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Social Commerce as a Driver to Enhance Trust and Intention to Use Cryptocurrencies for Electronic Payments

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ABSTRACT The deployment of cryptocurrencies in e-commerce has reached a significant number of transactions and continuous increases in monetary circulation; nevertheless, they face two impediments: a lack of awareness of the technological utility, and a lack of trust among consumers. E-commerce carried out through social networks expands its application to a new paradigm called social commerce. Social commerce uses the content generated within social networks to attract new consumers and influence their behavior. The objective of this paper is to analyze the role played by social media in increasing trust and intention to use cryptocurrencies in making electronic payments. It develops a model that combines constructs from social support theory, social commerce, and the technology acceptance model. This model is evaluated using the partial least square analysis. The obtained results show that social commerce increases the trust and intention to use cryptocurrencies. However, mutual support among participants does not generate sufficient trust to adequately promote the perceived usefulness of cryptocurrencies. This research provides a practical tool for analyzing how collaborative relationships that emerge in social media can influence or enhance the adoption of a new technology in terms of perceived trust and usefulness. Furthermore, it provides a significant contribution to consumer behavior research by applying the social support theory to the adoption of new information technologies. These theoretical and practical contributions are detailed in the final section of the paper.

INDEX TERMS Cryptocurrencies, trust, social commerce, social support, technology acceptance model.

I. INTRODUCTION

Bitcoin is a decentralized Peer-to-Peer (P2P) payment system, whose innovative characteristic is establishing trust between two unknown entities without the need for a central authority to certify the accuracy and integrity of the transactions. In such a way, Bitcoin is a digital representation of value that does not need to be issued by a credit institution or central bank. In some cases, it can be used as an alternative to money [1]. Bitcoin provides the bases for other new virtual currencies which employ similar characteristics and algorithms [2]. Virtual currencies are based on strong cryptographic methods. For this reason, they are also named cryptocurrencies [3], [4].

Currently, Bitcoin is gaining its place in e-commerce. The latest data report continuous increase both in Bitcoins circulating on the internet and in number of transactions per day [5]. However, despite this growth in transactions, cryptocurrencies are not yet widely used in electronic commerce. They face two main impediments in their deployment:

(i) The characteristics and coverage capacities of their underlying technology are still unknown [6], [7], even by cryptocurrency users themselves. The technological foundations of cryptocurrencies and their utility is a mystery for new users and also for new business enterprises [8].

(ii) There is a lack of perceived trust by the consumer that determines their low acceptance [9]. Cryptocurrencies propose a disruptive way of carrying out transactions on the web. The reliability of transactions is delegated to a cryptographic test and the intervention

of a control authority is excluded [3]. However, people are unwilling to trust a faceless infrastructure [9], that is infrastructure without the traditional banking of a central authority or institution. These aspects have diminished the perceived usefulness and trust in their use [10].

An environment that promotes trust among users is social networks. Through the social links that arise from these networks, a new paradigm called *social commerce* (s-commerce) emerges [11]. This paradigm provides the necessary tools to establish confidence [12]. As with cryptocurrencies, social networks overcome geographic barriers and provide freedom of behavior to the user. Users can take advantage of the experiences of others to understand the utility of a given technology, and this influences the decision to use.

Social media applications provide easy and effective ways for communication, sharing of opinions and exchange of information [13]. The communication media are the backbone of social commerce, and extend the functionalities of electronic commerce to create trust in the adoption of new technologies [13].

Since trust is a critical aspect in e-commerce and a good metric to analyze the degree of influence on users [14], the **main objective** of this research is to study the role played by social media in increasing trust and intention to use cryptocurrencies for electronic payments.

In order to achieve this goal, an analysis of the key strengths of cryptocurrencies and an extensive field work were developed. The **novelty** of this approach adds the behavioral perspective in using the new payment instruments for e-commerce transactions.

This research makes **contributions** to theory and practice of social commerce in relation to novel electronic payment methods: firstly, the theory of social support in the adoption of new information technologies is extended; secondly, a reliable model is provided to analyze the trust, risk and intention of using cryptocurrencies, and; finally, this model allows professionals, entrepreneurs and researchers to better understand the role of social media in the intention to use cryptocurrencies.

The sections of this document are structured as follows: section two presents the background and review of the literature; section three describes the research model; section four presents the research methodology, the analysis of the data and the results obtained; and finally, the conclusions are presented in section five, along with the contributions of the paper and future areas of research.

II. BACKGROUND AND LITERATURE REVIEW

The following subsections discuss the state-of-the-art of the aspects related to this research. There are many research works on the topics involved due to disruptive nature of cryptocurrencies in society and their implications on e-commerce. In this section, only the most recent and representative works are analyzed. Likewise, a summary of the most outstanding studies of social commerce in the context of social support is presented. In addition, a summary of the reference disciplines used in the research is presented.

A. CRYPTOCURRENCIES

A cryptocurrency is a type of virtual currency based on cryptographic principles and decentralized management. The transactions are managed through two main innovations: P2P and blockchain. Blockchain is a public access ledger that records and organizes all transactions within blocks. The credibility of each transaction is based on the veracity of a cryptographic test provided by the network. As a P2P system, the transactions are replicated, validated and updated, in such a way that they coincide in each node of the network [3].

Cryptocurrencies offer a completely decentralized network independent of the influence of any central and government authority. These advances provide an ingenious form of payment that includes the creation and transfer of currency between the users of electronic commerce platforms [15]. The added value of cryptocurrencies in e-commerce come from: (i) their ***utility*** as payment method and (ii) the ***trust*** they provide to users:

(i) The use of cryptocurrencies provides financial and payment freedom, that is a user can conduct transactions (send and receive money) with any user with no restrictions and regardless of their geographic location. The lack of restrictions and the elimination of a third party intermediary are taken advantage of by those users who do not want to pay high international rates for remittance services, providing efficient and lucrative savings for the user in each transaction [16]. Bitcoin offers an alternative method of payment for the purpose of carrying out monetary transactions quickly and with low operating costs [2]. The cost of a transaction processed on the blockchain is based on the volume of data transmitted instead of the monetary value exchanged [17]. The characteristic of divisibility (number of digits) is supported by cryptocurrencies based on the blockchain and allows for the execution of micropayments and donations [17].

(ii) Trust plays a key role in s-commerce [12]. The mathematical basis of the cryptocurrencies are designed for establishing trust between unknown identities without the need for a third party [3]. Cryptocurrencies rely on the authenticity of a cryptographic test provided by the network, instead of relying on a central entity [18]. The use of blockchain as the supporting technology for cryptocurrencies provides transparency, integrity and accurate identification in recording transactions, so that any user node can verify them [3]. Bitcoin is irreversible and provides mechanisms to prevent the double spending of money, that is, the use of the same currency in multiple transactions [19]. The proof-of-work is the cryptographic mechanism capable of resolving the duplicate expenditure problem, any attacker would need to employ an enormous computational effort to modify the transactional history of the network [19].

TABLE 1. Representative prior research studies on social perspective of cryptocurrencies.

Research	Findings
Trust	
Trust model using digital currency in B2C environments [10]	The intervention of institutional trust and the regulation of cryptocurrencies are essential.
In Blockchain We Trust? Not Yet, Say Consumers [30]	Building trust between users and online services needs work and time. Decentralization may not be enough to guarantee a fair relationship among users.
Anonymity and its effects on seller ratings [31]	Anonymity hides the relationship between buyer and seller. Buyers need to know the reputation of the seller.
Behaviour	
Transaction volumes of Bitcoin [32]	The volumes of searches for information related to bitcoin can predict its transaction volumes.
Social interactions in the creation of bitcoin price [33]	Excessive searches for information precede drastic reductions in bitcoin prices. The volume of user comments precedes the creation of bitcoin pricing bubbles.
Cryptocurrency price drivers [34]	There are positive correlations between online factors and price strengthen. These correlations appear to be caused by particular market events.
User analysis	
Exploratory analysis of bitcoin users [35]	Age, geographic location and political orientation are predictors of attraction to bitcoin.
Analysis of the language of bitcoin users on twitter [36]	People who use cryptocurrencies are less sociable. Cryptocurrency users avoid mentioning family, relatives, friends and feelings in their tweets.
Classification of bitcoin consumers [37]	Computer programmers and criminals are attracted to bitcoin, while investors are not.
The experience of using bitcoin in Europe [7]	The use of bitcoin is not prominent due to a lack of familiarity with the technology
Perceived usefulness	
User Adoption and Future Potential [38]	Users consider perceived ease of use still low. However, perceived usefulness as a payment method is confirmed.
Braving Bitcoin [39]	Benefits of virtual currencies depend on type of users who use them. For certain groups of users, they are useful, but also have risks and drawbacks for others.

On the other hand, users and investors perceive some **risks** when they operate with cryptocurrencies. For example, double-spending risk [20]. Fortunately, intensive research is developing to avoid the risks and to improve security of this monetary system [15], [18], [21]. Another consideration that deserves attention is the impossibility of recovering user-caused errors, like the loss of the wallet and the mistaken entry of a sending/receiving address, since once a transaction is executed, there is no way to recover the coins due to the irreversible nature of bitcoin [22], [23]. The characteristic of anonymity hides a user's identity by providing an encrypted public address. Anonymity gives criminals an advantage in that they can hide their personal information, intentions and the origin of the funds, which creates ideal scenarios for illicit activities [1]. Due to the lack of laws and regulations acting as legal protection, the value of bitcoin over a regular basis is very volatile and therefore the risk is higher than for any currency [16]. Table 1 contains a representative summary of previous research on social perspective of cryptocurrencies and shows the main findings related to trust, behavior, user analysis and perceived usefulness as payment method. Unlike previous studies, this research adds the paradigm of social commerce and social support theory to analyze the behavioral perspective of using cryptocurrencies in electronic transactions.

B. SOCIAL COMMERCE AND SOCIAL SUPPORT

Social commerce emerges as a new paradigm in the evolution of e-commerce which highlights technological advances made in constructing a new socially-oriented business model [24], [25]. Social commerce involves various disciplines, such as marketing, sociology, psychology and computer sciences [26].

S-commerce can be defined as ''an internet-based commercial application, leveraging social media and web 2.0 technologies which support social interaction and user-generated content in order to assist consumers in their decision-making and acquisition of products and services within on-line marketplaces and communities'' [27]. S-commerce involves all of the stakeholders along a value chain in a collaborative and participatory way [24]. In s-commerce, consumers have the following roles: consumer of products/services, user of information technologies [28] and owner of their information [29]. S-commerce allows consumers to generate content by integrating social media and e-commerce platforms [14].

Social media has increased and the access barriers have reduced [40]. The social commerce technologies provide facilities for the consumer to acquire the necessary information to join an online community [25]. Advances in communication media technologies allow the incorporation of social functionalities (such as recommendations, referrals, ratings, reviews, forums and communities) into electronic commerce platforms [13]. Consumers use social media due to: the search for information about a product or technology; the need to share knowledge, information and experiences with others [14], and; the need to establish relationships of trust with each other [14]. Hence, social media applications lead to the propagation of information in electronic commerce

TABLE 2. Prior research of social commerce focused on social support.

Research	Findings
Analysis of the continuity of participation in online communities in Malaysia [42]	Social support and constructs of the theory of planned behavior (TRA) influence the intention to continue participating in communities.
Analysis of the uncertainty of the seller and the product in the purchasing behavior within social commerce [43]	Social factors can significantly improve the purchasing intention of users in social commerce.
Analysis of the influence of social commerce sites on the purchasing experience [44]	Social commerce sites positively influence social interactions in cognitive and affective terms.
Analysis of social media in online communication [13]	Social support generates social commerce intention. Social commerce constructs generate social support.
Analysis of social support on relationship quality in social commerce sites [25]	Social support influences relationship quality.
Perceived interactivity analysis, perceived personalization and perceived sociability in social commerce [45]	Social support and social presence influence social commerce intention.

FIGURE 1. Summary of reference disciplines used in the research model.

and increase the participation of users. The social network provides guidelines for: integration, social support and links of an individual in the network [41].

Members of an online community participate in collaborative activities to provide support to others [25]. In this way, social media environment induces emotional and informational support [13]. This social support arises from the conduct of interpersonal relationships, and it is the perception of being cared for, receiving responses and assistance from their social group [41]. The support consists of providing information, recommendations, knowledge and emotional help to other members of a social environment. Social support can generate trust, commitment and influence the behavioral intention to use a service, product or technology [25]. In the case study conducted through this work, the technology is cryptocurrency.

Previous studies have investigated social commerce in the context of social support, from the behavioral point of view. In Table 2, a summary of these studies is shown. In contrast to previous studies, this research analyzes the effects of social commerce and social support from a psychological point of view, which is a key feature on user trust about the perceived usefulness and intention to use of cryptocurrencies. According to this objective and to the review of the literature, a research model is defined in section 3.

C. SUMMARY OF REFERENCE DISCIPLINES USED IN THE RESEARCH MODEL

The research involves the study of two groups of disciplines or fields of study:

(i) *Cryptocurrencies,* which corresponds to the specific domain of study in the technical, social and economic aspects. These are cross-sectional considerations throughout the study.

(ii) *Theory and support techniques* to enable defining the variables and hypotheses included in the research model (section 3). In addition, within this field of study, the technique for validation and evaluation of the outcomes is included (section 4).

Figure 1 shows a summary of the reference disciplines used in this investigation.

III. RESEARCH MODEL AND DEVELOPMENT OF HYPOTHESES

This work develops a model to study the role played by social commerce in improving perceived trust and intention to use cryptocurrencies for electronic payments. In this process, the variables (or constructs) was classified into 3 groups: technology acceptance constructs (perceived usefulness and intention to use), specific constructs of adoption (perceived trust and perceived risk), and social commerce usage and social support constructs.

Trust is linked to perceived usefulness in order to explain and predict consumer behavior when using cryptocurrencies. Social commerce and social support are used to analyze whether the adoption of cryptocurrencies (intention to use and perceived usefulness) is improved through trust. Social commerce usage and social support are constructs that allow us to examine whether the collaborative and social relationships of the participants enable improvement of the trust and

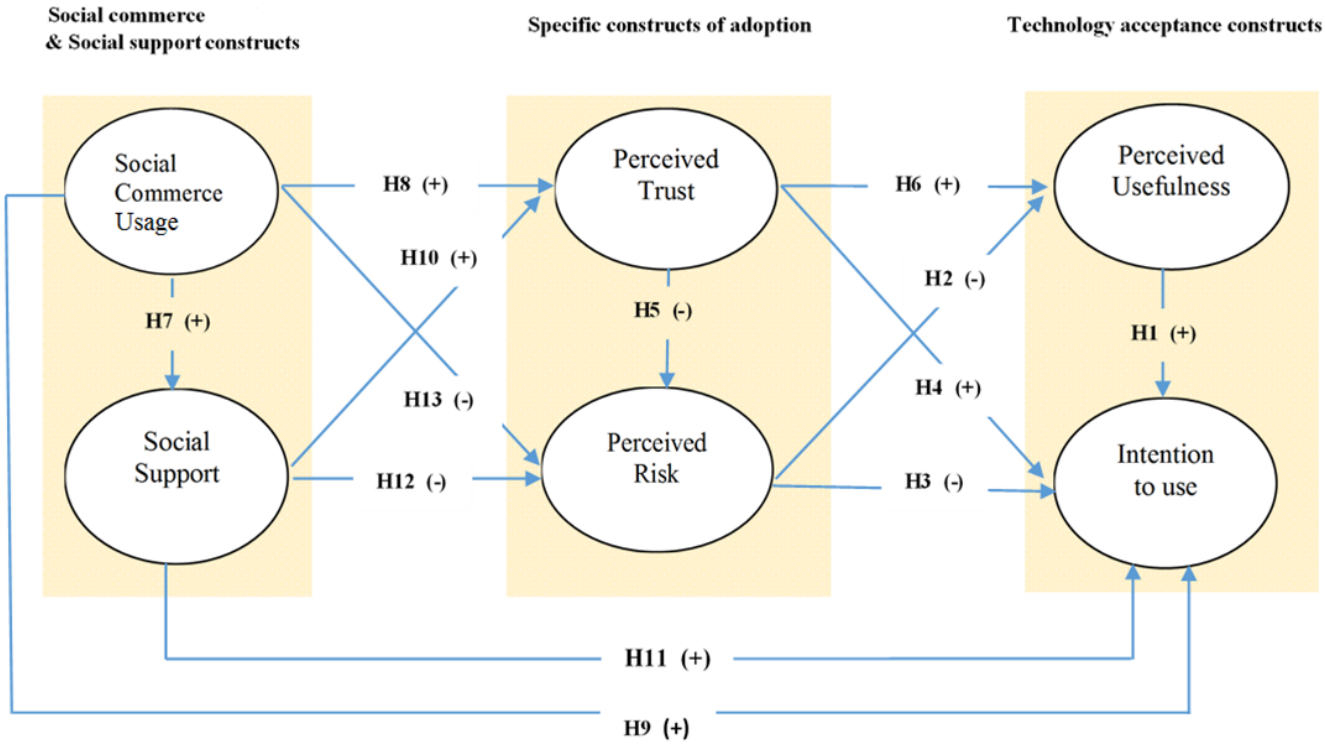

FIGURE 2. Proposed research model.

acceptance of cryptocurrencies as a means of payment. Social commerce usage and social support are factors that allow us to investigate whether social features improve the perceived trust of cryptocurrencies and, in turn, reduce the perceived risk of use. Based on the supporting literature presented in the previous section and in the definition of the constructs, the hypotheses of the model are proposed. The research model is shown in figure 2.

A. PERCEIVED USEFULNESS AND INTENTION TO USE

Some investigations have focused their studies on technological acceptance models. Amongst them, two models stand out: Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT). Both models are characterized by explaining the acceptance of technology based on behavioral intention [46]. TAM facilitates the understanding of behavioral intention and helps predict the adoption of a new technology in a variety of contexts [46]. TAM has been widely studied for its predictive power and simple application in information systems [47]. For its part, UTAUT is an important theory of IT acceptance based on the original TAM constructs [48].

'Perceived usefulness' is a TAM construct that influences behavioral intention [47]–[49]. Similarly, 'Performance expectancy' is a UTAUT construct, based on the original construct of perceived usefulness. The definitions and items of both constructs are quite similar [48], [49] and they agree on the same approach [46]. In a comparative study conducted by Rahman *et al.* [46], it was demonstrated that both constructs have high correlations with each other and similar effects on behavioral intention. In a nutshell, both constructs possess similar statistical evidence [46]. However, TAM explains a greater amount of variance and information about behavior intention than UTAUT [46].

Unlike the previous ones, the perceived utility (TAM) is a common and simple determinant of understanding during all the stages of specification of requirements, development and adoption of an early disruptive technology [50]. For these reasons, this research prefers to use the term perceived usefulness instead of performance expectancy to define *"the degree to which a person believes that the use of cryptocurrencies in electronic payments will improve their job performance"* [48], [49].

In addition, 'behavioral intention' can be considered as a dependent variable that is useful for the study of the acceptance of technology in early stages [51]. In the context of IT implementation, cryptocurrencies are at an early stage of innovation. Hence, this research defines the *"intention to use"* as *"the intention of a person to use cryptocurrencies in electronic payments"* [48].

The technological innovation of cryptocurrencies is independent of geographical location and can cross the borders of countries. In addition, the absence of physical representation (paper or metal) contributes to a significant saving in the costs of production, transportation and handling of currency [22]. In this way, cryptocurrencies offer a fast payment method

with low transaction costs and free from intermediation which favours its use for: purchase, sale and exchange of goods and services; sending of international remittances to any person in the world; the execution of micro-payments and donations, and; investment and savings. In essence, cryptocurrencies provide an open and portable payment platform for any user, and gives it with freedom of action for sending payments anywhere [6].

From all the above, the first proposed research hypothesis is as follows:

- *Hypothesis 1. Perceived usefulness has a positive effect on the intention to use cryptocurrencies.*

B. PERCEIVED RISK

The perceived risk is the feeling of uncertainty regarding the negative results of an event or situation, such as the use of a product or service. Thus, perceived risk is an important factor that influences perceived utility and purchase intention in commerce [52], [53]. In this work, it is defined as *"the expectation of losses associated with electronic payments using cryptocurrencies"*.

The most innovative use of cryptocurrency is the ability to deploy a decentralized payment network, but this service is hindered by the apparent lack of guarantee in its operations and the volatility of its value function [16]. In this manner, one important reason for uncertainty among users is the inability of cryptocurrency to maintain stable prices; this feature makes it difficult to comply with its function as a unit of account. Besides this, the risks inherent to the lack of regulation, speculation activities, vulnerability to cyber-attacks, prevent their growth as a global currency [22]. Other aspects which affect risk and vulnerability are irreversibility of transactions, impossibility of key recovering due to forgetfulness or loss, and theft of wallets [6], [9]. Hence, the research proposes the following hypotheses related to risks perception:

- *Hypothesis 2. Perceived risk has a negative effect on the perceived usefulness of cryptocurrencies.*
- *Hypothesis 3. Perceived risk has a negative effect on the intention to use cryptocurrencies*

C. TRUST

A concept related to the risk construct is the 'perceived trust'. Trust is a predominant factor in human behavior and influences the intention to perform electronic transactions [12]. Individuals will only conduct e-commerce transactions when there is trust [12]. Trust helps to reduce social complexity, vulnerability and the risk perceived by a user when engaging in an electronic commerce transaction [54].

This research uses the following definition of "trust": *"the willingness to take risks based on the belief, expectation, competence and integrity of electronic payments made with cryptocurrencies"* [55]. Belief leads to behavioral intentions based on trust [10].

In virtual currencies transactions, trust is provided by strong cryptographic methods supported by a distributed P2P system and the blockchain innovation [18]. Cryptocurrencies and blockchain allows anyone who has access to the internet to verify the authenticity of their information. In this way, cryptocurrencies are difficult to forge. Any user wishing to forge a transaction will be frustrated by the large amount of computational power that will have to be used to completely rebuild the entire blockchain [31].

Furthermore, the trust also refers to the integrity, confidentiality and security of the data in a transaction [56]. Regarding this matter, cryptocurrencies use cryptographic methods that guarantee confidentiality. Cryptocurrencies are reliable because they provide a transparent method of impersonal verification without intermediaries, which reduces transaction costs, maintains credibility in the system and motivates their usage [57].

This research proposes the following research hypotheses related to trust:

- *Hypothesis 4. Perceived trust has a positive effect on the intention to use cryptocurrencies.*
- *Hypothesis 5. Perceived trust has a negative effect on the perceived risk of using cryptocurrencies.*
- *Hypothesis 6. Perceived trust has a positive effect on the perceived usefulness of cryptocurrencies.*

D. SOCIAL COMMERCE AND SOCIAL SUPPORT

The concept of s-commerce arose in order to improve collaboration and relations of trust in electronic commerce, by adapting collaborative tools in social communication media [24]. The use of web 2.0 improves the participation of users in social networks [27].

This research uses the following definition of "*social commerce usage*" as *"the use of social media, online media that support social interaction and user contributions, to increase trust and intention to use cryptocurrencies in electronic payments"* [58]. Through social commerce, users obtain emotional and informational values that encourage them to participate in their community. The main value that users obtain in collaborative interactions is social support [44], [45]. Hence, this research defines "*social support*" as *"the perceived attention, love and support of the members of a group to use cryptocurrencies in electronic payments*" [25].

Through P2P networks, cryptocurrencies eliminate the hierarchical structures of a society to promote collaboration and equal opportunities. The use of cryptocurrencies in payment and social networks allows a more inclusive financial and learning participation. In this way, cryptocurrencies provide global access without cultural, social and economic restrictions. Hence, the research proposes the following hypothesis related to social commerce usage:

- *Hypothesis 7. Social commerce usage has a positive effect on social support for using cryptocurrencies*

In addition, s-commerce leads to a significant amount of social and emotional support which increases trust [12]. User evaluations and information provided by a reliable source affect the intention to use [43], and it is clear that recommendations from friends and customers increase trust

and loyalty toward a brand or product [26]. Social support generated in social communities improves confidence and commitment to use a specific product or service [25]. Social interactions by nature have the ability to influence decision and behavioral intention [13], [59], and they produces a positive and directly proportional impact on the behavior of the consumer [14]. Hence, the research proposes the following additional hypotheses related to social commerce usage:

- *Hypothesis 8. Social commerce usage has a positive effect on the perceived trust in using cryptocurrencies.*
- *Hypothesis 9. Social commerce usage increases the intention to use cryptocurrencies.*
- *Hypothesis 10. Social support has a positive effect on the perceived trust in using cryptocurrencies.*
- *Hypothesis 11. Social support increases the intention to use cryptocurrencies.*

Users create and share information by means social commerce. This trend definitely affects the confidence and intention to use a product [26]. Through social and collaborative support, users develop social identity with the online social community and naturally, they can mitigate the perceived risks in the intention to use a product [52]. Therefore, social support information can reduce the perceived risk and uncertainty with regard to a certain product or service [43]. According to this, the research proposes the following last hypotheses related to these concepts:

- *Hypothesis 12. Social support has a negative effect on the perceived risk of using cryptocurrencies.*
- *Hypothesis 13. Social commerce usage has a negative effect on the perceived risk of using cryptocurrencies.*

IV. EVALUATION AND RESULTS

A. SOURCE OF DATA

After creating the research model, a questionnaire was designed comprised of 6 variables (or constructs): perceived usefulness (4 items), intention to use (3 items), perceived risk (4 items), perceived trust (3 items), social commerce usage (4 items) and social support (6 items), as indicated in Appendix A. The questionnaire was prepared based on the academic literature on cryptocurrencies and reports published by governmental and banking authorities. The ranges of measurement follow the 7-point Likert scale (1: totally disagree to 7: totally agree).

The survey was mainly distributed at the University of Alicante and at businesses in the city of Alicante, including libraries and shopping centers (Alicante is a Spanish city of medium size located at the east of the country on the Mediterranean coast). Colleagues from various universities encouraged their students to distribute the questionnaire and collect answers. The survey was responded to by 125 participants with the following age distribution: 18-24 years old (50%), 25-34 (24%), 35-50 (20%), and over 50 (6%). Participants by their occupation were: university and postgraduate students (52%), professors (8%), business managers (10%), company employees (25%), government workers (5%). The participants' level of education was: university students (40%), graduates (38%), postgraduates (12%) and others (10%). Next, the data and results were analyzed.

B. DATA ANALYSIS METHODS

The technique employed to evaluate the model was PLS (Partial Least Square). PLS is a multivariate method of analysis used to estimate Structural Equation Models (SEM) based on variance [60]. PLS-SEM provides a set of predictive tools to evaluate and validate exploratory models in the initial stages of development of a theory [61]. In order to statistically evaluate the model, PLS uses a resampling method called bootstrapping. Bootstrapping defines confidence intervals of the parameters of the model and generates a set of subsamples from the original sample. Thus, bootstrapping is adequate when the presumption of normality is in doubt [60]. In this way, PLS works efficiently to estimate path models whose sample size is small [61].

According to Ringle and Sinkovics [61] and Barclay *et al.* [62], "*a rule of thumb for robust PLS path modeling estimations suggests that the sample size be equal to the larger of the following: ten times the largest number of structural paths directed at a particular construct in the inner path model*". Applying this rule of thumb for the current study: the sample size is 125, the variable with the highest number of direct impacts (5) is *"intention to use"*, and the minimum sample size required is 50 ($10*5 = 50$). Therefore, our sample size is adequate for PSL estimation procedures.

PLS-SEM uses a similar approach to factorial analysis of major components. PLS combines analysis of principal components, path and regression [60]. A path model includes a set of latent variables (or constructs). It is defined by two components: a structure model and a measurement model [61]. PLS-SEM is useful for analyzing constructs and, at the same time, to evaluate the structural model [60], [61]. Therefore, PLS-SEM is appropriate for the proposed analysis and research.

The first step is to validate the measurement model, to then generate the estimates using the bootstrapping technique with 500 resamples. The software used in the evaluation is SmartPLS version 3 [63].

C. EVALUATION OF THE MEASUREMENT MODEL

The evaluation of the measurement model is important because it guarantees that the results to obtain in later phases will be: (i) *reliable* and (ii) *valid*.

(i) In order to evaluate the reliability of the constructs, two indices are used: Cronbach's alpha and composite reliability. The internal consistency reliability represents the homogeneity in the constructs. According to Hair *et al.* [64], the suggested value for both indices should be greater than 0.7; although for exploratory investigations a value of 0.60 is considered to be acceptable. The reliability of the indicators is evaluated through their factor loading, whose value must be greater than 0.5 [64].

TABLE 3. Construct reliability and convergent validity.

	Cronbach's alpha	Composite reliability	AVE
Perceived trust	0.81108	0.88717	0.72533
Intention to use	0.88240	0.92712	0.80982
Perceived risk	0.90547	0.93183	0.77395
Social commerce usage	0.84070	0.89192	0.67430
Social support	0.94041	0.95359	0.77500
Perceived usefulness	0.91467	0.93979	0.79618

TABLE 4. Discriminant validitys.

	Perceived trust	Intention to use	Perceived risk	Social commerce usage	Social support	Perceived usefulness
Perceived trust	**0.85166**					
Intention to use	0.58070	**0.89990**				
Perceived risk	-0.74276	-0.50429	**0.87974**			
Social commerce usage	0.65760	0.53555	-0.58682	**0.82116**		
Social support	0.43390	0.36852	-0.28875	0.41229	**0.88034**	
Perceived usefulness	0.43611	0.55021	-0.37217	0.38406	0.25896	**0.89229**

Note: Bolded diagonal items are the square root of AVE

In the proposed model, reflective indicators are used. The results obtained demonstrate that the indices of internal consistency reliability of the constructs exceed the value of 0.81 (Table 3), and that the factor loading of the indicators is between 0.744 and 0.983 (appendix B). Therefore, the measurement model satisfies the reliability criteria.

(ii) A construct should satisfy the criteria of validity, that is high correlations between the items within the same construct (convergent validity), and low correlations between the items in different constructs (discriminant validity) [65]. The Average Variance Extracted (AVE) is a convergent measure of validity, whose suggested value should be above 0.5 [65]. As show in Table 2, AVE values for each construct exceed the 0.5 threshold and demonstrate that the model also meets the convergent validity criteria. Discriminant validity is evaluated using the criteria suggested by Chin [65]. As show in Table 4, the correlation between any two constructs is less than the square root of the AVE shared by the indicators within the construct. The discriminant validity can also be evaluated through a cross-loading analysis [65]. As show in Appendix B, each block of indicators has a greater load within their respective construct than in the others. According to these two criteria (Fornell and cross-loading), it was demonstrated that the model meets the discriminant validity criteria.

D. EVALUATION OF THE STRUCTURAL MODEL

The structural model is evaluated after proving that the measurement model satisfies the criteria of reliability and validity. One of the tasks in evaluating the structural model is testing the hypothesis, whose results make it possible to analyze (i) the standardized path coefficients and (ii) the coefficient of determination (R^2).

(i) The path regression coefficients represent the magnitude in which each predictive variable contributes to the variance of an endogenous variable. Each path is evaluated with respect to its sign, absolute value and significance using the bootstrapping technique [61]. According to Chin [65], the standardized paths should be at least 0.2, and ideally above 0.30 in order to be considered significant; values between 0.1 and 0.2 can be considered as moderate relationships. Figure 3 shows the standardized path coefficients (with their respective t value). All of the hypotheses are supported except for hypotheses H2, H3, H11 and H12.

(ii) The coefficient of determination (R^2) represents the amount of variance explained in each endogenous variable by its predictor variables [65]. R^2 represents the amount of variance within the construct that is explained by the model. According to the results, the model explains 17% of social support, 19.5% of perceived usefulness, 46.4% of perceived trust, 48.1% of intention to use and 57.3% of perceived risk. In Figure 3,

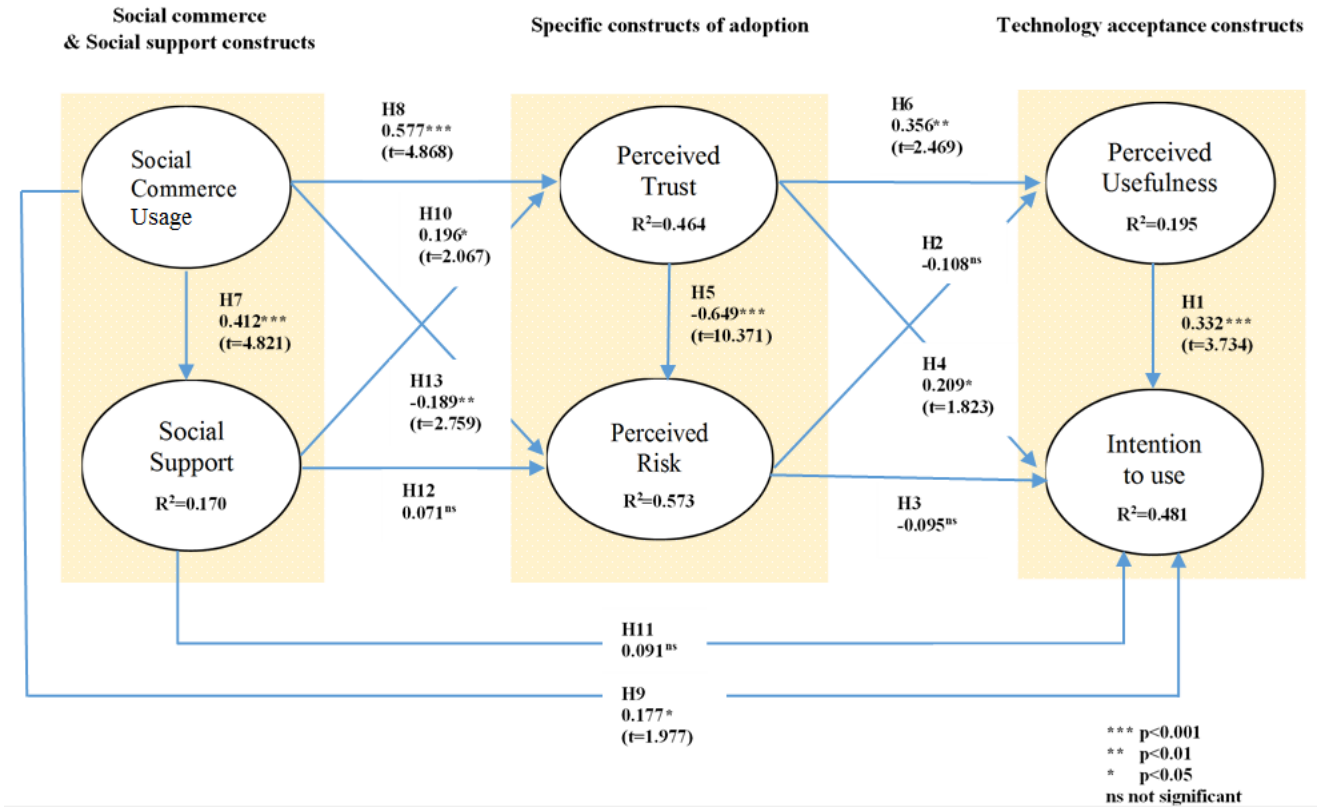

FIGURE 3. PLS results of structural model.

all of the R^2 values are greater than 10%, the minimum threshold suggested [66].

1) MEDIATION ANALYSIS

A direct effect is the relationship that ties together two constructs. An indirect effect is a sequence of relationships with the intervention of at least one construct [65]. Although indirect effects of less than 0.08 are trivial, the total combination of all of the effects can be substantial [64]. Table 5 shows a summary of effects

2) EFFECT SIZE

The effect size (f^2) is the degree of impact that one independent variable has on another dependent variable. f^2 helps to identify whether a variable is essential in the model. Values of 0.02, 0.15 and 0.35 for f^2 can be considered to be small, medium and large, respectively [61]. The results for f^2 are shown in table 6.

V. DISCUSSION AND CONCLUSIONS

A. SUMMARY OF RESULTS

The model presented meets the requirements of reliability and validity (convergent and discriminant). The testing of the hypothesis shows that:

(i) Social commerce usage increases perceived trust (H8), social support (H7), intention to use (H9) and reduces perceived risk (H13); social support increases perceived trust (H10); perceived trust reduces the perceived risk (H5), increases the intention to use (H4) and the perceived usefulness (H6); perceived usefulness increases intention to use (H1).

(ii) The effects of social support on perceived risk (H12) and intention to use (H11) are not supported. Our results could not be consistent with Lu *et al.* [54] and Bai *et al.* [43], as social network users are able to find the social support that backs their behavior intention and reduces the perceived uncertainty of the online environment. One possible explanation is that users of cryptocurrencies are not very expressive or effective in their social relationships, unlike traditional users of any social media [36]. Perhaps due to illicit activities behind using crypto currencies. Thus, social support may not be perceived or adequate [67].

(iii) The effects of perceived risk on perceived utility (H2) and on the intention to use (H3) were not supported. Our results could not match Christensen results [68], who affirms that the characteristics of a disruptive technology involve risk and uncertainty, which affect the viability and behavior. There are some possibilities that can explain these results. Firstly, 90% of the respondents are students and professionals in computer science and related disciplines. Our respondents are

TABLE 5. Summary of effects.

Relationship	Direct effect	Indirect effect	Total effect
H1.Perceived usefulness ⟶ Intention to use	0.332***		0.332***
H2.Perceived risk ⟶ Perceived usefulness	-0.108ns		-0.108ns
H3.Perceived risk ⟶ Intention to use	-0.095ns	-0.036ns	-0.131ns
H4.Perceived trust ⟶ Intention to use	0.209*	0.203**	0.412***
H5.Perceived trust ⟶ Perceived risk	- 0.649***		-0.649***
H6.Perceived trust ⟶ Perceived usefulness	0.356**	0.070ns	0.426***
H7.Social commerce usage ⟶ Social support	0.412***		0.412***
H8.Social commerce usage⟶ Perceived trust	0.577***	0.081*	0.658***
H9.Social commerce usage ⟶ Intention to use	0.177*	0.330***	0.507***
H10.Social support ⟶ Perceived trust	0.196*		0.196*
H11.Social support ⟶ Intention to use	0.091ns	0.072*	0.163*
H12.Social support ⟶ Perceived risk	0.071ns	-0.127*	-0.056ns
H13.Social commerce usage ⟶ Perceived risk	- 0.189**	-0.398***	-0.587***
Social commerce usage ⟶ Perceived usefulness		0.297***	0.297***
Social support ⟶ Perceived usefulness		0.076*	0.076*

***p<0.001; **p<0.01; *p<0.05; ns not significant

TABLE 6. Effect size.

Construct	Relationship	Path coefficient	f^2	Effect size
Perceived trust R^2=0.464	H8. Social commerce usage -> Perceived trust	0.577***	0.515	Large
	H10. Soporte social -> Perceived trust	0.196*	0.060	Small
Perceived usefulness R^2=0.195	H2. Perceived risk -> Perceived usefulness	-0.108ns	0.006	-
	H6. Perceived trust - > Perceived usefulness	0.356**	0.071	Small
Intention to use R^2=0.481	H1. Perceived usefulness -> Intention to use	0.332***	0.167	Medium
	H3. Perceived risk -> Intention to use	-0.095ns	0.007	-
	H4. Perceived trust -> Intention to use	0.209*	0.029	Small
	H9. Social commerce usage -> Intention to use	0.177*	0.031	Small
	H11. Social support ->Intention to use	0.091ns	0.012	-
Social support R^2=0.170	H7. Social commerce usage -> Social support	0.412***	0.205	Medium
Perceived risk R^2=0.573	H5. Perceived trust -> Perceived risk	-0.649***	0.528	Large
	H12. Social support -> Perceived risk	-0.071ns	0.009	-
	H13. Social commerce usage -> Perceived risk	-0.189**	0.046	Small

*** p<0.001; ** p<0.01; * p<0.05 ; ns not significant

adequately trained (in topics related to cryptocurrencies) and are aware of the perception of risk. Secondly, most respondents are classmates and coworkers, they may have developed a certain social identity in their respective university communities. In turn, social identity can provide the sense of protection to its members and mitigate the perception of risk on perceived utility and behavioral intention [52].

Finally, users may be aware that the evasion of legal supervision carries benefits despite the inherent risks of using cryptocurrencies [69].

The model, through the variance (R^2), explains 17% of social support, 19.5% of perceived usefulness, 46.4% of perceived trust, 48.1% of intention to use and 57.3% of perceived risk. Once the hypothesis testing was completed, the following results were obtained:

(iv) The effects on intention to use, by order of magnitude, are: perceived usefulness (path = 0.332, f^2 = 0.167), perceived trust (path = 0.209, f^2 = 0.029) and social commerce usage (path = 0.177, f^2 = 0.031). The perceived usefulness has a medium effect on the intention to use. Social commerce usage and perceived trust are not strong predictors of intention to use. One possible explanation for the low intention to use is that the characteristics of disruptive technologies are poorly valued and appreciated in the early stages of innovation [70].

(v) The effects on perceived risk, by order of magnitude, are: perceived trust (path = −0.649, f^2 = 0.528) and social commerce usage (path = −0.189, f^2 = 0.046). Perceived trust has an important degree of effect on the perceived risk. Social commerce usage has a small effect on perceived risk. However, due to the intervention of perceived trust, the indirect effect of social commerce usage (-0.398) on perceived risk is stronger than the direct effect (-0.189). The results concur with Shanmugam *et al*. [12] in that social commerce usage influence the behavior of the user through perceived trust.

(vi) The effects on perceived trust, by order of magnitude, are: social commerce (path = 0.577, f^2 = 0.515) and social support usage (path = 0.196, f^2 = 0.060). The effect of social commerce usage on social support is significant (path = 0.412), its effect size is medium (f^2 = 0.205). The results fulfil the criteria of Hajli [14], whose findings suggest that social commerce usage (0.412) leads to support (emotional and informational). The issue of cryptocurrencies generates social interaction of users on the web. This result demonstrates that social commerce usage increases perceived trust (0.577), however, the mutual support (0.196) among the participants of a social environment does not generate sufficient trust to use cryptocurrencies. According to the results shown in table 7, users are willing to request suggestions on the use of cryptocurrencies, but even they are not willing to give their recommendation to other users. Our results suggest that if a potential user of cryptocurrency prefers to ask for recommendations, it is due to curiosity, and that the lack of behavioral intent is because users are waiting for others to act [71].

(vii) The effect of perceived trust on perceived usefulness is significant (path = 0.356), its effect size is small (f^2 = 0.071). The indirect effect of social commerce usage (0.297) on perceived usefulness is significant. In contrast, the indirect effect of social support (0.076) on perceived usefulness is minimal. This result shows that social functionalities promote the usefulness of cryptocurrencies (0.297); however, the perceived social support is not transmitted adequately (0.076). Our results suggest that the information generated through social support does not generate enough confidence to adequately promote the perceived utility. The results shown in table 7 indicate that users do not fully perceive the disruptive usefulness of cryptocurrencies. This statement is valid because the information on a disruptive technology is scarce and does not provide sufficient grounds to make a decision on use [68]. Paradoxically, although social media platforms are providers of social support (0.412), the lack of specialized information [6], [7] could lead to stressful support searching by users, which means low-skilled and perceived social support [67].

B. CONTRIBUTION TO RESEARCH AND PRACTICE

This research makes contributions to both theory and practice. In*terms of theory*, a valid and reliable model is developed to analyze the role played by social media in increasing trust and intention to use cryptocurrencies in making electronic payments. Our model is based on the combination of: the theory of social support, social commerce and the technology acceptance model. Therefore, our model provides guidelines on how social commerce can influence the trust and perceived usefulness of a technology (such as cryptocurrencies) to promote its use. In this way, the model extends the theory of social support in the adoption of new information technologies.

In *terms of practice*, the research model can be applied to a specific social network and it enables researchers and practitioners to better understand the following aspects:

(a) The inherent nature of cryptocurrencies. The paper explains the added value of cryptocurrencies and their disruptive way of making transactions. In addition, through a survey, the paper identifies the risks that cause the user uncertainty and discourage their usage.

(b) The role of social commerce in the creation of trust. Social networks provide the functionalities for human communication. The social features enable the monitoring and analysis of perceived trust. Trust is a determining factor in generating a competitive advantage in the cryptocurrency market. This factor serves as a statistical indicator for the development of new advertising strategies, marketing and investment campaigns.

(c) The role of social support in the reduction of perceived risk. The risks of using cryptocurrencies are clear in relation to volatility, lack of regulations and attacks on the network. A good option is to request advice, suggestions and sufficient information available before making electronic transactions with cryptocurrencies. Social networks have the ability to innovate and improve learning through opinions, comments and interpersonal

TABLE 7. Questionnaire and obtained statistic results.

Construct / Indicators (Items)		Mean	Standard deviation	Variance
Perceived trust (Adapted from [73],[74])				
CF1	I believe that electronic payments made with cryptocurrencies are integral	5.39	1.27	1.62
CF2	I believe that electronic payments made with cryptocurrencies are trustworthy because they guarantee the privacy of the data collected in a transaction	3.75	1.28	1.66
CF3	I believe that electronic payments made with cryptocurrencies are reliable because they avoid fraud and reduce the risk in the transaction	3.04	1.04	1.08
Intention to use (Adapted from [48])				
IU1	In the future, I intend to continue using cryptocurrencies in electronic payments.	4.56	1.37	1.87
IU2	In my daily life, I will always try to use cryptocurrencies in electronic payments,	3.73	1.35	1.84
IU3	I often plan to continue using cryptocurrencies in electronic payments.	3.13	1.44	2.08
Perceived risk (Adapted from [75])				
RP1	When I use cryptocurrencies for electronic payments, I worry about fraud due to the lack of legal regulations.	6.05	1.15	1.32
RP2	When I use cryptocurrencies for electronic payments, I worry about losing the value of my money due to the volatility of the cryptocurrency	5.38	1.33	1.77
RP3	When I use cryptocurrencies for electronic payments, I do not feel totally safe due to illegal attacks and activities	4.76	1.38	1.91
RP4	When I use cryptocurrencies for electronic payments, I worry that electronic devices may not work well due to cryptographic failures and that the payment may be processed incorrectly	4.11	1.36	1.87
Social Commerce Usage (Adapted from [13])				
SC1	I am willing to recommend the use of cryptocurrencies in electronic payments, to my friends in forums and communities	3.11	0.75	0.57
SC2	I am willing to share my experience in the use of cryptocurrency with my friends in forums and communities or through ratings and reviews.	4.37	1.25	1.56
SC3	I would like to use people's online recommendations to buy a product using cryptocurrencies	5.51	1.27	1.61
SC4	I would like to request suggestions from my friends in my forums and communities before making a purchase using cryptocurrency	5.93	1.18	1.39
Social support (Adapted from [13])				
SS1	Virtual communities and social networks expressed their interest and concern when I had problems making electronic payments using cryptocurrencies.	3.24	1.16	1.35
SS2	Some people in social networks gave me online assistance when I had difficulties making electronic payments using cryptocurrencies	3.12	1.58	2.49
SS3	Some people in social networks expressed their solidarity when I had difficulties making electronic payments using cryptocurrencies	3.82	1.72	2.96
SS4	Some people in social networks offered me information to resolve the difficulties I was having when making electronic payments using cryptocurrencies.	4.59	1.62	2.65
SS5	Some people in social networks helped me discover the root of my mistakes when making electronic payments using cryptocurrencies	5.27	1.53	2.35
SS6	Some people in social networks gave me suggestions when I needed to make electronic payments using cryptocurrencies	3.99	1.32	1.76
Perceived usefulness (Adapted from [47],[48])				
UP1	Using cryptocurrencies in electronic payments improves the effectiveness, profitability and investment of my money	2.77	1.18	1.38
UP2	Using cryptocurrencies in electronic payments allows me to increase my productivity	3.44	1.30	1.68
UP3	I find that the use of cryptocurrencies in electronic payments is useful because it allows me to quickly and inexpensively send money to anyone in the world	4.10	1.27	1.61
UP4	Using cryptocurrencies I improve my economic performance because I have total control over my money.	4.54	1.23	1.52

Note: The scoring for the items corresponds to the Likert scale (1= completely disagree - 7= completely agree)

relationships. These social actions can improve the intention to use and decrease the perceived risk in online environments.

(d) *The role of social commerce in the adoption of cryptocurrencies*. The financial market monitors the price and profit variations of cryptocurrencies. In turn, this is a reason for individuals to exchange opinions in the forums. Social networks play an important role as an instrument for promotion and added value in the adoption of cryptocurrencies by potential users. Social networks become the mechanism that enables the introduction of cryptocurrencies into society. Therefore, social networks become a qualitative and quantitative analysis tool in relation to the acceptance of a disruptive

TABLE 8. Cross-loading.

Construct / Indicators (items)	Perceived trust	Intention to use	Perceived risk	Social commerce usage	Social Support	Perceived usefulness
Perceived trust						
CF1	**0.74407**	0.34242	-0.44915	0.43953	0.32908	0.25846
CF2	**0.90335**	0.57569	-0.58811	0.56902	0.41943	0.45223
CF3	**0.89795**	0.53189	-0.80794	0.64481	0.36070	0.38058
Intention to use						
IU1	0.42223	**0.81655**	-0.36321	0.42682	0.27771	0.35546
IU2	0.52949	**0.94471**	-0.45571	0.44379	0.30575	0.51883
IU3	0.59363	**0.93287**	-0.52144	0.56044	0.39623	0.57809
Perceived risk						
RP1	-0.86739	-0.56929	**0.87940**	-0.64558	-0.35910	-0.41049
RP2	-0.64700	-0.42489	**0.92132**	-0.54768	-0.23172	-0.30412
RP3	-0.52542	-0.36314	**0.89720**	-0.39532	-0.17789	-0.26977
RP4	-0.43308	-0.34130	**0.81771**	-0.38556	-0.18548	-0.27990
Social commerce usage						
SC1	0.57649	0.50504	-0.47211	**0.77555**	0.47209	0.30153
SC2	0.63262	0.50234	-0.60559	**0.86742**	0.26266	0.38012
SC3	0.51605	0.41284	-0.46969	**0.86877**	0.32837	0.36654
SC4	0.37046	0.27578	-0.31806	**0.76716**	0.26873	0.16394
Social support						
SS1	0.41220	0.38576	-0.35252	0.35099	**0.75068**	0.26714
SS2	0.25061	0.26312	-0.20270	0.28232	**0.86918**	0.17069
SS3	0.41155	0.36755	-0.27752	0.37532	**0.92643**	0.24071
SS4	0.39485	0.28713	-0.20886	0.37618	**0.89379**	0.18787
SS5	0.35944	0.25979	-0.17442	0.33624	**0.84096**	0.23042
SS6	0.41359	0.34149	-0.26635	0.42308	**0.98317**	0.24538
Perceived Usefulness						
UP1	0.44181	0.50426	-0.36558	0.43035	0.28184	**0.86771**
UP2	0.42620	0.52741	-0.38376	0.40620	0.32670	**0.92165**
UP3	0.33302	0.47676	-0.31291	0.25303	0.19483	**0.92124**
UP4	0.33976	0.44569	-0.24884	0.25392	0.09075	**0.85655**

Note: Bolded items are the factor loadings of items in their respective construct

technology (such as cryptocurrencies). Comments and suggestions are the inputs for predicting the intention to use. The model allows analysis of the predictive power of social media in human behaviour.

C. LIMITATIONS AND FUTURE RESEARCH

This study has some limitations. Firstly, the data analysis only corresponds to 125 samples, however PLS-SEM is an efficient method to estimate models with small sample sizes. 90% of the participants have studied at university and only 10% do not belong to this category. Therefore, our sample is limited to a specific level of formal education. Future research should consider a greater number and diversity of respondents, in order to analyze specific groups of data (age, gender, culture [59]), which will reveal important implications in the context of cryptocurrencies. Secondly, although the research reveals significant findings from the behavioral point of view, this study does not include all the social factors that affect the intention to use cryptocurrencies. Future research can expand the current study in various ways. For example, as H2 and H3 were not supported, the consideration of a new factor called social identity [52], could confirm whether this construct moderates the effects of risk on perceived utility and intention to use. In the same way, since H11 and H12 were

not supported, the addition of a new factor called shared language [72], could confirm if this variable moderates the effects of social support on the perceived risk and intention to use. In summary, it is suggested that future research explores other paradigms and theoretical social perspectives in order to better understand and improve the adoption of cryptocurrencies in society.

APPENDIX A
QUESTIONNAIRE

See Table 7.

APPENDIX B
FACTOR LOADING OF THE INDICATORS

See Table 8.

REFERENCES

[1] *European Central Bank, Virtual Currency Schemes—A Further Analysis*, Eur. Central Bank, Frankfurt, Germany, Feb. 2015.

[2] N. E. Egorova and K. A. Torzhevskiy, "Bitcoin: Main trends and perspectives," *Brit. J. Econ., Manage. Trade*, vol. 12, no. 1, pp. 1–11, 2016.

[3] S. Nakamoto. (2008). *Bitcoin: A Peer-to-Peer Electronic Cash System*. Accessed: May, 1, 2018. [Online]. Available: https://bitcoin.org/bitcoin.pdf

[4] Y.-L. Gao, X.-B. Chen, Y.-L. Chen, Y. Sun, X.-X. Niu, Y.-X. Yang, "A secure cryptocurrency scheme based on post-quantum blockchain," *IEEE Access*, vol. 6, pp. 27205–27213, 2018.

[5] Blockchain Luxembourg S. A. (2018). *Bitcoin Stats*. Accessed: May, 1, 2018. [Online]. Available: https://blockchain.info/en/stats

[6] V. Gautam, "Cryptocurrencies: Are disruptive financial innovations here?" *Mod. Economy*, vol. 6, no. 7, pp. 816–832, 2015.

[7] D. Leung and A. Dickinger, "Use of bitcoin in online travel product shopping: The European perspective," in *Information and Communication Technologies in Tourism*. Cham, Switzerland: Springer, 2017, pp. 741–754, doi: 10.1007/978-3-319-51168-9_53.

[8] A. H. Dyhrberg, "Hedging capabilities of bitcoin. Is it the virtual gold?" *Finance Res. Lett.*, vol. 16, pp. 139–144, Feb. 2016.

[9] H. Gjermundrød and I. Dionysiou, "Recirculating *lost* coins in cryptocurrency systems," in *Proc. Int. Conf. Bus. Inf. Syst.*, 2014, pp. 229–240.

[10] A. Zarifis, L. Efthymiou, X. Cheng, and S. Demetriou, "Consumer trust in digital currency enabled transactions," in *Proc. Int. Conf. Bus. Inf. Syst.*, 2014, pp. 241–254.

[11] H. Han, H. Xu, H. Chen, "Social commerce: A systematic review and data synthesis," *Electron. Commerce Res. Appl.*, vol. 30, pp. 38–50, Jul./Aug. 2018.

[12] M. Shanmugam, S. Sun, A. Amidi, F. Khani, and F. Khani, "The applications of social commerce constructs," *Int. J. Inf. Manage.*, vol. 36, no. 3, pp. 425–432, 2016.

[13] N. Hajli and J. Sims, "Social commerce: The transfer of power from sellers to buyers," *Technol. Forecasting Social Change*, vol. 94, pp. 350–358, May 2015.

[14] N. Hajli, "Social commerce constructs and consumer's intention to buy," *Int. J. Inf. Manage.*, vol. 35, no. 2, pp. 183–191, 2015.

[15] A. Beikverdi and J. Song, "Trend of centralization in Bitcoin's distributed network," in *Proc. 16th Int. Conf. Softw. Eng., Artif. Intell., Netw. Parallel/Distrib. Comput. (SNPD)*, Jun. 2015, pp. 1–6.

[16] M. Kubát, "Virtual currency bitcoin in the scope of money definition and store of value," *Procedia Econ. Finance*, vol. 30, pp. 409–416, Jan. 2015.

[17] A. Killeen, "The confluence of bitcoin and the global sharing economy," in *The Handbook of Digital Currency*, D. L. K. Chuen, Ed. San Diego, CA, USA: Academic, 2015, pp. 485–503, ch. 24.

[18] U. Rajput, F. Abbas, R. Hussain, H. Eun, and H. Oh, "A simple yet efficient approach to combat transaction malleability in bitcoin," in *Proc. Int. Workshop Inf. Secur. Appl.*, 2015, pp. 27–37.

[19] X. Zhou, Q. Wu, B. Qin, X. Huang, and J. Liu, "Distributed bitcoin account management," in *Proc. IEEE Trustcom/BigDataSE/ISPA*, Aug. 2016, pp. 105–112.

[20] C. Decker and R. Wattenhofer, "Bitcoin transaction malleability and MtGox," in *Proc. Eur. Symp. Res. Comput. Secur.*, 2014, pp. 313–326.

[21] M. Conti, S. Kumar E, C. Lal, S. Ruj, "A survey on security and privacy issues of bitcoin," *IEEE Commun. Surveys Tuts.*, to be published, doi: 10.1109/COMST.2018.2842460.

[22] P. Ciaian, M. Rajcaniova, A. Kancs, "The digital agenda of virtual currencies: Can bitcoin become a global currency?" *Inf. Syst. e-Bus. Manage.*, vol. 14, no. 4, pp. 883–919, 2016, doi: 10.1007/s10257-016-0304-0.

[23] P. K. Kaushal, A. Bagga, R. Sobti, "Evolution of bitcoin and security risk in bitcoin wallets," *Proc. Int. Conf. Comput. Commun. Electron. (Comptelix)*, Jul. 2017, pp. 172–177.

[24] Y. Baghdadi, "A framework for social commerce design," *Inf. Syst.*, vol. 60, pp. 95–113, Aug./Sep. 2016.

[25] N. Hajli, "The role of social support on relationship quality and social commerce," *Technol. Forecasting Social Change*, vol. 87, pp. 17–27, Sep. 2016.

[26] E. Turban, J. Strauss, and L. Lai, *Social Commerce: Marketing, Technology and Management*. Cham, Switzerland: Springer, 2016.

[27] Z. Huang and M. Benyoucef, "From e-commerce to social commerce: A close look at design features," *Electron. Commerce Res. Appl.*, vol. 12, no. 4, pp. 246–259, 2013.

[28] T. Hu, P. Zhang, and H. Dai, "What and how social commerce: Developing an integrative formative model," in *Proc. 3rd Int. Conf. Inf. Sci. Control Eng.*, Jul. 2016, pp. 748–752.

[29] Y. Wang, Q. Min, and S. Han, "Understanding the effects of trust and risk on individual behavior toward social media platforms: A meta-analysis of the empirical evidence," *Comput. Hum. Behav.*, vol. 56, pp. 34–44, Mar. 2016.

[30] R. Aitken. In Blockchain We Trust? Not Yet, Say Consumers. Forbes. Accessed: May 1, 2018. [Online]. Available: https://www.forbes.com/sites/rogeraitken/2017/09/23/in-blockchain-we-trust-not-yet-say-consumers/#1525140117fd

[31] D. Vandervort, "Challenges and opportunities associated with a bitcoin-based transaction rating system," in *Proc. Int. Conf. Financial Cryptogr. Data Secur.*, vol. 8438, 2014, pp. 33–42, doi: 10.1007/978-3-662-44774-1_3.

[32] M. Matta, I. Lunesu, and M. Marchesi, "Is bitcoin's market predictable? Analysis of Web search and social media," in *Knowledge Discovery, Knowledge Engineering and Knowledge Management*. Cham, Switzerland: Springer, 2016, pp. 155–172, doi: 10.1007/978-3-319-52758-1_10.

[33] D. Garcia, C. J. Tessone, P. Mavrodiev, and N. Perony, "The digital traces of bubbles: Feedback cycles between socio-economic signals in the bitcoin economy," *J. R. Soc. Interface*, vol. 11, no. 99, 2014, doi: 10.1098/rsif.2014.0623.

[34] R. C. Phillips and D. Gorse, "Cryptocurrency price drivers: Wavelet coherence analysis revisited," *PLoS ONE*, vol. 13, no. 4, p. e0195200, 2018.

[35] J. Bohr and M. Bashir, "Who uses bitcoin? An exploration of the bitcoin community," in *Proc. 12th Annu. Int. Conf. Privacy, Secur. Trust*, Jul. 2014, pp. 94–101.

[36] I. Hernandez, M. Bashir, G. Jeon, and J. Bohr, "Are bitcoin users less sociable? An analysis of users' language and social connections on twitter," in *Proc. Int. Conf. Hum.-Comput. Interact.*, 2014, pp. 26–31.

[37] A. Yelowitz and M. Wilson, "Characteristics of Bitcoin users: An analysis of Google search data," *Appl. Econ. Lett.*, vol. 22, no. 13, pp. 1030–1036, 2017.

[38] A. W. Baur, J. Bühler, M. Bick, and C. S. Bonorden, "Cryptocurrencies as a disruption? Empirical findings on user adoption and future potential of Bitcoin and co," in *Proc. Conf. e-Bus., e-Services e-Soc.* in Lecture Notes in Computer Science, vol. 9373, 2015, pp. 63–80, doi: 10.1007/978-3-319-25013-7_6.

[39] D. Folkinshteyn, M. Lennon, "Braving Bitcoin: A technology acceptance model (TAM) analysis," *J. Inf. Technol. Case Appl. Res.*, vol. 18, no. 4, pp. 220–249, 2016.

[40] L. Zhou, P. Zhang, and H. Zimmermann, "Social commerce research: An integrated view," *Electron. Commerce Res. Appl.*, vol. 12, no. 2, pp. 61–68, 2013.

[41] B. H. Gottlieb and A. E. Bergen, "Social support concepts and measures," *J. Psychosomatic Res.*, vol. 69, no. 5, pp. 511–520, 2010.

[42] N. Hajli, M. Shanmugam, P. Powell, and P. E. D. Love, "A study on the continuance participation in on-line communities with social commerce perspective," *Technol. Forecasting Social Change*, vol. 96, pp. 232–241, Jul. 2015.

[43] Y. Bai, Z. Yao, and Y.-F. Dou, "Effect of social commerce factors on user purchase behavior: An empirical investigation from renren.com," *Int. J. Inf. Manage.*, vol. 35, no. 5, pp. 538–550, 2015.

[44] C. Li, "How social commerce constructs influence customers' social shopping intention? An empirical study of a social commerce website," *Technol. Forecast. Soc. Chang.*, to be published, doi: 10.1016/j.techfore.2017.11.026.
[45] H. Zhang, Y. Lu, S. Gupta, and L. Zhao, "What motivates customers to participate in social commerce? The impact of technological environments and virtual customer experiences," *Inf. Manage.*, vol. 51, no. 8, pp. 1017–1030, 2014.
[46] M. Rahman, M. F. Lesch, W. J. Horrey, and L. Strawderman, "Assessing the utility of TAM, TPB, and UTAUT for advanced driver assistance systems," *Accident Anal. Prevention*, vol. 108, pp. 361–373, Nov. 2017.
[47] V. Venkatesh and H. Bala, "Technology acceptance model 3 and a research agenda on interventions," *Decision Sci.*, vol. 39, no. 2, pp. 273–315, 2008.
[48] V. Venkatesh, J. Y. L. Thong, and X. Xu, "Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology," *MIS Quart.*, vol. 36, no. 1, pp. 157–178, 2012.
[49] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quart.*, vol. 13, no. 3, pp. 319–340, 1989.
[50] L. Schmidthuber, D. Maresch, and M. Ginner, "Disruptive technologies and abundance in the service sector—Toward a refined technology acceptance model," *Technol. Forecasting Social Change*, to be published, doi: 10.1016/j.techfore.2018.06.017.
[51] J. M. O. Egea and M. V. R. González, "Explaining physicians' acceptance of EHCR systems: An extension of TAM with trust and risk factors," *Comput. Hum. Behav.*, vol. 27, no. 1, pp. 319–332, 2011.
[52] S. Farivar, O. Turel, and Y. Yuan, "Skewing users' rational risk considerations in social commerce: An empirical examination of the role of social identification," *Inf. Manage.*, to be published, doi: 10.1016/j.im.2018.05.008.
[53] J. P. Peter and M. J. Ryan, "An investigation of perceived risk at the brand level," *J. Marketing Res.*, vol. 13, no. 2, pp. 184–188, 1976.
[54] B. Lu, W. Fan, and M. Zhou, "Social presence, trust, and social commerce purchase intention: An empirical research," *Comput. Hum. Behav.*, vol. 56, pp. 225–237, Mar. 2016.
[55] J. Huang and D. Nicol, "Trust mechanisms for cloud computing," *J. Cloud Comput., Adv., Syst. Appl.*, vol. 2, p. 9, Apr. 2013.
[56] P. Papadopoulou, M. Nikolaidou, and D. Martakos, "What is trust in E-government? A proposed typology," in *Proc. 43rd Hawaii Int. Conf. Syst. Sci.*, Jan. 2010, pp. 1–10.
[57] C. Dierksmeier and P. Seele, "Cryptocurrencies and business ethics," *J. Bus. Ethics*, pp. 1–14, Aug. 2016, doi: 10.1007/s10551-016-3298-0.
[58] D. Kim, "Under what conditions will social commerce business models survive?" *Electron. Commerce Res. Appl.*, vol. 12, no. 2, pp. 69–77, 2013.
[59] C. S.-P. Ng, "Intention to purchase on social commerce websites across cultures: A cross-regional study," *Inf. Manage.*, vol. 50, no. 8, pp. 609–620, 2015.
[60] A. A. Aibinu and A. M. Al-Lawati, "Using PLS-SEM technique to model construction organizations' willingness to participate in e-bidding," *Automat. Construct.*, vol. 19, no. 6, pp. 714–724, 2010.
[61] C. M. Ringle and R. R. Sinkovics, "The use of partial least squares path modeling in international marketing," *Adv. Int. Marketing*, vol. 20, pp. 277–319, Mar. 2009.
[62] D. Barclay, C. Higgins, and R. Thompson, "The partial least squares (PLS) approach to causal modeling: Personal computer adoption and use as an illustration," *Technol. studies*, vol. 2, no. 2, pp. 285–309, 1995.
[63] C. M. Ringle, S. Wende, and J. M. Becker. (2015). SmartPLS—Statistical Software For Structural Equation Modeling. Boenningstedt: SmartPLS GmbH. Accessed: Jan. 15, 2018. [Online]. Available: http://www.smartpls.com
[64] J. F. Hair, Jr., W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate Data Analysis*, 7th ed. Edinburgh, Scotland: Pearson Education, 2009.
[65] W. W. Chin, "How to Write Up and Report PLS Analyses," in *Handbook of Partial Least Squares: Concepts, Methods and Applications*, V. Esposito, W. W. Chin, J. Henseler, H. Wang, Eds. Berlin, Germany: Springer, 2010, pp. 655–690.
[66] R. F. Falk and N. B. Miller, *A Primer for Soft Modeling*, 1st ed. Akron, OH, USA: Univ. Akron Press, 1992.
[67] B. Liu and L. Wei, "Modeling social support on social media: Effect of publicness and the underlying mechanisms," *Comput. Hum. Behav.*, vol. 87, pp. 263–275, Oct. 2018.
[68] C. Christensen, *Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Boston, MA, USA: Hardvard Business School Press, 1997.
[69] M. Bashir, B. Strickland, and J. Bohr, "What motivates people to use Bitcoin?" in *Proc. Int. Conf. Social Inform.* in Lecture Notes in Computer Science, vol. 10047, 2016, pp. 347–367.
[70] J. L. Bower and C. M. Christensen, "Disruptive technologies: Catching the wave," *Harv. Bus. Rev.*, vol. 73, no. 1, pp. 43–53, 1995.
[71] W. Presthus and N. O'Malley, "Motivations and barriers for end-user adoption of bitcoin as digital currency," *Procedia Comput. Sci.*, vol. 121, pp. 89–97, Jan. 2017.
[72] Y.-H. Tsai, S.-W. Joe, C.-P. Lin, R.-T. Wang, and Y.-H. Chang, "Modeling the relationship between IT-mediated social capital and social support: Key mediating mechanisms of sense of group," *Technol. Forecasting Social Change*, vol. 79, no. 9, pp. 1592–1604, 2012.
[73] M.-J. Kim, N. Chung, and C.-K. Lee, "The effect of perceived trust on electronic commerce: Shopping online for tourism products and services in South Korea," *Tourism Manage.*, vol. 32, no. 2, pp. 256–265, 2011.
[74] Y. Lu, L. Zhao, and B. Wang, "From virtual community members to C2C e-commerce buyers: Trust in virtual communities and its effect on consumers' purchase intention," *Electron. Commerce Res. Appl.*, vol. 9, no. 4, pp. 346–360, 2010.
[75] M.-C. Lee, "Factors influencing the adoption of Internet banking: An integration of TAM and TPB with perceived risk and perceived benefit," *Electron. Commerce Res. Appl.*, vol. 8, no. 3, pp. 130–141, 2009.

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