carried out to ensure the validity of the factors in the context of a student town, Manipal. The survey was taken in person. Forty people were approached, of which thirty agreed to respond to the survey.

2.3. Data Collection

The next step after formulating a well-designed questionnaire is collecting the data, and the sample size and the expression for the computation are given in Equations (1) and (2) [17].

$$n = N \times X / (X + N - 1) \quad (1)$$

$$X = Z_{\alpha/2}^2 \times p \times (1 - p) / \text{MOE}^2 \quad (2)$$

Additionally, $Z_{\alpha/2}$ is the critical value of the normal distribution at $\alpha/2$ (e.g., for a confidence level of 95%, α is 0.05, and the critical value is 1.96), MOE is the margin of error, p is the sample proportion, and N is the population size. Here, $N = 50,000$; $Z_{\alpha/2} = 1.96$; $p = 14\%$; $\text{MOE} = 5\%$. Upon substituting them in the equation, the sample size is 185.

To collect data from students, a Google form was created, which was then circulated to various students using social media. The data were collected from various professors of the Manipal Institute of Technology. A consent form authorized by the Manipal Academy of Higher Education was also produced to the teachers for their cooperation. For those who were uncomfortable reading in English, questions from the survey were translated into Kannada or Hindi in the most neutral way possible by the authors. Data were collected from different individuals in Manipal, like students, professors, doctors, shopkeepers, businesspeople, delivery personnel, and various organizational set-ups. Approximately 330 people were approached, out of which 185 people responded.

2.4. Data Preparation and Analysis

After the collection of the data, they were prepared in a specific way such that the software was able to read and interpret the data. All the entries acquired during data collection were uploaded to the spreadsheet so that only the questions and the responses of Part B of the questionnaire were considered. Data entry is depicted in Table 2.

Table 2. Coded entry from questionnaire.

Q1	Q2	Q3	Q4	Q5	Q6
4	5	4	3	2	1
5	5	2	1	3	4
4	4	4	2	1	3
2	4	1	2	3	2
3	3	2	4	5	2

The data were imported as a new project on Smart PLS, and the data were uploaded. The software calculates the mean, median, standard deviation, excess kurtosis, and skewness of each question and the data.

The initial results (from SPSS) show the outline of the participants' patterns of response to each question (Table 2). However, the results obtained to find the critical factors using PLS were used. A New Path Model was constructed on Smart PLS with the help of latent variables. Latent variables are defined as those that cannot be determined directly but are the ultimate objective of the research. The nature of the latent variable depends upon the nature of its associated indicator variable [10].

In this research design, the factors that influence the usage of m-payments are considered latent variables, and the questions associated with them are considered indicator variables. The model was developed by constructing 13 latent variables, of which 12 are the factors influencing the use of m-payments. The latent variables need to be named as the different factors, re-arranged, and connected to develop relations between the variables. Here, the 12 factors are entirely independent, whereas the use of m-payments is dependent on all these factors. After constructing the new path model, the questions that act as indicator variables are related to their corresponding factors, as shown in Figure 2. Once the indicators and latent variables are successfully linked together in Smart PLS (i.e., no more red-color circles and arrows), the path modeling procedure can be performed using the PLS algorithm.

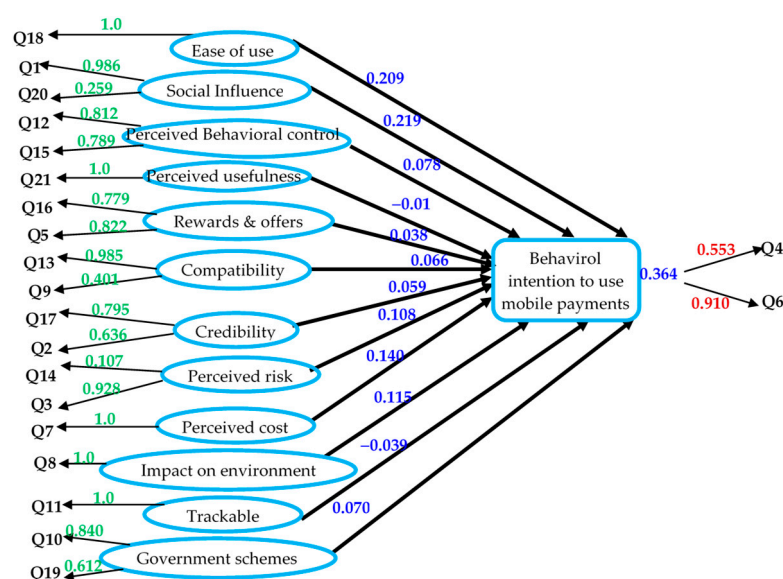


Figure 2. Path coefficient values using SEM.

PLS regression is a new technique that generalizes and combines features from PCA and multiple regression [11] and is extremely useful when predicting a set of outcome variables from a large set of predictor variables. Upon stimulation via the PLS Algorithm, two types of results are produced: The numbers in the circle depict the variance of the latent variable explained by the other latent variables. The numbers on the arrows depict the path coefficients, which indicate the dominant effect of one variable on another. The weight of various path coefficients is used to rank their relative statistical importance. The factors that are considered to influence the use of m-payments are independent of each other. Hence, there are no numbers inside the circle. Path coefficients of each factor are determined in the path model itself.

3. Results and Discussion

3.1. Results of the Pilot Study and Main Study

The results from the pilot study shown in Figure 3 indicate that perceived usefulness (0.390) has the strongest effect on the usage of m-payments. It is followed by the impact on the environment, which indicates that people are aware that m-payment methods can be a substitute for debit cards and credit cards that are made of plastic. Factors like compatibility (-0.066), ease of use (-0.200), perceived risk (-0.010), perceived behavioral control (-0.269), rewards and offers (-0.196) and trackable (-0.0492) have negative path coefficients, indicating that they have no positive effects on the usage of m-payments.

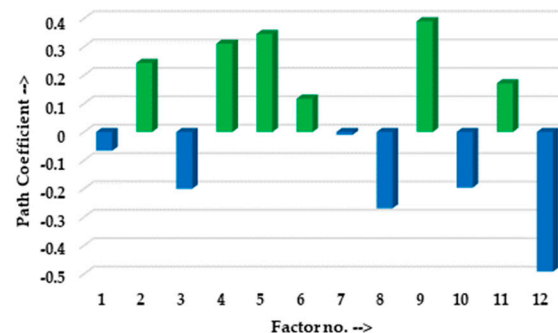


Figure 3. Bar graph of the path coefficients versus factors (pilot study).

The results obtained from the pilot study cannot be used to identify critical factors due to the small sample size of 30. The results obtained from the main study indicate that social influence (0.219) has the strongest effect on the usage of m-payments, as shown in Figure 4. It means that people in Manipal have adapted to m-payment methods by observing their peers. They realized that it was an efficient way to transfer money to their peers. The findings suggest that social influence has a direct impact on technology acceptance. It also indicates that people prefer m-payment methods due to ease of use (0.209). M-payment is relatively comfortable and easy to use compared to other modes of payment like debit or credit cards. The procedure followed is not tedious and can be understood by most individuals. It is also observed that perceived risk (-0.108) has the least or no effect on the usage of m-payment methods. It is because Manipal is an education town, and the majority of the population includes students. Students do not worry much about using a payment system since they are dependent individuals and are not working professionals yet. In addition, the bar graph shows that perceived usefulness (-0.014) and trackable (-0.039) variables have negative path coefficients. This can be explained by the fact that the majority of the sample were students, and the student community does not generally keep their expenses in check. Students mainly adopt the payment methods used by the people who are important to them.

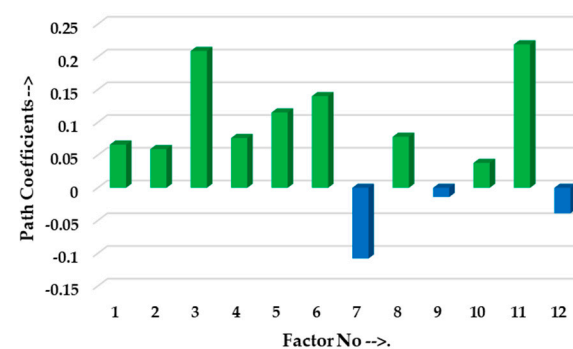


Figure 4. Bar graph of the path coefficients versus factors (main study).

To identify the critical factors considered in the study, bootstrapping was performed in smart PLS. It produced t-statistics values, which indicate the criticality of the factor. The procedure that calculates the test statistic compares collected data to what is expected under the null hypothesis. So, if the sample size is big enough, it can be said that the t value is significant. In the present study, if the absolute t-value is higher or equal to 1.96, then those factors are critical. The above t-statistic values indicate that ease of use (2.469) and social influence (2.277) are the critical factors, as presented in Table 3.

Table 3. Results of t-statistics.

S. No	Factors	t-Stat	Hypothesis Accepted	S. No	Factors	t-Stat	Hypothesis Accepted
1	Ease of use	2.46	Validated	7	Creditability	0.61	Null hypothesis
2	Social influence	2.27	Validated	8	Perceived Risk	1.02	Null hypothesis
3	Per. Behavioral control	0.83	Null hypothesis	9	Perceived Cost	1.51	Null hypothesis
4	Perceived usefulness	0.18	Null hypothesis	10	Impact on Environment	0.77	Null hypothesis
5	Rewards and offers	0.48	Null hypothesis	11	Trackable	0.50	Null hypothesis
6	Compatibility	0.710	Null hypothesis	12	Govt. Schemes	1.468	Null hypothesis

Cronbach's alpha: Cronbach's alpha is a measure of scale reliability as well as the measure of internal consistency, that is, how closely related the set of items is as a group. Cronbach's alpha reliability coefficient normally ranges between 0 and 1. However, there is no lower limit to the coefficient. The closer the Cronbach's alpha coefficient is to 1.0, the greater the internal consistency of the items in the scale, as based on Equation (3).

$$\alpha = r \times k / [1 + (k - 1) r] \quad (3)$$

where k is the number of items considered, and r is the mean of the inter-item correlations [20]. The size of alpha is determined by both the number of items in the scale and the mean inter-item correlations. A negative number indicates that something is wrong with the collected data. The statistical significance of all the items in a measurement model results in convergent validity. The validity could also be verified through average variance extracted (AVE) [21]. Cronbach's Alpha and AVE values of factors are presented in Table 4.

Table 4. Cronbach's Alpha and AVE values of factors.

S. No	Factors	Cronbach's Alpha	AVE	S. No	Factors	Cronbach's Alpha	AVE
1	Ease of use	1	1	7	Creditability	0.07	0.52
2	Social influence	0.17	0.52	8	Perceived Risk	0.42	0.43
3	Per. Behavioral control	0.44	0.64	9	Perceived Cost	1	1
4	Perceived usefulness	0.42	0.43	10	Impact on Environment	1	1
5	Rewards and offers	0.44	0.64	11	Trackable	1	1
6	Compatibility	0.38	0.56	12	Govt. Schemes	0.18	0.54

3.2. Discussion

The value of AVE should be greater or equal to 0.5 to achieve the validity and reliability of the factors, as shown in Table 4. It is inferred that factors that have a Cronbach's Alpha values of less than 0.5 are inconsistent because people have entered different responses for the questions that have the same background. Convergent validity is obtained since the values of AVE are greater than 0.5 except for perceived risk (0.436), although it is very close to 0.5. The results obtained from the study are in agreement with recent studies available in the literature [4,5].

4. Conclusions

The demographic characteristics of the survey were obtained from the reformed data. These characteristics were further analyzed using Smart PLS, in which path coefficients, t-statistics, and consistency tests were conducted. According to the t-statistics test, ease of use and social influence are the critical factors influencing the usage of m-payments. M-payments should be perceived as one of the ways of curbing environmental pollution. The survey data were collected using convenient sampling. The samples were collected from people who use m-payments regularly. This ensures that people have complete knowledge of how the payment system works. To rectify this, data should also be collected from people who have negative remarks about this technology. A large part of the sample consisted of students, out of which most of them were male. Hence, the results are biased towards the opinions of the young generation.

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