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An Empirical Study of User Adoption of Cryptocurrency Using Blockchain Technology: Analysing Role of Success Factors like Technology Awareness and Financial Literacy

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Abstract: The study aims to investigate how an individual's technology awareness, subjective financial literacy and personal innovativeness characteristics impact the intention to use blockchain-based digital currencies such as cryptocurrency. The UTAUT 2 (Unified Theory of Acceptance and Use of Technology 2) model is extended with crucial constructs to develop the conceptual model. A total of 312 responses are analysed using Covariance-Based Structural Equation Modelling (CB-SEM). The moderation effects are assessed using multi-group analysis. The findings show a significant moderating effect of technology awareness and subjective financial literacy on the relationship between performance expectancy (PE) and behavioural intention to use cryptocurrency (BI). It further identified that performance expectancy (PE) mediates personal innovativeness (PI) and usage intentions (BI). The study adds to the growing literature of digital currency adoption by focusing on individual innovativeness, technology awareness and financial literacy. It also proposes a research model that can be generalised for new-age consumer-based financial technology adoption.

Keywords: blockchain; cryptocurrency; UTAUT2; user adoption; digital currency

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1. Introduction

Blockchain technology can transform financial and non-financial domains with its application [1]. In recent years, blockchain has become the base technology to solve multiple perennial financial problems such as double spending [2], speeding up payment [3], lowering transaction costs, interoperability [4] and asset digitisation [5]. One of the most discussed applications of blockchain in industry and academics is its capability to power digital currency [6]. The revolution started with the launch of the first digital currency, Bitcoin [7]. Digital currency is a financial innovation that can disrupt financial services, and its development can fundamentally impact the financial ecosystem and business [8]. The benefits of digital currency are numerous, such as security, resistance to manipulation, the programmability of money [4] and efficiency gains [9]. Cryptocurrencies, stablecoins and CBDC (Central Bank Digital Currency) are the three major kinds of digital currencies [10]. Due to such a wide range of benefits, multinational companies such as Microsoft, Paypal and Starbucks accept payment in digital currencies such as cryptocurrencies. Consumers can pay in more than 40 digital currencies while booking rooms at hotel chains such as The Pavilions Hotels & Resorts [11]. Central banks globally are working on the research, development and piloting of digital currencies [12,13]. Countries such as the Central African Republic (CAR) and El Salvador, which has a seventy per cent (70%) unbanked population, have adopted Bitcoin [14]. Cryptocurrencies can fulfil broader goals of efficiency in payment systems and financial inclusion [3]. Digital currency is defined as money with an embedded decentralised payment mechanism using a distributed ledger by the Bank of

International Settlements [15]. The Australian Accounting Standard Board (AASB) defined digital currency as "a form of exchange that only exists digitally and is not linked to any physical currency" [16].

The above discussion shows that digital currency is a new kind of electronic money involving innovative technology (blockchain) to execute financial operations (payments, transfers, lending and deposits). Researchers Kim et al., Salcedo and Gupta and Solberg Söilen et al. [17–19] identified the need to understand the role of consumer acceptance in making digital currencies sustainable and successful as an innovation. Being in its growing phase, Molina-Collado et al. [20] have called for research on consumer behaviour phenomena towards cryptocurrencies. Kim [21] called for research on the technological aspects impacting consumer behaviour towards the use of cryptocurrency. We respond to the calls of Molina-Collado et al. and Kim [20,21] by examining the behavioural intention to use cryptocurrency.

The literature on consumer behaviour towards digital currency is emerging, and there is a huge scope to dive deep into the consumer perspective. Research on consumer behaviour towards digital currency has focused on the adoption of cryptocurrency [22,23] and CBDC adoption in households [19] and in industries such as tourism [17,24]. Sohaib et al. [25] investigated the impact of technology readiness on cryptocurrency adoption. Kim [21] combined the theory of planned behaviour with money attributes to investigate the finance-related behaviour of consumers to use Bitcoin in the Covid era. At the same time, Salcedo and Gupta [18] assessed how an individual's national cultural values influenced people's willingness to use blockchain-based money as a spending currency.

However, there is a scarcity of research that examined consumer adoption through the lens of individual characteristics such as innovativeness, technology awareness and subjective financial literacy, which is crucial to understand the intention to use new age currencies [21,26,27]. Kim et al. [17] identified that highly innovative consumers would search for information on digital currency and hence would gain more financial and digital literacy to evaluate the usage of digital currencies in the tourism industry. The awareness of blockchain technology also helped individuals perceive the benefits of Bitcoin [28].

Hence, the following research questions summarise the objective of our study:

RQ1: What factors influence the behavioural intention to use blockchain-based digital currencies such as cryptocurrencies?

RQ2: How does personal innovativeness influence the behavioural intention to use cryptocurrencies?

RQ3: How does technology awareness influence the intention to use cryptocurrencies?

RQ4: How does subjective financial literacy influence the intention to use cryptocurrencies?

The scope of the study considers cryptocurrency, a subclass of digital currency [29], to study user adoption because of its user base and early usage compared to other digital currencies. The purview of the paper is to study user intention to use cryptocurrency. It is not focused on any one specific cryptocurrency. The study is conducted in India, which is expected to have a user base of 156 million cryptocurrency users in 2023, making it the second largest user base in the world with 304 million cryptocurrency users by 2027 as per a report by Statista [30,31]. In this study, we have used a survey-based approach to collect data from respondents in India who had at least basic awareness about cryptocurrency (Appendix A). We have applied a covariance based structural equation modelling (CB-SEM) method to analyse the responses and infer the results. Our study contributes in multiple ways. Firstly, it identified how users' intention to use blockchain-based digital currencies such as cryptocurrencies is directly impacted by "performance expectancy", "social influence" and "trust". Secondly, it unravelled how personal innovation indirectly influences the intention to use cryptocurrency via performance expectancy. Furthermore, personal innovativeness also influences performance expectancy as well as effort expectancy associated with using cryptocurrencies. Thirdly, it validated the moderating role of technological awareness in impacting behavioural intention and addresses the call of Kim [21] by studying the role

of technological aspects in cryptocurrency adoption. Fourthly, the study also empirically verifies the moderating role of subjective financial literacy in impacting users' behavioural intentions of using cryptocurrencies.

2. Literature Review

2.1. Blockchain Technology

Tapscott and Tapscott [32] describe the attempts made by innovators in early 1981 to introduce encryption to address the internet industry's struggles with security, privacy and inclusiveness that affected business over the internet. However, the effort to use encryption failed due to the participation of third parties. Similarly, the present financial system works effectively but lacks a trust-based approach [7]. The blockchain protocol, which was first proposed in 2008, is a set of rules that ensures the integrity of data shared among billions of devices without going via a reliable third party [32].

Beck et al. [33] defined blockchain as a "distributed ledger technology in the form of a distributed transactional database, secured by cryptography, and governed by a consensus mechanism". Tapscott and Tapscott [32] describe it as a global ledger or spreadsheet that verifies and approves transactions utilizing a large peer-to-peer network. According to [32], there is no central database to be hacked because each blockchain is decentralised and runs on computers offered by users across the globe. A blockchain is both secure and public at the same time because of encryption.

When a person wants to add a transaction to the blockchain, he/she sends the transaction to the blockchain network, which is then verified by participating nodes (miners) using a cryptographic algorithm [34]. Several transactions form a block, added to the blockchain after the peer-to-peer network forms a consensus on its validity [35]. The consensus on validity requires proof of work performed by volunteering nodes (miners) in the network. It is practically not possible to tamper with the transactions within a valid block. Every transaction on the blockchain is tracked, and tampering with a specific transaction would require changes in previous blocks [35]. According to Underwood [35], blockchain technology can potentially enhance supply chains, prevent a repeat of the 2008 financial crisis and provide individuals in developing nations with recognised identities, asset ownership and financial inclusion.

Pilkington [36] presents the timeline of blockchain, which dates back to 1974 with the concept of TCP/IP protocol, a key enabler of blockchain technology created by Vinton Cerf and Robert Kahn. The concept of proof-of-work consensus originated from the "hash cash" proof-of-work algorithm by Adam Back. In 1996, Nick Szabo's smart contract was introduced. In 1997, Wei Dai's distributed electronic cash system 'b-money' was introduced. Following this, Nick Szabo started the work of "bit gold". The notable introduction to Bitcoin and its underlying technology blockchain was first penned down in the whitepaper.

The applications and transactions that previously required a verification step through a centralised architecture or a trusted third party can run without a middle agent because of blockchain technology, causing significant transformation to traditional business processes [32]. The properties of blockchain—traceability, decentralisation, auditability, anonymity and security—make it worthwhile for multiple domains such as logistics, education, healthcare, property management and finance [6,37].

Our study focuses on the role of blockchain technology in powering digital currencies such as cryptocurrency. We see that blockchain has introduced numerous novel properties into currencies. These properties have improved the payment system and benefitted users and businesses [4]. Hence, studying the drivers influencing the acceptance of blockchain-based digital currency becomes vital.

2.2. The Unified Theory of Acceptance and Use of Technology 2

The extant literature has testified to the importance of the Technology Acceptance Model (TAM) and its variations in explaining the adoption of financial innovations [8]. TAM has offered a credible and accurate model of user technology adoption; however, it

has drawn criticism due to providing relatively generic data about consumers' perceptions of emerging technology [38]. To overcome the limitations of TAM and attain a unified perspective on user adoption of new technology, Venkatesh et al. [39] developed the UTAUT (Unified Theory of Acceptance and Use of Technology) model by unifying eight theories.

UTAUT was introduced for the organisational context and later extended to the consumer context as UTAUT 2 by Venkatesh et al. [40] with novel constructs—hedonic motivation price value and habit in addition to the existing constructs. The theory emphasises the role of "effort expectancy", "social influence" and "performance expectancy" in determining the user's behavioural intention to use technology [40]. The behavioural intention to use and facilitating conditions impact user behaviour. "Effort expectancy" refers to "the degree of ease associated with consumers' use of technology". "Performance expectancy" describes "the degree to which using a technology will provide benefits to consumers in performing certain activities". "Social influence" is defined as "the extent to which consumers perceive that important others (e.g., family and friends) believe they should use a particular technology". "Facilitating Conditions" is the degree of user "perception that resources and support are available to perform a behaviour" [40].

UTAUT and UTAUT2 have been extended by incorporating relevant constructs such as personal innovativeness, trust and risk to determine the adoption of emerging financial technology domains such as m-payments [41–43], internet banking [43,44] and internet-based crowdfunding [45]. Digital currencies are currently in their nascent stage and built on a new backend technology of blockchain that generates multiple new propositions such as decentralisation, programmability, immutable transactions and auditability of money for users. Hence, we extended the UTAUT2 model with personal innovativeness [46], trust [47] and perceived risk [48], along with technology awareness [49,50] and subjective financial literacy [51] as moderators.

For our study, we have employed UTAUT2 but have not considered hedonic motivations because of the absence of fun or pleasure (hedonic) in using digital currencies for traditional finance purposes. We have also not considered price value and habit because digital currencies are new to consumers, and sufficient time is required for perceiving the price and value trade-off as well as habit formation. We present the relevant studies on digital currency adoption in Table 1.

Table 1. Digital currency adoption studies.

Authors	Focus of the Study	Theoretical Foundation
Salcedo and Gupta [18]	Examine the willingness to use blockchain currencies based on national cultural values.	Hofstede's framework of national culture
Solberg Söilen et al. [19]	Examine household acceptance of CBDCs (central bank digital currencies)	UTAUT and institutional trust theory (ITT)
Kim [21]	Understand usage behaviour of Bitcoin in the Covid-19 era through a psychological approach.	Theory of Planned Behaviour (TPA) and money attitudes
Kim et al. [17]	Study CBDC as a payment method adoption in the tourism sector	Attention, Interest, Desire, and Action (AIDA) model
Esmaeilzadeh et al. [52]	Proposed a moderated-mediation model developed through qualitative research to study the adoption of cryptocurrency.	UTAUT and utility theory
Shahzad et al. [23]	Examine the adoption of cryptocurrencies by people in China	Technology Acceptance Model (TAM) extended with Awareness, Perceived Trustworthiness
Arias-Oliva et al. [53]	Understanding the variables impacting behavioural intention to use cryptocurrency in Spain	Extension of Technology Acceptance Model (TAM) with perceived risk and financial literacy
Albayati et al. [22]	Investigate consumer behaviour towards financial transactions based on blockchain technology and cryptocurrency.	Technology Acceptance Model (TAM) with external variables: design, experience, social influence, regulatory support and trust
Sohaib et al. [25]	Understanding cryptocurrency adoption combining technology readiness dimension and TAM using SEM and ANN	Technology Acceptance Model (TAM) with Technology Readiness (TR)

3. Hypotheses Development and Conceptual Model

3.1. Personal Innovativeness

Personal innovativeness is a crucial characteristic of an individual that influences the adoption of an innovation and signifies individual willingness to accept a novel technology [54]. Agarwal and Prasad [46] posited personal innovativeness as an individual trait and defined it in the specific domain of IT as "the willingness of an individual to try out any new information technology". In the context of digital currency adoption, Kim et al. [17] find that consumers with high innovativeness are more inclined towards the trial intention of digital currencies. Similarly, Nazifi et al. [26] observed that innovativeness amplified the effectiveness of cryptocurrency compensation on recovery satisfaction. Hence, we propose the following:

H1a: *Personal innovativeness (PI) will positively influence the behavioural intention to use cryptocurrencies (BI).*

On the other hand, empirical studies found the positive influence of personal innovativeness (PI) on the perceived usefulness of wireless technology [55] and online check-in [56], whereas Twum et al. [57] found PI impacting performance expectancy (PE) for e-learning. Innovation characteristics lead to the search for new information [54] to satisfy one's curiosity; hence, in the process, an individual gains knowledge to evaluate the usability of digital currencies [17]. Therefore, personal innovativeness will eventually help understand the performance gains from using digital currencies. Therefore, we hypothesise the following:

H1b: *Personal Innovativeness (PI) will positively influence the performance expectancy (PE).*

Personal innovativeness is also a significant antecedent of PEOU (perceived ease of use) in distinct contexts of mobile-based financial services [58], wireless technology [55] and mobile commerce [55]. Innovativeness leads to more information about technology, hence increasing the likelihood that a person will think the technology as simple to use and less complicated [56]. In this study, we propose that innovative individuals are skilful and knowledgeable and hence would overcome the complexity and effort required to use digital currencies.

H1c: *Personal Innovativeness (PI) will positively influence the effort expectancy (EE).*

3.2. Performance Expectancy and Effort Expectancy

Performance expectancy (PE) is a significant determinant in impacting the behavioural intention to use a novel technology [40]. It depicts the extent to which an individual perceives that using technology will help him/her improve performance, mainly fast transactions, speeding up payment, lowering transaction costs and auditability in the context of blockchain-based digital currencies. Solberg Söilen and Benhayoun, and Arias-Oliva et al, [19,53] reported that PE significantly impacts the behavioural intention to use cryptocurrency and CBDC, respectively. Hence, we propose the following:

H2: *Performance expectancy (PE) will positively influence the behavioural intention to use cryptocurrencies (BI).*

Effort expectancy (EE) is associated with the "degree of ease associated with the use of the system" [40]. EE, or perceived ease of use (PEOU) [59], is a crucial determinant of behavioural intentions in the adoption of digital currency [19,23], open banking [60], mobile banking [61] and mobile payments [38,62]. It signifies that an individual is willing to employ a financial/banking technology if he/she perceives it as simple and does not need much hard work [43]. For digital currencies, easy onboarding to currency network, user interface and functionality may positively determine user intention to use cryptocurrencies. Hence, we anticipate the following:

H3: *Effort expectancy (EE) will positively influence the behavioural intention to use cryptocurrencies (BI).*

Several financial technology adoption studies such as open banking [60], internet banking [63], mobile financial services [58] and mobile banking [64] validated that effort expectancy positively impacts the performance expectancy of users towards the usage intentions of new technology. Davis [59] confirmed that perceived usefulness is positively impacted by ease of use. We anticipate that the ease of operations associated with blockchain-based digital currencies would influence the performance expectancy. Therefore, we propose the following:

H4: *Effort expectancy (EE) positively influences the performance expectancy (PE).*

3.3. Social Influence

Social influence (SI) reflects the extent to which one perceives that other significant ones who are important believe the user should use the new technology. It represents subjective norms and is a direct positive determinant of behavioural intentions. Interpersonal influence or opinions of social influencers such as family, relatives or friends impact an individual intention to adopt new financial technology such as open banking [60], mobile payments [38], mobile banking [43,63] and digital currencies [19,53]. Rogers [54] identified that early adopters of technology depend on social interaction and participation for information. Hence, we propose the following:

H5: *Social influence (SI) significantly influences the behavioural intention to use cryptocurrencies (BI).*

3.4. Facilitating Conditions

Using digital currencies requires users to learn specific skills such as setting up and connecting to the currency network. According to Oliveira et al. [65], users are more likely to embrace and use banking technology to perform specific tasks if they believe that the infrastructure and support needed to do so are available. Hence, we propose the following:

H6: *Facilitating Conditions (FC) positively influence the behavioural intention to use cryptocurrencies (BI).*

3.5. Trust

Trust (TR) is crucial in the adoption of an innovation [47,66]. Based on psychology and sociology studies [47], trust is a set of beliefs that the other party would fulfil their expected commitments. Trust is crucial to adopt digital currency for performing transactions [67,68] and a necessary condition for digital transactions [69]. Trust significantly influences behavioural intention to use mobile banking and mobile payment adoption [62,64,70]. New-age financial innovations such as cryptocurrency [66], CBDC [19] and open banking [60] observed trust as a significant factor for adoption. In this study, we hypothesise the following:

H7: *Trust (TR) significantly influences behavioural intention to use cryptocurrencies (BI).*

3.6. Perceived Risk

Risk and uncertainties are inherently associated with innovation [71]. Perceived risk (PR) is consumers' perceptions about the negative outcomes of uncertain situations [72]. Researchers have confirmed the role of risk in impacting the adoption of financial innovations such as mobile payment [73] and open banking [60]. Digital currencies as new financial innovations are also associated with technological risks due to practical design and implementation and financial risks due to volatility [74]. So, in this study, we propose the following:

H8: *Perceived risk (PR) negatively impacts the behavioural intention to use cryptocurrencies (BI).*

3.7. The Mediating Role of Performance Expectancy

Personal innovativeness influences innovation adoption as it assimilates an individual's natural disposition to try out innovations and appreciate the performance gains [75]. Perceived usefulness can mediate personal innovativeness [76] because, during the initial

adoption phase of an IS innovation, intense curiosity and boldness can powerfully amplify the perceived benefits of the innovation [55]. In line with Lu et al. [55], performance expectancy may mediate the relation of personal innovativeness leading to behavioural intention to use cryptocurrency. We propose the following:

H9: *Performance expectancy (PE) mediates the relationship between personal innovativeness (PI) and behavioural intention to use cryptocurrencies (BI).*

3.8. The Moderating Role of Technology Awareness

Awareness is instrumental in technology adoption and was first highlighted in IDT theory (Innovation Diffusion Theory) by (Rogers, 1995). According to Dinev and Hu [49], awareness refers to how much a target group is apprised of innovation and has an idea of what it entails. In reference to blockchain technology, the awareness of technology has significantly impacted the intended advantages of using blockchain databases [50]. Mattke et al. [28] found that blockchain awareness and knowledge might shape how users perceive Bitcoin's benefits. The underlying features of blockchain-based applications can benefit users in numerous ways, such as protecting user personal information from unauthorised access and fraud due to its inherent properties of immutability, detection of data tampering and transparency [50]. Hence, in this study, we hypothesise that higher technology awareness about blockchain-based digital currencies might lead to high-performance gains and amplify the behavioural intention to use the currencies for payment. We propose the following:

H10: *Technology Awareness (TA) moderates the effect of performance expectancy on behavioural intention to use cryptocurrencies (BI).*

3.9. The Moderating Role of Subjective Financial Literacy

Financial literacy (FL) refers to one's confidence and ability to manage finances through long-term planning and short-term financial decision-making while keeping in mind economic circumstances and life events [77]. With the increasing attention on financial literacy from academics, the term has taken a variety of meanings [51]. Most researchers agree that there are two dimensions to financial literacy—" subjective financial literacy" and "objective financial literacy" [78–80]. Objective financial literacy (OFL) refers to the actual knowledge of the user, whereas subjective financial literacy (SFL) refers to one's perceptions or confidence in financial literacy [51,81]. Financial literacy has gained broad interest in various financial behaviour studies but received less attention in technology adoption that may change financial behaviour [60]. As blockchain-based digital currencies are a technological innovation that would be used for financial purposes, the financial literacy level of a user may decide how a user appreciates the blockchain-based currencies. In line with Chan et al. [60], we hypothesise that financial literacy has a moderating role because financial literacy relates to the knowledge to understand what blockchain-based digital currency offers. In addition, we have considered subjective financial literacy in our research, as [51] assert that in contrast to objective test-based literacy measures, an individual's self-reported financial literacy or the SFL has independent predictive power for financial outcomes.

H11: *Financial literacy (FL) moderates the effect of performance expectancy on behavioural intention to use cryptocurrencies (BI).*

4. Methodology

We developed the questionnaire for data collection using the existing literature (Appendix A). We adapted the items for "performance expectancy", "effort expectancy", "social influence" and "facilitating conditions" from [40] and modified them in the context of cryptocurrency adoption [19,53]. Scales for personal innovativeness [73], trust [82], perceived risks [48,83] and technology awareness [49,50] were also adapted. For financial literacy scales for items, FL1 is adapted from [84], and FL2 and FL3 are adapted from [51,53].

We used a seven-point Likert Scale (7 = "strongly agree" to 1 = "strongly disagree") as the measurement scale. To further ensure the unambiguity and clarity of the items, face validity and content validity were realised by five scholarly experts and two industry consultants working in the digital currency domain. In order to identify the appropriate sample size for utilizing the regression approach in our study, we used G*Power 3.1.9.7 software to perform a priori power analysis with required parameters of 9 predictors (Figure 1), with a moderate effect size of value 0.15, a test power level of 90% and a maximum error allowed of 5%. The minimum adequate sample size was calculated as 141. A pilot test with 45 respondents was conducted, and exploratory factor analysis (EFA) was performed. All the items loaded significantly under the respective constructs; hence, the adapted questionnaire was used for further data collection.

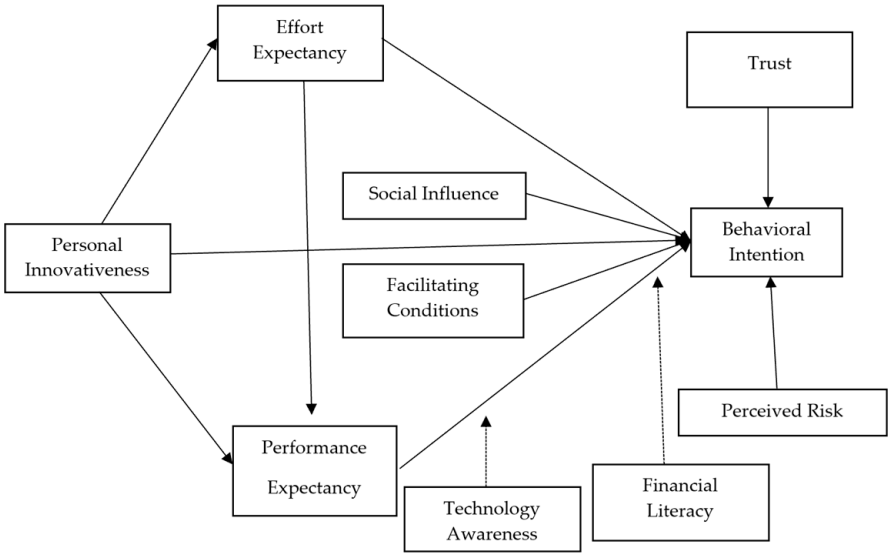

Figure 1. The Conceptual Model.

We adopted an anonymous and voluntary participation approach to collect the survey data. Data was collected in major cities of India (Bengaluru, Chandigarh, Delhi, Hyderabad, Kanpur, Mumbai and Ranchi), which are well positioned for the survey with a considerable number of users with cryptocurrency usage experience [30]. The data was collected using purposive sampling.

A self-administered survey questionnaire link was sent to prospective respondents through email and social media networks covering all parts of India. The respondents were employees of technology or a management company and students enrolled in master's or doctoral level technology or management courses in national universities of India who possess some knowledge about digital currencies. A total of 329 responses were received over three weeks. A basic awareness question about cryptocurrencies (Appendix A) was put to identify the appropriate sample. Seven (7) samples reported that they had never heard of any digital currencies; hence, their responses were discarded. After removing ten (10) unengaged responses, we selected 312 responses for further analysis. The sample characteristics of the qualifying sample are presented in Table 2.

Table 2. Sample characteristics.

	Frequency	Percentage
Age (in years)		
18–25	170	54.5%
25–35	104	33.4%
36–45	31	9.9%
Above 45	7	2.2%
Gender		
Male	228	73.1%
Female	84	26.9%
Annual Income		
Less than five lakhs	177	56.7%
Between 6 and 15 lakhs	89	28.5%
Between 15 and 25 lakhs	24	7.7%
Between 25 and 40 lakhs	9	2.9%
Above 40 lakhs	13	4.2%
Highest Education		
Graduate	174	55.8%
Postgraduate	125	40.1%
Doctorate	13	4.1%
Total	312	100

5. Data Analysis and Results

5.1. Structural Equation Modeling

The present study employed Covariance-Based Structural Equation Modelling (CB-SEM) to analyse the primary data using SPSS AMOS version 23 software. We have used CB-SEM method because our research objective is theory testing and confirmation of the relationships. CB-SEM has several benefits over other types of SEM approaches. It uses a Maximum Likelihood Estimation (MLE) procedure which provides stable and valid results [85]. CB-SEM can account for "measurement error in both the predictive and outcome variables" [86], "providing a more accurate estimate of the model parameters [87,88]". CB-SEM assumes the data to be normal. Hence, we conducted the normality test for each indicator using the skewness and kurtosis test. The skewness and kurtosis value were within the suggested range of −1 to 1 [89,90].

The equation for our structural equation model is expressed below. Let the general equation for the structural model be

$$\eta = \gamma\xi + \beta\eta + \zeta$$

where η is the endogenous construct, γ is the relationship between the exogenous constructs to endogenous constructs, ξ_m is the exogenous construct and m is the number of exogenous construct. ζ is the measurement error for η_n and n is the number of endogenous constructs. β is the relationship between endogenous constructs to endogenous constructs" [91]. The path diagram of the structural equation is presented in Figure 2. The structural equation for our proposed model is as follows:

$$\eta_1 = \gamma_{11}\xi_1 + \beta_{12}\eta_2 + \beta_{13}\eta_3 + \gamma_{12}\xi_2 + \gamma_{13}\xi_3 + \gamma_{14}\xi_4 + \gamma_{15}\xi_5 + \zeta_1$$

$$\eta_2 = \gamma_{21}\xi_1 + \zeta_2$$

$$\eta_3 = \gamma_{31}\xi_1 + \beta_{23}\eta_2 + \zeta_3$$

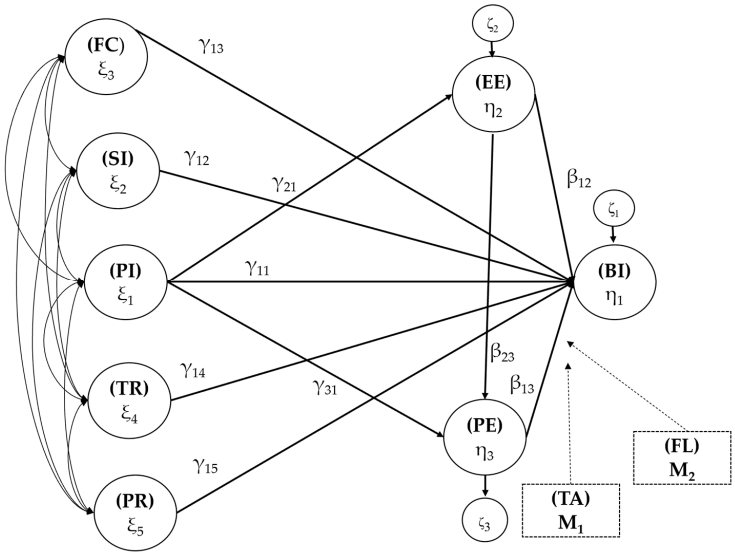

Figure 2. Path diagram.

The mediation effect hypothesised in the study is represented in Figure 3

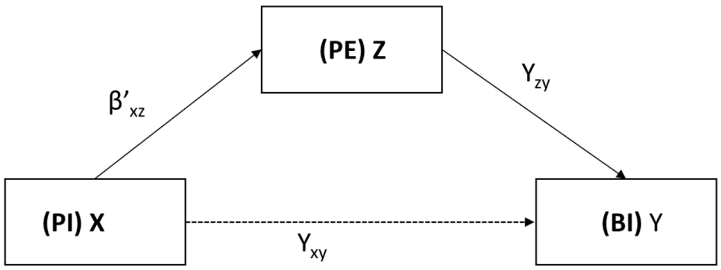

Figure 3. Mediation effect.

Let X be the independent variable, Z be a mediator and Y be the dependent variable. The direct effect for the path X→ Y(PI→BI) is as Y_{xy} and the indirect effect is the product of β'_{xz} and Y_{zy}. Hence, the total effect is the sum of the direct and indirect effects on the dependent variable is represented as $Y = Y_{xy} + \beta'_{xz}Y_{zy}$ [92,93].

The moderation effects are represented in Figure 4.

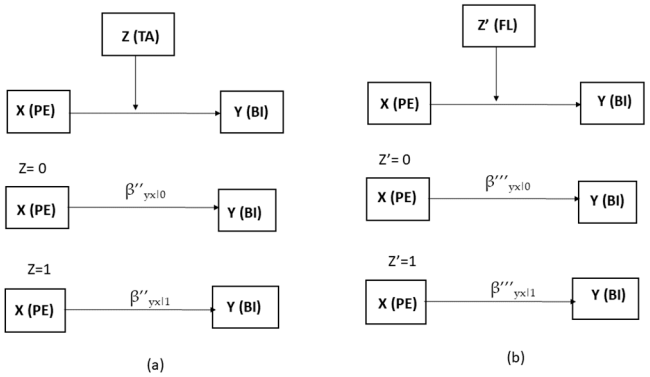

Figure 4. (**a**). Moderation effects of Technology Awareness (TA); (**b**) Moderation effect of Financial Literacy (FL).

For analysing the moderation effect, we have applied multi-group analysis. Hair et al. [94] suggest to study the moderation effect separately from the basic model. Hence, the moderation effect of technology awareness z for z = 0 which implies low technology

awareness group can be expressed as $\beta''_{yx|0}$. The moderation effect of variable z for z = 1 which implies high technology awareness group can be expressed as $\beta''_{yx|1}$ (Figure 4). Similarly, the moderation effect of subjective financial literacy z′, for z′ = 0 which implies low subjective financial literacy group can be expressed as $\beta'''_{yx|0}$. The moderation effect of variable z′ for z′ = 1 which implies high subjective financial literacy group can be expressed as $\beta'''_{yx|1}$ (Figure 4).

5.2. Non-Response and Common Method Bias

We checked for non-response bias between early and late respondents, and we conducted an independent *t*-test for equality of means. The test resulted in no difference in means and variances between the early and late respondent groups [95]. The Common Latent Factor (CLF) approach is applied to investigate the common method variance across all the model's variables [96]. The model without CLF was compared to the standardised regression weights with CLF, and the difference between regression weights were found to be less than 0.2, similar to [97,98]. The results showed no significant Common Method Bias (CMB) [99].

5.3. Reliability and Validity

The items loaded under their corresponding constructs, demonstrating significant factor loadings [100]. Cronbach's alpha coefficient, ranging from 0.837 to 0.955, indicated a satisfactory level of internal reliability [100]. The respective values for composite reliability (CR) and average variance extracted (AVE) [101] were above 0.50 and 0.70 (Table 3), which confirmed convergent validity. The discriminant validity was examined [101], and results are provided in Table 3.

Table 3. Descriptive statistics and discriminant validity.

Construct	Item Code	Mean	Std Deviation	FL	Alpha
Performance Expectancy (PE)					0.912
	PE1	4.125	1.77	0.852	
	PE2	3.923	1.80	0.794	
	PE3	3.971	1.80	0.873	
	PE4	3.888	1.71	0.889	
Effort Expectancy (EE)					0.899
	EE1	4.737	1.62	0.853	
	EE2	4.683	1.58	0.938	
	EE3	4.385	1.65	0.812	
Personal Innovativeness (PI)					0.856
	PI1	4.766	1.60	0.816	
	PI2	4.093	1.78	0.809	
	PI3	4.933	1.68	0.824	
Trust (TR)					0.955
	TR1	3.837	1.67	0.888	
	TR2	4.083	1.73	0.887	
	TR3	3.894	1.71	0.952	
	TR4	3.881	1.73	0.943	
Perceived Risk (PR)					0.863
	PR1	4.708	1.65	0.747	
	PR2	5.135	1.59	0.915	
	PR3	5.189	1.64	0.818	
Facilitating Conditions (FC)					0.837
	FC1	4.061	1.78	0.79	
	FC2	3.981	1.81	0.847	
	FC3	4.574	1.70	0.755	

Table 3. *Cont.*

Construct	Item Code	Mean	Std Deviation	FL	Alpha
					0.918
Social Influence (SI)	SI1	3.147	1.65	0.813	
	SI2	3.413	1.65	0.94	
	SI3	3.558	1.72	0.914	
					0.835
Financial Literacy (FL)	FL1	4.410	1.57	0.808	
	FL2	4.394	1.60	0.817	
	FL3	4.817	2.11	0.717	
					0.908
Technology Awareness (TA)	TA1	4.353	1.63	0.752	
	TA2	3.878	1.93	0.738	
	TA3	3.939	1.98	0.735	
	TA4	4.413	1.80	0.805	
	TA5	4.429	1.80	0.759	
					0.851
Behavioural Intention (BI)	BI1	3.849	1.60	0.918	
	BI2	4.045	1.62	0.914	
	BI3	4.077	1.74	0.799	

Descriptive statistics and exploratory factor analysis results

	AVE	CR	BI	EE	PE	SI	PR	TR	PI	FC
BI	0.772	0.910	0.878							
EE	0.756	0.902	0.576	0.869						
PE	0.727	0.914	0.816	0.531	0.852					
SI	0.793	0.919	0.673	0.409	0.612	0.890				
PR	0.688	0.868	0.031	0.155	0.021	0.055	0.829			
TR	0.843	0.955	0.716	0.617	0.682	0.61	−0.115	0.918		
PI	0.666	0.955	0.602	0.619	0.543	0.057	0.178	0.565	0.816	
FC	0.637	0.840	0.657	0.776	0.537	0.598	0.125	0.747	0.691	0.798

Discriminant validity results

Note: The square root of AVE values represented in the diagonal is greater than the inter-construct correlation.

5.4. Model Fit

The overall fitness of the structural model [102] was assessed with multiple fit indices CMIN/df = 2.3, RMSEA = 0.085, CFI = 0.908, GFI = 0.83, AGFI = 0.83 and NFI = 0.911 (Table 4). The fit indices values indicated model fitness for further analysis.

Table 4. Model fit indices.

Fit Indices	Values	Acceptable Thresholds
CMIN/df	2.3	≤3
RMSEA	0.085	0.05–0.10
CFI	0.908	>0.9
GFI	0.83	>0.7
NFI	0.911	0–1

Note(s): CMIN/df: Minimum Discrepancy Function by Degrees of Freedom divided, GFI: Goodness of Fit Index, CFI: Comparative Fit Index, RMSEA: Root Mean Square of Error Approximation, NFI: Normed Fit Index.

5.5. Hypothesis Testing Results

The hypothesised relationships were examined between the variables using SPSS AMOS version 23 software [94]. The results for the hypothesis are presented as

$$\eta 1 = 0.126\xi_1 + 0.021\eta_2 + 0.504\eta_3 + 0.217\xi_2 + 0.078\xi_3 + 0.133\xi_4 - 0.017\xi_5$$

$$\eta 2 = 0.715\xi_1$$

$$\eta 3 = 0.487\xi_1 + 0.195\eta_2$$

The model explained a 51% variance in effort expectancy, 40% in performance expectancy and 73% in behavioural intention. The results of the hypothesis are given in Table 5 and represented in Figure 5. The mediating effects of performance expectancy (PE) on the relationship of personal innovativeness (PI) and BI (H9) were examined by applying the bootstrapping method [94]. The direct effect was found insignificant (β = 0.139, p = 0.185) whereas the indirect effect (β = 0.359, p = 0.000) was found significant. This implies an indirect-only mediation [92,103] (Table 6): "Indirect- only: if indirect is significant but not direct effect" [92]. The mediation results are given in Table 6.

Table 5. Hypothesis testing results.

Hypothesis	Relationship	Coefficient	*p*-Value	Result
H1a	Personal Innovativeness (PI)→ Behavioural Intention (BI)	0.126	0.215	Not Supported
H1b	Personal Innovativeness (PI)→Performance Expectancy (PE)	0.487	***	Supported
H1c	Personal Innovativeness (PI)→ Effort Expectancy (EE)	0.715	***	Supported
H2	Performance Expectancy (PE)→ Behavioural Intention (BI)	0.504	***	Supported
H3	Effort Expectancy (EE) → Behavioural Intention (BI)	0.021	0.724	Not Supported
H4	Effort Expectancy (EE) → Performance Expectancy (PE)	0.195	0.024 **	Supported
H5	Social Influence (SI)→ Behavioural Intention (BI)	0.217	***	Supported
H6	Facilitating Conditions (FC)→ Behavioural Intention (BI)	0.078	0.380	Not Supported
H7	Trust (TR)→ Behavioural Intention (BI)	0.133	0.053 *	Supported
H8	Perceived Risk (PR)→ Behavioural Intention (BI)	−0.017	0.692	Not Supported

Path significance: *** $p < 0.001$; ** $p < 0.05$, * $p < 0.1$.

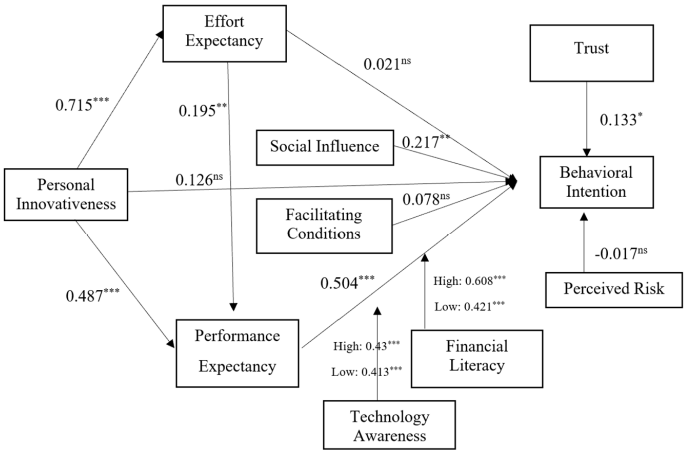

Figure 5. Results obtained after testing the hypothesesPath significance: *** $p < 0.001$; ** $p < 0.05$, * $p < 0.1$, ns is non- significant.

Table 6. Mediation analysis results.

Hypothesis	Mediation Relationship	Indirect Effect	Direct Effect	Result
H9	Personal Innovativeness (PI)→ Behavioural Intention (BI) via Performance Expectancy (PE)	0.359 (p = 0.000)	0.139 (p = 0.185)	Indirect only mediation

Using multi-group analysis, we examined the moderating effect of technology awareness and financial literacy [102]. Two sub-groups (high and low) were created by the median split of the average value of technology awareness and financial literacy. For technology awareness, two groups, high (n1 = 156) and low (n2 = 156), were created, and the model fit of the multi-group unconstrained structural model was checked ($\chi2$ = 1024.110, df = 566, CFI = 0.920 and RMSEA = 0.051). The $\chi2$ is the chi-square value, df is the "degree of freedom", CFI is "Comparative Fit Index" and RMSEA is "Root Mean Square of Error Approximation". All values were within the limits and recommended a good fit. The invariance across the two groups using the chi-square difference test ($\Delta\chi2$) of the unconstrained ($\chi2$ = 1024.110, df = 566) and fully constrained model ($\chi2$ = 1070.311, df = 590) were checked. The model invariance was not evident ($\Delta\chi2$ = 24, p = 0.004), which implied there is a difference between the two groups. Thus, further analysis was carried out by constraining the structural path (PE to BI), and the results are presented in Table 7.

Table 7. Moderation analysis results.

Effect	Moderator	High		Low		Δχ2	Moderation
Performance Expectancy (PE)→ Behavioural Intention (BI)		*Estimate*	*t-value*	*Estimate*	*t-value*		
	Technology Awareness (TA)	0.43	6.528 ***	0.413	6.716 ***	7.089 **	Yes
	Financial Literacy (FL)	0.608	7.244 ***	0.421	6.905 ***	38.222 ***	Yes

*** $p < 0.001$; ** $p < 0.01$.

For financial literacy, two groups, high (n1 = 171) and low (n2 = 141), were created, and the model fit of the multi-group unconstrained structural model was checked ($\chi2$ = 979.135, df = 564, CFI = 0.927 and RMSEA = 0.050). The $\chi2$ is the chi-square value, df is the "degree of freedom", CFI is "Comparative Fit Index" and RMSEA is "Root Mean Square of Error Approximation". All values were within the limits, which implied it is a good fit. The invariance across the two groups using the chi-square difference test ($\Delta\chi2$) of the unconstrained ($\chi2$ = 979.135, df = 564) and fully constrained model ($\chi2$ = 1039.869, df = 589) were checked. The model invariance was not evident ($\Delta\chi2$ = 25, p = 0.000), which implied there is a difference between the two groups. Thus, further analysis by constraining the structural path (PE to BI) was carried out, and the results are presented in Table 7.

6. Discussion

Cryptocurrency is an innovations that may disrupt the financial ecosystem [8] with innumerable benefits of faster payments, cross-border payment, robustness, no third-party involvement and trust-less transactions over the existing fiat-based systems. The study highlights the prime factors that could influence a user's behavioural intention to use new and innovative cryptocurrency (Figure 5). The study identified that an individual's innovativeness helps understand the perceived performance gains from using cryptocurrencies (H1b) and significantly impacts the effort expectancy associated with cryptocurrencies (H1c). Kalinić et al. [104] confirmed a similar phenomenon in the domain of peer-to-peer mobile payments. The study findings indicate that personal innovativeness does not directly impact (H1a) the usage intention of cryptocurrencies. The results validate that behavioural intention to use cryptocurrencies is impacted by performance expectancy (H2), which is in line with other digital currency studies [19,23,25]. The results could not validate the role of effort expectancy in influencing the intention to use cryptocurrencies (H3), which

is similar to [19,53] in the context of digital currency adoption. However, perceived ease of use was found significant in the study by Shahzad et al. [23] in impacting cryptocurrency adoption in China. The results indicated the importance of effort expectancy in positively impacting performance expectancy (H4), which is accordant with the results of other new-age financial technology studies such as peer-to-peer mobile payments [104] and open banking [60]. The impact of social influence (H5) is significant in influencing behavioural intention, which aligns with the finding of other studies [19,23,25,53] on digital currency. Facilitating conditions were not found to be significant. Our analysis found trust to be significant (H7), which is crucial for adopting cryptocurrency [66,67]. The effect of perceived risk was not validated in negatively impacting behavioural intention (H8), which was also observed in the study performed by [53]. The study revealed that performance expectancy mediates the effect of personal innovativeness on behavioural intention to use cryptocurrency (H9). This mechanism proves that innovative individuals are indirectly influenced by perceived gains to exhibit the intention of using cryptocurrencies. The finding is new to the domain of cryptocurrency adoption. The study demonstrates how technology awareness and subjective financial literacy of individuals help to understand the perceived usefulness of using cryptocurrency leading to usage intentions (H10 and H11). It revealed that individuals with high technology awareness better perceive the gains from the use of cryptocurrencies than low technology-aware people. Similarly, individuals with high subjective financial literacy perceive the gains from using cryptocurrencies better than those with low subjective financial literacy.

7. Implications

7.1. Theoretical Implications

The study adds several theoretical contributions to the growing domain of cryptocurrency and digital currency literature. Firstly, the study identified "performance expectancy", "social influence" and "trust" as direct factors influencing the behavioural intention of users to use cryptocurrency. The second contribution extends the contribution by [17], which identified innovation characteristics as an effective tool to stimulate the process of consumer adoption. We found that innovativeness also influences effort expectancy associated with using cryptocurrencies. The study's uniqueness lies in identifying that personal innovativeness impact behavioural intention to use cryptocurrencies indirectly through performance expectancy. In other words, performance expectancy mediates the relationship between personal innovativeness (PI) and behavioural intention to use cryptocurrencies (BI). Thirdly, as cryptocurrencies involve the role of advanced technology (blockchain) and finance [67], it is crucial to focus on the effect of individual technological awareness and financial literacy in impacting adoption. The study confirmed the moderating role of technological awareness of an individual in understanding and benefitting from using cryptocurrencies. Hence, the study responds to the call of Kim [21] by covering the technological perspectives impacting the behavioural intention to use cryptocurrency. Fourthly, the study testified that the moderating role of subjective financial literacy is also crucial in understanding the benefits of cryptocurrency leading to adoption. In contrast, individuals with low financial literacy showed a lower understanding of the benefits and a slightly lower intention to use cryptocurrencies. We utilised Subjective Financial Literacy (SFL)—one's self-perception about financial literacy, which has been used in a handful of research studies.

7.2. Managerial Implications

The research study provides valuable insights for financial services organisations, associated with advancing and advocating cryptocurrency. Cryptocurrencies—the most common form of digital currency—are widely used for transactions but are still minuscule compared to internet banking or fiat-based transactions. The main reason users are not using them from a utility perspective could be unawareness or an unclear understanding of the usage process. Our study outlines some key measures for organisations to increase the

adoption of cryptocurrencies below. Organisations working in the domain of decentralised payment wallets, cross-border payment, NFTs (non-fungible tokens), gamification and the metaverse [105] where cryptocurrency payments or other blockchain-based digital currency payments can be successfully implemented [3] can onboard more users by making an effort to spread awareness and knowledge about the benefits of the currencies as the study suggests that performance gains are a powerful determinant of the usage intention of digital currencies. The second most important determinant of the usage intention of cryptocurrencies are social influence, which organisations can utilise to promote the advantages of cryptocurrencies. Financial services organisations can strategise to leverage social influence by promoting their cryptocurrency or related services on Web 3.0 and Web 2.0-based social media networks where choices of important ones can influence users. Norton and Kaduthanum [3] mention that merchants can get an early mover advantage and acquire new customer segments by introducing cryptocurrency payments. The study suggests that merchants can first target innovative people who can quickly understand the benefits and spread awareness. The findings reflect that effort expectancy determines performance expectancy, indicating that financial services organisations should educate the users about the user interface and the know-how of the cryptocurrencies, such as how to connect to the network and make payments so that users may perceive it as simple to use, leading to understanding the usefulness. Further, the study finds that at an individual level, technology awareness and a high perception of financial literacy encourage users to use cryptocurrencies. Hence, organisations can design specific campaigns targeting high-technology-aware groups and young consumer groups with high subjective financial literacy. Our study confirms that trust in cryptocurrencies is crucial to users to show the usage intentions. The reason could be increased consumer trust towards financial technology after the global financial crisis [60]. Trust is essential but not easily attainable [104], so organisations should campaign to nurture user trust towards cryptocurrency. Marella et al. [68] discussed creation of trust in cryptocurrencies. Existing payment providers who have built consumer trust would have the trust advantage as they could leverage their brands and introduce cryptocurrency payments for users [3]. Individuals would trust their services above other new payment providers [3].

8. Conclusions

The study focused on understanding behavioural intention to use cryptocurrency. The study identified "performance expectancy (PE)", "effort expectancy (EE)" and "trust (TR)" as the direct and positive antecedents that impact user intention to use cryptocurrency. The study explains a novel phenomenon of how an individual's personal innovativeness (PI) indirectly influences the intention to use cryptocurrency through performance expectancy (PE). The personal innovativeness (PI) of an individual also directly influences performance expectancy (PE) which shows that innovativeness of an individual helps in understanding the performance gains from using cryptocurrency. Two significant and new confirmations of the study are the moderating role of technology awareness and subjective financial literacy in impacting behavioural intention. The results explain that technology-aware individuals better perceive the gains from using cryptocurrency and are more likely to show their intention to use these currencies. In contrast, low technology-aware individuals reflected a lower understanding of the perceived gains from using cryptocurrency and hence showed a slightly lower intention to use cryptocurrency. The study also empirically verifies the moderating role of subjective financial literacy in impacting users' behavioural intentions of using cryptocurrencies. Individuals with high subjective financial literacy were found to better perceive the gains from using cryptocurrencies and showed higher intention to use.

9. Limitations and Future Research

The study presents several novel results but has a few limitations. It also suggests avenues of future research. The data is collected in India which can limit the generalisation

of empirical findings. Hence, future studies can focus on different and multiple regions to generalise the results. Second, we have not focused on any one specific cryptocurrency. Future studies can extend the work by exploring the intention to use a specific cryptocurrency. Third, the study examined the intention to use cryptocurrency from only a utility perspective, and we have not considered the hedonic motivations associated with use of the cryptocurrencies. This limits the scope of study only to traditional financial transactions purposes. Future studies can explore the hedonic realm associated with the use of cryptocurrency in different domains such as blockchain-based gaming, trading of non-fungible tokens (NFTs), the metaverse and other user-based applications. Future studies can understand the role of age, gender and income level on the usage intention of cryptocurrencies. Future adoption studies can also study the regulatory perspective along with the technological and financial perspective to study cryptocurrency adoption, also mentioned by Kim and Yoo et al. [21,27].

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Appendix A

Table A1. Survey Questionnaire.

Constructs	Item Code
Performance expectancy (PE)	
Using cryptocurrencies will increase opportunities to achieve important goals for me.	PE1
Using cryptocurrencies would increase my work productivity (accepting payments from peers/clients in cryptocurrencies is easier as no 3rd party like banks are involved)	PE2
Using cryptocurrencies will increase my standard of living.	PE3
Using cryptocurrencies would enable me to perform my payments more quickly.	PE4
Effort expectancy (EE)	
It will be easy for me to learn how to use cryptocurrencies.	EE1
Using cryptocurrencies will be clear and understandable for me.	EE2
It will be easy for me to become an expert in the use of cryptocurrencies.	EE3
Personal innovativeness (PI)	
I heard about new information technology. I would look for ways to experiment with it.	PI1
Among my peers, I am the first one to try out new information technologies	PI2
I like to experiment with new technologies	PI3
Trust (TR)	
I trust Cryptocurrencies to be reliable.	TR1
I trust Cryptocurrencies to be secure.	TR2
I believe Cryptocurrencies are trustworthy.	TR3
I trust Cryptocurrencies.	TR4
Perceived risk (PR)	
Using cryptocurrency is risky.	PR1
There is too much uncertainty associated with the use of cryptocurrencies	PR2
Compared with other currencies or investments, cryptocurrencies are riskier.	PR3
Facilitating conditions (FC)	
I have the necessary resources to use cryptocurrencies.	FC1
I have the necessary knowledge to use cryptocurrencies	FC2
I can get help if I have difficulty using cryptocurrencies	FC3

Table A1. *Cont.*

Constructs	Item Code
Social influence (SI)	
People (family, friends) who are important to me think that I should use cryptocurrency.	SI1
People who influence my behaviour think that I should use cryptocurrency	SI2
People whose opinions that I value would like that I use cryptocurrency.	SI3
Financial literacy (FL)	
I rate my overall financial knowledge on a scale of 1 to 7 as	FL1
I feel I have a high capacity to deal with financial matters	FL2
I have a good level of financial knowledge	FL3
Technology awareness (TA)	
I follow news and development about cryptocurrencies	TA1
I seek advice on blogs, social media or about cryptocurrency products or services.	TA2
I discuss with friends and people around me about cryptocurrencies.	TA3
I read about Cryptocurrency usage in newsletters or articles.	TA4
I hear about cryptocurrency on TV, podcasts or the radio.	TA5
Behavioural intention (BI)	
I intend to periodically use cryptocurrency.	BI1
I want to use the services where can pay by cryptocurrency.	BI2
I want to use cryptocurrency to pay for my use.	BI3
Awareness test	
I have never heard of any digital currencies like cryptocurrencies	
I know basic details about cryptocurrencies	
I know what to do with cryptocurrencies	
I am aware of and know how to use cryptocurrencies	

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