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# Unveiling the Confirmation Factors of Information System Quality on Continuance Intention towards Online Cryptocurrency Exchanges: The Extension of the Expectation Confirmation Model

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**Abstract:** This study is based on the Expectation Confirmation Model and the Information System Success Model to evaluate the influence of perceived usefulness and satisfaction towards online cryptocurrency exchanges. Therefore, this study deconstructs the "confirmation" component of the information system continuous use model into three different components: confirmation of information quality, confirmation of system quality, and confirmation of service quality, to investigate the factors that influence the desire to use online cryptocurrency exchanges continuously. This research used a questionnaire methodology, with data collected from 248 users of cryptocurrency platforms. This study found that perceived usefulness and satisfaction significantly correlated with continuance intention. Furthermore, information quality, system quality, and service quality significantly correlated with perceived usefulness and satisfaction. Finally, perceived usefulness was found to be significantly correlated with satisfaction.

**Keywords:** cryptocurrency; expectation confirmation model; information quality; system quality; service quality; perceived usefulness; satisfaction; continuance intention

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## 1. Introduction

Blockchain is a term that has received much attention in the recent financial technology boom [1]. The term blockchain can be further distinguished into two parts: block and chain. A "block" is a block of information related to a transaction. It is used for bookkeeping if it contains a record of property transactions and as a trigger medium for the operation of a smart contract or decentralized autonomous organization if it contains an execution mechanism. Therefore, the function of a block depends on the information contained in it and the system environment in which it is located [2]. Each block is a series of cryptographically generated data blocks, with each containing information about the cryptocurrency transaction to verify the validity of the information (forgery-proof) and subsequent block generation. It has been called trustless [3,4].

The acceptance of virtual currencies as a means of payment has been increasing worldwide, and virtual currencies such as Litecoin, Ethereum, Ripple, and Neo have sprung up after Bitcoin. However, Bitcoin is still considered one of the world's most widely accepted virtual currencies. In recent years, research on cryptocurrencies has focused partly on the improvement of the underlying technology [5] and the appropriate application scenarios and their impact on financial and economic factors [6–8]; however, there is little literature on the considerations of users' behavior regarding the use of cryptocurrency platforms. In addition, previous studies on cryptocurrency user behavior and intention to use have mainly focused on the discussion of cryptocurrency risk and intention to use [9–11].

Past research has also targeted online cryptocurrency platform users. For instance, a study by Johnson et al. [12] described the risks associated with cryptocurrency trading by explaining the harmful aspects of speculative trading. Johnson et al. [12] used a qualitative approach and provided insights regarding the conditions leading the users to stay engaged in trading, the positive and adverse impacts of trading on cryptocurrency traders, and the ways cryptocurrency traders cope with harm reduction. A recent study by Aleksandr et al. [13] was also related to the risk and safety of online cryptocurrency platform users. According to Aleksandr et al. [13], cryptocurrency traders incur several risks while using online cryptocurrency platforms. The risks include financial fraud, cyber risks, and hacking. These kinds of risks are initiated because of the decentralization of all the online cryptocurrency platforms. Hence, Aleksandr et al. [13] propose that all cryptocurrency platforms should have a global set of regulations implemented for the safety of cryptocurrency traders. Another previous study by Sakas et al. [14] also targeted online cryptocurrency platform users. Sakas et al. [14] targeted the online wallet applications of cryptocurrency and associated them with the affiliate marketing methodologies of firms. According to Sakas et al. [14], supply chain firms using cryptocurrency wallet applications as affiliate marketing links can increase their website visibility and digital performance. Although the previous studies mentioned and described the risks and safeguards related to online cryptocurrency platforms and cryptocurrency traders, they still failed to mention the use of information systems to enhance the efficiency of these methodologies.

On the other hand, the quality of information systems is essential for the success of a platform [15,16]. A high-quality information system provides users with stable, reliable, easy-to-use, and practical features that enhance their satisfaction and experience with the platform. This includes system reliability, user experience, performance, and security. When the system works smoothly, the interface is easy to use, and the response time is quick and error-free, users can complete tasks more efficiently, be more productive, and feel satisfied. A successful platform requires high reliability, continuous operation, and low vulnerability to failure. In addition, the performance and security of the information system are critical to user trust and dependability.

In summary, organizations and platform developers should focus on and invest in improving information system quality (INFQ) to achieve long-term success and competitive advantage. However, there is not much discussion on the INFQ of cryptocurrency platforms. Therefore, to fill the knowledge gap in previous studies, this study provides a deeper understanding of users' antecedents of cryptocurrency platforms and the impact of service quality (SERVQ), system quality (SYSQ), and trust in cryptocurrency platforms on users' behavior and continuous intention (CI) to use them.

## 2. Literature Review

### *2.1. Information System Quality of Online Cryptocurrency Exchanges*

Parasuraman et al. [17] proposed that service quality is the difference between customer expectation and contact satisfaction, and based on these gaps, Parasuraman et al. [18] proposed a service quality scale (SERVQUAL). The five components of SERVQUAL are (1) "tangibility" as the perception of physical facilities, (2)" reliability" as the correct implementation of the company's service commitment, (3) "responsiveness" as the ability of service personnel to help customers' initiative, (4) "assurance" as the professionalism of service personnel, and (5) "caring" as customization. Cronin [19] proposed that the structure of perceptual SERVQ is divided into interaction quality, physical environment quality, and outcome quality. Interaction quality is the dimension of interaction between customers and service providers, physical environment quality is the dimension of customers' feelings about the service environment, and outcome quality is the dimension of overall feelings in the service process; and the subconstructs of the three dimensions are built on the tests of reliability, responsiveness, and empathy.

However, in Parasuraman et al. [18], most of the studies related to SERVQ assessment were empirical and investigated in traditional service industries such as restaurants, hotels,

and banks [20,21]. However, directly using SERVQUAL to measure the service quality of information systems will be conceptually and empirically difficult. A suitable measurement model for information systems' service quality should be developed with information systems or digital services [22]. Therefore, information services-related service quality scales include WebQual [23], which measures the quality of web services, and E-S-QUAL and E-RecS-QUAL measurement models for online shopping sites [24].

In addition, DeLone and McLean [25] proposed an integrated "Information System Success Model" to assess corporate information systems' success or effectiveness. In 2003, DeLone and McLean [26] revised the 1992 Information System Success Model and incorporated Pitt et al.'s (1995) view that the original 1992 Information System Success Model should include "SERVQ", thus formally revising it to the DeLone and McLean [26] Information Systems Success Model. The model uses INFQ, SYSQ, and SERVQ as proxies for information system quality and independent variables to see if they affect system usage and willingness to use, and user satisfaction. DeLone and McLean [26] have also been used in past studies to assess the use of information systems in enterprises.

From the above service quality measurement scales, we can see that there are differences in the measurement components and questions due to different research purposes, so the services of online cryptocurrency exchanges should also have their mechanisms to measure service quality. INFQ, SYSQ, and SERVQ play a crucial role in online cryptocurrency exchanges. Firstly, the quality of information directly affects users' trust in the platform. Complete, accurate, and timely information provides users with the relevant data and insights to make informed investment and trading decisions.

Secondly, system quality is the key element to ensure the smooth operation of the platform. A stable and secure system ensures the reliability of transactions and the safety of assets. The efficiency and reliability of the system are the basis of user experience and one of the key factors to attract and retain users.

SERVQ is critical to building good user relationships [27,28]. Friendly, professional, and timely customer service enhances users' satisfaction with the platform and provides support to help and solve problems. Good service quality helps build the platform's reputation, attract more users, and increase user loyalty [29]. In conclusion, INFQ, SYSQ, and SERVQ are crucial to the successful operation of online cryptocurrency exchanges and user satisfaction. Platform operators should focus on these aspects and continuously improve them to ensure user trust, smooth transaction process, and good user experience.

### *2.2. Expectation Confirmation Model*

The Expectation Confirmation Model (ECM) was developed by Bhattacherjee [30] to explain how users' satisfaction with an information system service is formed. The basic concept of the ECM is based on the relationship between users' expectations of a product or service and their actual experience. The core concept of the ECM is that consumers' satisfaction is formed based on their perception of whether the actual experience meets their expectations. The following are the three essential components of the ECM [30]:

- Perceived Usefulness (PU): It refers to users' subjective evaluation of the functionality and value of a product or service. PU indicates that users perceive that the product or service can satisfy their needs and provide practical benefits [31–33]. This construct concerns users' perceptions of the product or service's value, including whether they think the product or service will help them achieve their goals or solve their problems.
- Confirmation: Confirmation refers to the user's evaluation of whether the actual experience meets their expectations. It involves users comparing the actual experience with their expectations of the product or service to determine consistency or discrepancy [34]. When users' actual experience matches their expectations, they feel validated that the product or service has met their expectations. If the actual experience exceeds expectations, there is a positive confirmation; conversely, if the actual experience is lower than expectations, there is a negative confirmation.

- Satisfaction: Satisfaction indicates the user's overall evaluation of the actual experience. It reflects users' feelings about the product or service, including satisfaction and preference levels. When users' actual experience meets or exceeds their expectations, they usually feel satisfied and positively evaluate the product or service [31,35,36]. Satisfaction is one of the important indicators of consumer behavior and loyalty, which is important for companies to understand consumer feedback and provide better products or services.

The three dimensions of the ECM described above are interrelated and positively impact users' ongoing intentions to use a service or information system. Understanding the definition and interrelationship of the ECM constructs can help researchers delve into the process of consumer expectation formation and satisfaction formation, and provide valuable insights to improve the design and delivery of products or services [37–39]. Therefore, this study aims to combine the concepts of information system quality and the ECM to provide insight into the ongoing usage intentions of cryptocurrency users. By understanding the impact of information system quality on user expectations and confirmation, we will assess users' PU and satisfaction with the online cryptocurrency exchange and explore the impact of these factors on ongoing usage intentions. Based on the above, this study combines the two theoretical foundations of the ECM and the Information Systems Success Model [26] to examine the determinants of user acceptance of online cryptocurrency exchanges through a review and analysis of the relevant literature and how to enhance users' perceived ease of use, PU and satisfaction, and CI.

## 3. Methodology

### *3.1. Operational Definitions and Measurement Items Development*

This study is based on Bhattacherjee's [30] model and, according to his reasoning, incorporates the confirmation of the information system SERVQ to investigate the influence of online cryptocurrency exchange's PU and satisfaction. In addition, this study takes McKinney et al.'s [40] model as a reference and modifies it by deconstructing the confirmation factor into "INFQ" and "SYSQ" constructs because users experience both information and system phases. However, the McKinney et al. [40] model did not include SERVQ in the study. SERVQ was incorporated into this study by referring to the information system SERVQ measurement models of DeLone and McLean [26], Pitt et al. [41], and Kettinger and Lee [42]. Therefore, this study deconstructs the "confirmation" component of the information system continuous use model into three different components: "confirmation of INFQ", "confirmation of SYSQ", and "confirmation of SERVQ", to investigate the factors that influence the desire to use online cryptocurrency exchanges continuously. For the operational definitions of the six constructs in this study, please refer to Table 1.

The design of the questionnaire was based on the literature of the questionnaire concerning related studies. The original researcher's scale items were adapted to the needs of this study, and some of the wording was modified to fit the variables measured in this study. The current study employed partial least squares (PLS) to analyze the validity and reliability of the questionnaire items measuring the constructs used in the study. This study used two stages to conduct the reliability and validity analysis of the questionnaire. In the first stage, the convergent and discriminant validity of the questionnaire items and variables were analyzed. In the second stage, the empirical analysis was conducted to measure the reliability of the model measured by the constructed questionnaire [43]. PLS is considered to be one of the most reliable tools in the measurement and correlation of measurement items and variables [44].

All questions were measured on a 7-point Likert scale, ranging from 1: "strongly disagree" to 7: "strongly agree." The questionnaire was translated from the literature, contextually modified, and reviewed by two scholars working on virtual money platforms and technology finance and then revised to address the responses. Subsequently, a pretest was conducted by a research assistant, and the questionnaire was distributed to 20 subjects (all with experience using online cryptocurrency exchanges) who were asked

to ask questions and make suggestions about the content of the questionnaire that they had doubts about, needed to add to, or needed to correct. Based on these suggestions, the scale questions were revised in detail, and the sample was administered based on the revised questionnaire.

**Table 1.** Operational Definition of Constructs.

| Construct | Definition | Source |
| --- | --- | --- |
| Confirmation of information quality | The content of the information provided by the online cryptocurrency exchange is compared to the user's expectations of the quality of the information after using the system. | McKinney et al. [40]; Lee et al. [45] |
| Confirmation of system quality | The system operation, functions, and interface arrangement provided by the online cryptocurrency exchange are compared with the users' expectations of the system quality after using the system. | McKinney et al. [40]; Lee et al. [45] |
| Confirmation of service quality | The part of the service provided by the online cryptocurrency exchange is compared with the user's expectations of the quality of the service after using the system. | Lee et al. [45] |

### *3.2. Hypotheses Development and Research Framework*

Olsen [46] highlighted a significant correlation between quality, satisfaction, and loyalty. Bhattacherjee [30] also pointed out that satisfaction can be considered the primary key to maintaining a long-term customer loyalty base. Higher customer satisfaction is associated with higher customer loyalty, i.e., a positive relationship exists between the two. Past studies also indicate that satisfaction significantly affects repeat purchase behavior or CI [47–49]. Therefore, the following research hypothesis is proposed in this study:

**Hypothesis 1 (H1).** *Users' satisfaction is significantly associated with the CI of using the online cryptocurrency exchange.*

Ashfaq et al. [49] identified PU as an essential factor influencing Chatbots' intention to repeat use. Thus, when users perceive that engaging in behavior is beneficial, they will continue to do so regardless of changes over time. Existing studies have also found that the PU of using a website has a significant effect on satisfaction and CI [50–53]. Therefore, the following research hypothesis is proposed in this paper:

**Hypothesis 2 (H2).** *PU is significantly associated with the CI of using the online cryptocurrency exchange.*

Bhattacherjee and Lin [34] further confirmed that the association between PU and user satisfaction is significant in the study of the ECM. A positive association between PU and satisfaction was also found in related studies of E-services and M-services [54,55]. Therefore, this study proposes a third research hypothesis as follows:

**Hypothesis 3 (H3).** *PU is significantly associated with the satisfaction of using online cryptocurrency exchanges.*

Bhattacherjee [30] argues that users have pre-use PU, and if this cognition is different from the actual cognition used, the user enters a state of mental adjustment to reconcile;

the rational user will modify the cognition in his mind to match the actual situation. Therefore, the higher the degree of expectation confirmation, the higher the degree of PU [52]. Therefore, if users' actual performance of the three qualities of information, system, and service meets their expectations, the PU of the online cryptocurrency exchange will also be increased. Therefore, the fourth-to-sixth research hypotheses of this study are as follows:

**Hypothesis 4 (H4).** *Expectation confirmation of INFQ is significantly associated with the PU of online cryptocurrency exchanges.*

**Hypothesis 5 (H5).** *Expectation confirmation of SYSQ is significantly associated with the PU of online cryptocurrency exchanges.*

**Hypothesis 6 (H6).** *Expectation confirmation of SERVQ is significantly associated with the PU of online cryptocurrency exchanges.*

Amin et al. [56] concluded that in the context of mobile payment, satisfaction with the service is formed if the user's expectations of the quality of the information system are met. These three factors explain 70% of the variation in satisfaction. According to the ECM, user satisfaction is determined by the information system's two components of expectation and confirmation. However, expectation is only a basis, and confirmation is the authentic expression of users' evaluation after use. As pointed out in previous studies on E-services, the confirmation of service quality significantly affects customer satisfaction [57,58]. Therefore, the research hypotheses for items seven to nine of this study are as follows:

**Hypothesis 7 (H7).** *Expectation confirmation of INFQ is significantly associated with the satisfaction of online cryptocurrency exchanges.*

**Hypothesis 8 (H8).** *Expectation confirmation of SYSQ is significantly associated with the satisfaction of online cryptocurrency exchanges.*

**Hypothesis 9 (H9).** *Expectation confirmation of SERVQ is significantly associated with the satisfaction of online cryptocurrency exchanges.*

Therefore, based on Bhattacherjee's [30] ECM and the viewpoint of information system SERVQ, this study deconstructs the model's confirmation structure in three dimensions: INFQ, SYSQ, and SERVQ use online cryptocurrency exchange users as the empirical target to investigate the effects of PU, quality confirmation, and quality satisfaction on CI. The impact of the online cryptocurrency exchange users on the CI is investigated. The model of this study is shown in Figure 1.

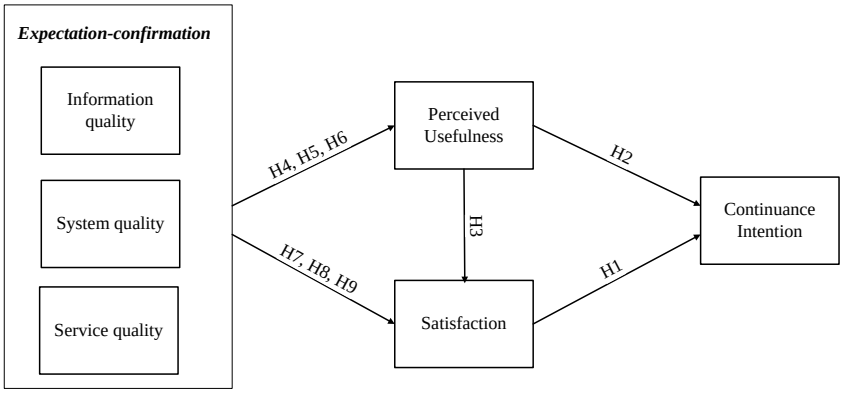


**Figure 1.** Research Framework and Hypotheses.

This study was conducted by a professional survey organization that sampled users of online cryptocurrency exchanges in Taiwan. This research employed a convenience sampling methodology for data collection [59] and collected a total of 273 samples. Binance and Maicoin are two of the most popular cryptocurrency trading platforms in Taiwan. Therefore, our research detected duplication of respondents, incomplete surveys, and respondents using online cryptocurrency platforms other than Binance and Maicoin as exclusion criteria to avoid sampling bias [60]. After deleting the invalid samples, the number of valid samples was 248. These samples included participants of different age groups, genders, education levels, occupational categories, and income levels. According to past research, in the case of cryptocurrency users, the groups are not only differentiated with the help of demographics but other factors, including motivations and purchase intentions. Furthermore, cryptocurrency users are deemed to follow similar and common needs compared to other similar markets [1].

The proportion of males was 72%; the highest proportion was in the age group of 31–40 (38%), followed by 21–40 (36%); the proportion of those married was 44%; the proportion of those with tertiary education was 53%, and those with a master's degree was 40%; the highest proportion of occupations was in the electronic information industry (27%), followed by the military and public education (24%); and the experience in using online cryptocurrency exchanges was mainly in Maicoin and Binance. The average percentage of users using the Maicoin platform was 42.1%; on the other hand, 57.9% of users were using the Binance platform. Finally, the average frequency of respondents using the online cryptocurrency exchange platforms was found to be in the range of 1 to 5 times per month.

## 4. Empirical Data Analysis

### *4.1. Outer Model*

The two-stage method of Anderson and Gerbing [61] was used, and the empirical data of this study were analyzed using Smartpls 4.0 software. Firstly, it should be ensured that the measurement instruments used have good reliability and validity.

The reliability of a measurement tool indicates the consistency and stability of its measurement results, while validity indicates whether the measurement tool can accurately measure the concept to be studied. In convergent validity, we are concerned with the correlation between the measurement instrument and the concept it measures. In order to ensure astringent validity, we need to conduct validation of the measurement model. This can be achieved by analyzing the indicators of the factor loading, average variance extracted (AVE), and reliability. From the results in Table 2, all the measures in this study have a factor loading above 0.7, and the values of reliability and AVE for each construct are also above 0.7 and 0.5, respectively. This indicates that the measurement tools can accurately measure the study concepts and provide reliable and valid findings [43,62].

**Table 2.** Convergent Validity.

| Construct | Range of Factor Loading | Composite Reliability | Average Variance Extracted |
|---|---|---|---|
| Information Quality | 0.892~0.955 (3 items) | 0.949 | 0.861 |
| System quality | 0.770~0.860 (3 items) | 0.863 | 0.678 |
| Service quality | 0.731~0.825 (3 items) | 0.829 | 0.618 |
| Perceived Usefulness | 0.819~0.847 (3 items) | 0.872 | 0.694 |
| Satisfaction | 0.776~0.857 (3 items) | 0.857 | 0.666 |
| Continuance Intention | 0.839~0.920 (3 items) | 0.920 | 0.793 |

Discriminant validity is an assessment method used to identify different constructs' differences [63]. It is used to determine whether a measure can distinguish between

different concepts to ensure the model's validity. To examine the discriminant validity, we first calculate the confidence interval of the correlation coefficients between the different constructs. If the confidence interval between the constructs in the empirical data does not contain 1 at the 95% confidence level, then the concepts are considered to have good discriminant validity (as shown in Table 3) [64].

**Table 3.** The 95% Confidence Interval of Correlations.

| Relationship | Correlation Coefficient | Lower Bound | Upper Bound |
|---|---|---|---|
| INFQ <-> CI | 0.398 | 0.271 | 0.513 |
| PU <-> CI | 0.479 | 0.357 | 0.591 |
| PU <-> INFQ | 0.474 | 0.347 | 0.584 |
| SAT <-> CI | 0.581 | 0.478 | 0.673 |
| SAT <-> INFQ | 0.430 | 0.307 | 0.538 |
| SAT <-> PU | 0.503 | 0.402 | 0.598 |
| SERVQ <-> CI | 0.622 | 0.535 | 0.702 |
| SERVQ <-> INFQ | 0.335 | 0.209 | 0.452 |
| SERVQ <-> PU | 0.471 | 0.374 | 0.568 |
| SERVQ <-> SAT | 0.512 | 0.413 | 0.609 |
| SYSQ <-> CI | 0.600 | 0.504 | 0.685 |
| SYSQ <-> INFQ | 0.340 | 0.209 | 0.459 |
| SYSQ <-> PU | 0.453 | 0.332 | 0.569 |
| SYSQ <-> SAT | 0.583 | 0.484 | 0.672 |
| SYSQ <-> SERVQ | 0.510 | 0.406 | 0.610 |

Note: INFQ = Information quality; SYSQ = System quality; SERVQ = Service quality; PU = Perceived usefulness; SAT = Satisfaction; CI = Continuance intention.

In addition, this study also examined the Heterotrait–Monotrait (HTMT) values between the constructs. The HTMT concept was introduced by Henseler et al. [65] within the context of PLS. HTMT methodology is effective in marketing and can be employed in various other disciplines [66]. HTMT can be described as the mean of the constructs' items correlations (also known as the hetero-method) in correspondence to the mean of the items' correlations (also known as the geometric mean) computing the same construct. As shown in Table 4, the empirical data of this study showed that the inter-configuration HTMT values were below 0.85, indicating that the measure has acceptable discriminant validity [43].

**Table 4.** Heterotrait–Monotrait (HTMT).

| Construct | CI | INFQ | PU | SAT | SERVQ | SYSQ |
|---|---|---|---|---|---|---|
| CI | | | | | | |
| INFQ | 0.446 | | | | | |
| PU | 0.567 | 0.551 | | | | |
| SAT | 0.720 | 0.517 | 0.645 | | | |
| SERVQ | 0.791 | 0.420 | 0.618 | 0.698 | | |
| SYSQ | 0.742 | 0.406 | 0.567 | 0.770 | 0.687 | |

Note: INFQ = Information quality; SYSQ = System quality; SERVQ = Service quality; PU = Perceived usefulness; SAT = Satisfaction; CI = Continuance intention.

### *4.2. Inner Model*

The inner model analysis is mainly used to examine the causal effect of each potential variable in the model and its significance.

This study conducted the significance analysis by assessing the hypothesized correlations' path coefficients, *p*-values, and t-values. In addition, this study used R-square values to explain the extent of variations in the proposed relationships [67]. The results are shown in Figure 2. The R-square is related to the proposed correlations' variation percentages, and its value lies between 0 and 1. The R-square of a relationship is stronger if the values are close to 1.


**Figure 2.** Inner Model Result. Note. ** $p < 0.01$, *** $p < 0.001$.

The significance of each path is also examined. The results of the final path analysis are shown in Figure 2 and Table 5, and the results are provided in this paper for hypothesis validation and analysis.

**Table 5.** Research Hypotheses Testing.

| Path | Standardized Path Coefficient | Standard Deviation | t-Value | *p*-Value |
|---|---|---|---|---|
| INFQ -> PU | 0.315 *** | 0.063 | 5.017 | 0.000 |
| INFQ -> SAT | 0.162 ** | 0.053 | 3.028 | 0.002 |
| SYSQ -> PU | 0.215 ** | 0.072 | 2.981 | 0.003 |
| SYSQ -> SAT | 0.348 *** | 0.061 | 5.722 | 0.000 |
| SERVQ -> PU | 0.256 *** | 0.057 | 4.454 | 0.000 |
| SERVQ -> SAT | 0.198 ** | 0.061 | 3.219 | 0.001 |
| PU -> SAT | 0.176 ** | 0.057 | 3.105 | 0.002 |
| PU -> CI | 0.249 *** | 0.068 | 3.679 | 0.000 |
| SAT -> CI | 0.456 *** | 0.060 | 7.544 | 0.000 |

Note 1: ** *p*-value < 0.01; *** *p*-value < 0.001. Note 2: INFQ = Information quality; SYSQ = System quality; SERVQ = Service quality; PU = Perceived usefulness; SAT = Satisfaction; CI = Continuance intention.

Firstly, H1, H2, and H3 examine the relationship between re-use intention, satisfaction, and perceived usefulness of online cryptocurrency exchanges. The results show that the user satisfaction constructs significantly correlate with the CI (β = 0.456, t-value = 7.544). The PU was significantly correlated with the CI (β = 0.249, t-value = 3.6779) and satisfaction (β = 0.176, t-value = 3.105). The results in Table 5 and Figure 2 show that empirical data support H1, H2, and H3. In Figure 2, the satisfaction and PU constructs explained 38.4% of the variance in the CI construct. Secondly, this study examined the constructs of PU, where the relevant research hypotheses are H4, H5, and H6. According to the data analysis,

there are significant correlations of INFQ (β = 0.315, t-value = 5.017), SYSQ (β = 0.215, t-value = 2.981), and SERVQ (β = 0.256, t-value = 4.454) with PU.

Therefore, H4, H5, and H6 were confirmed, and the three components of INFQ, SYQ, and SERVQ had 36.7% of explainable variation in expectation confirmation.

Finally, the three research hypotheses regarding the satisfaction constructs were H7, H8, and H9. According to the results of the research data, there were significant correlations of confirmation of INFQ (β = 0.162, t-value = 3.028), SYSQ (β = 0.348, t-value = 5.772), and SERVQ (β = 0.198, t-value = 3.219) with satisfaction. Therefore, H7, H8, and H9 were also confirmed empirically. In explaining the variation, the three dimensions of INFQ, SYSQ, and SERVQ explained 46.2% of the variation in the satisfaction dimensions.

## 5. Discussion and Conclusions

With the emergence of Bitcoin and blockchain concepts, cryptocurrencies and their applications using their related technologies have gradually emerged in the information and finance sector in recent years. Although most financial institutions worldwide are cautious and wait-and-see about cryptocurrencies, some e-commerce payment platforms have announced that they accept payments in mainstream cryptocurrencies, and some credit card companies allow purchases to be settled in cryptocurrencies. In light of this trend, this study demonstrates the importance of cryptocurrency as a research question for the services offered by online cryptocurrency exchanges, trust, and willingness to use them. Firstly, with the popularity of cryptocurrencies and the proliferation of cryptocurrency trading platforms, it is important to understand how the quality of the platform's information system services affects user experience and transaction behavior to understand the cryptocurrency market's operation and development. In the past, few papers have applied expectation confirmation theory, which is originally from the marketing field relating to the usage context of online cryptocurrency exchanges, and examined the user satisfaction and usage intention of online cryptocurrency exchanges in three quality dimensions. Therefore, this study proposes modifying Bhattacherjee's [30] expectation confirmation theory and DeLone and McLean's [26] viewpoint and deconstructing INFQ, SYSQ, and SERVQ as three levels of influence on the PU and satisfaction of online cryptocurrency exchanges. This study verifies that PU has a positive effect on the satisfaction and CI of an online cryptocurrency exchange on the one hand, and information system quality has a sequential effect on the psychological aspect of willingness on the other. The results of this study show that satisfaction with the SYSQ of the online cryptocurrency exchange has a higher impact on the CI than the INFQ and SERVQ of the online cryptocurrency exchange. Customers' PU of the online cryptocurrency exchange is an important factor influencing the satisfaction and CI of the online cryptocurrency exchange.

Secondly, the quality of information system services is directly related to the satisfaction of online cryptocurrency exchange users with the platform. Understanding the correlation between SERVQ and user satisfaction can help online cryptocurrency exchange operators improve their information systems and provide a better user experience, increasing user loyalty and growing the platform's user base. In addition, studying the correlation between online cryptocurrency exchanges and the quality of information system services can also provide guidance and recommendations to platform operators to improve their information systems and SERVQ to address possible problems and challenges. This will help enhance the reliability and stability of the entire cryptocurrency ecosystem and facilitate the development and maturation of the cryptocurrency market.

In conclusion, studying the correlation between online cryptocurrency exchanges and the quality of information system services can provide valuable insights to help us better understand the operation of the cryptocurrency market and user needs and drive continuous improvement and innovation in related platforms.

## 6. Research Limitations and Future Research Directions

The current research has the following limitations that can be addressed by future potential researchers. The current study collected data from 248 cryptocurrency platforms users in Taiwan, which represents a limited segment of a developing economy. Hence, future researchers are suggested to collect a larger sample size from another developing or developed economy and offer further insights regarding the empirical evidence of this research.

While this study aims to be rigorous, there are still some research limitations and future research work to be conducted. Firstly, the emergence of Bitcoin and blockchain technology has changed how people do business. However, the cryptographic, pseudonymous, and decentralized nature of Bitcoin also makes it difficult for governments to enforce the law domestically and across borders, especially when it comes to regulating and detecting the flow of Bitcoin funds.

Furthermore, in the current study, the opinions of all the online platform users were obtained regardless of their experience and expertise in the field. Hence, future researchers are advised to use expert survey methodology [68] and collect the opinions of experts in the field of cryptocurrency. In addition, researchers are also urged to mention the methodology for selecting experts and the criteria to analyze and validate their opinions.

Finally, the current study did not use any control variables in the data analysis. Hence, future researchers are advised to include demographic control variables or variables like previous experience [69] or trust [70] in the use of the online platforms.

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## References

1. Ante, L. Non-fungible token (NFT) markets on the Ethereum blockchain: Temporal development, cointegration and interrelations. *Econ. Innov. New Technol.* **2022**, 1–19. [CrossRef]
2. Hammi, M.T.; Hammi, B.; Bellot, P.; Serhrouchni, A. Bubbles of Trust: A decentralized blockchain-based authentication system for IoT. *Comput. Secur.* **2018**, *78*, 126–142. [CrossRef]
3. Zhao, J.L.; Fan, S.; Yan, J. Overview of business innovations and research opportunities in blockchain and introduction to the special issue. *Financ. Innov.* **2016**, *2*, 28. [CrossRef]
4. Połap, D.; Srivastava, G.; Yu, K. Agent architecture of an intelligent medical system based on federated learning and blockchain technology. *J. Inf. Secur. Appl.* **2021**, *58*, 102748. [CrossRef]
5. Krishnan, L.P.; Vakilinia, I.; Reddivari, S.; Ahuja, S. Scams and Solutions in Cryptocurrencies—A Survey Analyzing Existing Machine Learning Models. *Information* **2023**, *14*, 171. [CrossRef]
6. Zhang, L.; Xie, Y.; Zheng, Y.; Xue, W.; Zheng, X.; Xu, X. The challenges and countermeasures of blockchain in finance and economics. *Syst. Res. Behav. Sci.* **2020**, *37*, 691–698. [CrossRef]
7. Cunha, P.R.; Melo, P.; Sebastião, H. From bitcoin to central bank digital currencies: Making sense of the digital money revolution. *Future Internet* **2021**, *13*, 165. [CrossRef]
8. Bhimani, A.; Hausken, K.; Arif, S. Do national development factors affect cryptocurrency adoption? *Technol. Forecast. Soc. Change* **2022**, *181*, 121739. [CrossRef]
9. Anser, M.K.; Zaigham, G.H.K.; Imran Rasheed, M.; Pitafi, A.H.; Iqbal, J.; Luqman, A. Social media usage and individuals' intentions toward adopting Bitcoin: The role of the theory of planned behavior and perceived risk. *Int. J. Commun. Syst.* **2020**, *33*, e4590. [CrossRef]
10. Jariyapan, P.; Mattayaphutron, S.; Gillani, S.N.; Shafique, O. Factors influencing the behavioural intention to use cryptocurrency in emerging economies during the COVID-19 pandemic: Based on technology acceptance model 3, perceived risk, and financial literacy. *Front. Psychol.* **2022**, *12*, 5935. [CrossRef] [PubMed]
11. Sukumaran, S.; Bee, T.S.; Wasiuzzaman, S. Cryptocurrency as an investment: The Malaysian context. *Risks* **2022**, *10*, 86. [CrossRef]

12. Johnson, B.; Sun, T.; Stjepanović, D.; Vu, G.; Chan, G.C.K. "Buy High, Sell Low": A Qualitative Study of Cryptocurrency Traders Who Experience Harm. *Int. J. Environ. Res. Public Health* **2023**, *20*, 5833. [CrossRef]
13. Alekseenko, A.P. Model Framework for Consumer Protection and Crypto-Exchanges Regulation. *J. Risk Financ. Manag.* **2023**, *16*, 305. [CrossRef]
14. Sakas, D.P.; Giannakopoulos, N.T.; Nasiopoulos, D.K.; Kanellos, N.; Tsoulfas, G.T. Assessing the Efficacy of Cryptocurrency Applications' Affiliate Marketing Process on Supply Chain Firms' Website Visibility. *Sustainability* **2023**, *15*, 7326. [CrossRef]
15. Masri, N.W.; You, J.-J.; Ruangkanjanases, A.; Chen, S.-C.; Pan, C.-I. Assessing the effects of information system quality and relationship quality on continuance intention in e-tourism. *Int. J. Environ. Res. Public Health* **2020**, *17*, 174. [CrossRef] [PubMed]
16. Kim, J.; Kim, J. An integrated analysis of value-based adoption model and information systems success model for proptech service platform. *Sustainability* **2021**, *13*, 12974. [CrossRef]
17. Parasuraman, A.; Zeithaml, V.A.; Berry, L.L. A conceptual model of service quality and its implications for future research. *J. Mark.* **1985**, *49*, 41–50. [CrossRef]
18. Parasuraman, A.; Zeithaml, V.A.; Berry, L. SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *J. Retail.* **1988**, *64*, 12–40.
19. Brady, M.K.; Cronin, J.J., Jr. Some new thoughts on conceptualizing perceived service quality: A hierarchical approach. *J. Mark.* **2001**, *65*, 34–49. [CrossRef]
20. Bhat, M.A. Tourism service quality: A dimension-specific assessment of SERVQUAL. *Glob. Bus. Rev.* **2012**, *13*, 327–337. [CrossRef]
21. Koc, E.; Yazici Ayyildiz, A. An overview of tourism and hospitality scales: Discussion and recommendations. *J. Hosp. Tour. Insights* **2022**, *5*, 927–949. [CrossRef]
22. Van Dyke, T.P.; Kappelman, L.A.; Prybutok, V.R. Measuring information systems service quality: Concerns on the use of the SERVQUAL questionnaire. *MIS Q.* **1997**, *21*, 195–208. [CrossRef]
23. Barnes, S.J.; Vidgen, R. Interactive e-government: Evaluating the web site of the UK Inland Revenue. *J. Electron. Commer. Organ. JECO* **2004**, *2*, 42–63. [CrossRef]
24. Parasuraman, A.; Zeithaml, V.A.; Malhotra, A. ES-QUAL: A multiple-item scale for assessing electronic service quality. *J. Serv. Res.* **2005**, *7*, 213–233. [CrossRef]
25. DeLone, W.H.; McLean, E.R. Information systems success: The quest for the dependent variable. *Inf. Syst. Res.* **1992**, *3*, 60–95. [CrossRef]
26. DeLone, W.H.; McLean, E.R. The DeLone and McLean model of information systems success: A ten-year update. *J. Manag. Inf. Syst.* **2003**, *19*, 9–30.
27. Tseng, S.-M.; Wu, P.-H. The impact of customer knowledge and customer relationship management on service quality. *Int. J. Qual. Serv. Sci.* **2014**, *6*, 77–96. [CrossRef]
28. Barnes, J.G. Establishing meaningful customer relationships: Why some companies and brands mean more to their customers. *Manag. Serv. Qual. Int. J.* **2003**, *13*, 178–186. [CrossRef]
29. Ryu, M.H.; Kim, J.; Kim, S. Factors affecting application developers' loyalty to mobile platforms. *Comput. Hum. Behav.* **2014**, *40*, 78–85. [CrossRef]
30. Bhattacherjee, A. Understanding information systems continuance: An expectation-confirmation model. *MIS Q.* **2001**, *25*, 351–370. [CrossRef]
31. Chen, S.-C.; Liu, M.-L.; Lin, C.-P. Integrating technology readiness into the expectation–confirmation model: An empirical study of mobile services. *Cyberpsychol. Behav. Soc. Netw.* **2013**, *16*, 604–612. [CrossRef] [PubMed]
32. Zhao, H.; Khan, A. The Students' Flow Experience With the Continuous Intention of Using Online English Platforms. *Front. Psychol.* **2021**, *12*, 807084. [CrossRef] [PubMed]
33. Xu, Y.; Wang, Y.; Khan, A.; Zhao, R. Consumer Flow Experience of Senior Citizens in Using Social Media for Online Shopping. *Front. Psychol.* **2021**, *12*, 732104. [CrossRef] [PubMed]
34. Bhattacherjee, A.; Lin, C.-P. A unified model of IT continuance: Three complementary perspectives and crossover effects. *Eur. J. Inf. Syst.* **2015**, *24*, 364–373. [CrossRef]
35. Chen, H.; Chiang, R.H.; Storey, V.C. Business intelligence and analytics: From big data to big impact. *MIS Q.* **2012**, *36*, 1165–1188. [CrossRef]
36. Chen, S.-C.; Lin, C.-P. The impact of customer experience and perceived value on sustainable social relationship in blogs: An empirical study. *Technol. Forecast. Soc. Chang.* **2015**, *96*, 40–50. [CrossRef]
37. Lee, M.-C. Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation–confirmation model. *Comput. Educ.* **2010**, *54*, 506–516. [CrossRef]
38. Brown, S.A.; Venkatesh, V.; Goyal, S. Expectation confirmation in technology use. *Inf. Syst. Res.* **2012**, *23*, 474–487. [CrossRef]
39. Park, E.S.; Park, M.S. Factors of the technology acceptance model for construction IT. *Appl. Sci.* **2020**, *10*, 8299. [CrossRef]
40. McKinney, V.; Yoon, K.; Zahedi, F.M. The measurement of web-customer satisfaction: An expectation and disconfirmation approach. *Inf. Syst. Res.* **2002**, *13*, 296–315. [CrossRef]
41. Pitt, L.F.; Watson, R.T.; Kavan, C.B. Service quality: A measure of information systems effectiveness. *MIS Q.* **1995**, *19*, 173–187. [CrossRef]
42. Kettinger, W.J.; Lee, C.C. Pragmatic perspectives on the measurement of information systems service quality. *MIS Q.* **1997**, *21*, 223–240. [CrossRef]

43. Hair, J.F.; Risher, J.J.; Sarstedt, M.; Ringle, C.M. When to use and how to report the results of PLS-SEM. *Eur. Bus. Rev.* **2019**, *31*, 2–24. [CrossRef]
44. Shmueli, G.; Ray, S.; Estrada, J.M.V.; Chatla, S.B. The elephant in the room: Predictive performance of PLS models. *J. Bus. Res.* **2016**, *69*, 4552–4564. [CrossRef]
45. Lee, H.; Kim, J.; Kim, J. Determinants of success for application service provider: An empirical test in small businesses. *Int. J. Hum.-Comput. Stud.* **2007**, *65*, 796–815. [CrossRef]
46. Olsen, S.O. Comparative evaluation and the relationship between quality, satisfaction, and repurchase loyalty. *J. Acad. Mark. Sci.* **2002**, *30*, 240–249. [CrossRef]
47. Chen, M.-F.; Lee, C.-L. The impacts of green claims on coffee consumers' purchase intention. *Br. Food J.* **2015**, *117*, 195–209. [CrossRef]
48. Chen, S.-C.; Lin, C.-P. Understanding the effect of social media marketing activities: The mediation of social identification, perceived value, and satisfaction. *Technol. Forecast. Soc. Chang.* **2019**, *140*, 22–32. [CrossRef]
49. Ashfaq, M.; Yun, J.; Yu, S.; Loureiro, S.M.C. I, Chatbot: Modeling the determinants of users' satisfaction and continuance intention of AI-powered service agents. *Telemat. Inform.* **2020**, *54*, 101473. [CrossRef]
50. Chen, S.C.; Chen, H.H.; Chen, M.F. Determinants of satisfaction and continuance intention towards self-service technologies. *Ind. Manag. Data Syst.* **2009**, *109*, 1248–1263. [CrossRef]
51. Cheng, S.-I.; Chen, S.-C.; Yen, D.C. Continuance intention of E-portfolio system: A confirmatory and multigroup invariance analysis of technology acceptance model. *Comput. Stand. Interfaces* **2015**, *42*, 17–23. [CrossRef]
52. Chen, S.-C.; Yen, D.C.; Peng, S.-C. Assessing the impact of determinants in e-magazines acceptance: An empirical study. *Comput. Stand. Interfaces* **2018**, *57*, 49–58. [CrossRef]
53. Oertzen, A.-S.; Odekerken-Schröder, G. Achieving continued usage in online banking: A post-adoption study. *Int. J. Bank Mark.* **2019**, *37*, 1394–1418. [CrossRef]
54. Gao, L.; Bai, X. A unified perspective on the factors influencing consumer acceptance of internet of things technology. *Asia Pac. J. Mark. Logist.* **2014**, *26*, 211–231. [CrossRef]
55. Wu, L.-Y.; Chen, K.-Y.; Chen, P.-Y.; Cheng, S.-L. Perceived value, transaction cost, and repurchase-intention in online shopping: A relational exchange perspective. *J. Bus. Res.* **2014**, *67*, 2768–2776. [CrossRef]
56. Hsu, C.-L.; Lin, J.C.-C. What drives purchase intention for paid mobile apps?–An expectation confirmation model with perceived value. *Electron. Commer. Res. Appl.* **2015**, *14*, 46–57. [CrossRef]
57. Aparicio, M.; Bacao, F.; Oliveira, T. Grit in the path to e-learning success. *Comput. Hum. Behav.* **2017**, *66*, 388–399. [CrossRef]
58. Khan, A.; Chen, C.-C.; Suanpong, K.; Ruangkanjanases, A.; Kittikowit, S.; Chen, S.-C. The impact of CSR on sustainable innovation ambidexterity: The mediating role of sustainable supply chain management and second-order social capital. *Sustainability* **2021**, *13*, 12160. [CrossRef]
59. Mutambik, I. Customer Experience in Open Banking and How It Affects Loyalty Intention: A Study from Saudi Arabia. *Sustainability* **2023**, *15*, 10867. [CrossRef]
60. Ante, L.; Fiedler, F.; Steinmetz, F.; Fiedler, I. Profiling Turkish Cryptocurrency Owners: Payment Users, Crypto Investors and Crypto Traders. *J. Risk Financ. Manag.* **2023**, *16*, 239. [CrossRef]
61. Anderson, J.C.; Gerbing, D.W. Structural equation modeling in practice: A review and recommended two-step approach. *Psychol. Bull.* **1988**, *103*, 411. [CrossRef]
62. Xu, H.; Wang, Z.; Lian, N.; Khan, A.; Zhang, L. The Impact of Transformational Leadership on Organizational Commitment and Intention to Stay: Empirical Evidence From China's Performing Arts Industry. *Front. Psychol.* **2022**, *13*, 874803. [CrossRef] [PubMed]
63. Fornell, C.; Larcker, D.F. *Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics*; Sage Publications: Los Angeles, CA, USA, 1981.
64. Torkzadeh, G.; Koufteros, X.; Pflughoeft, K. Confirmatory analysis of computer self-efficacy. *Struct. Equ. Model.* **2003**, *10*, 263–275. [CrossRef]
65. Henseler, J.; Ringle, C.M.; Sarstedt, M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J. Acad. Mark. Sci.* **2015**, *43*, 115–135. [CrossRef]
66. Rönkkö, M.; Cho, E. An updated guideline for assessing discriminant validity. *Organ. Res. Methods* **2022**, *25*, 6–14. [CrossRef]
67. Akossou, A.; Palm, R. Impact of data structure on the estimators R-square and adjusted R-square in linear regression. *Int. J. Math. Comput.* **2013**, *20*, 84–93.
68. Christopoulos, D. Peer Esteem Snowballing: A methodology for expert surveys. In Proceedings of the Eurostat Conference for New Techniques and Technologies for Statistics, Eurostat, Brussels, 18–20 February 2009; pp. 171–179.

69. Tomczyk, Ł.; Potyrała, K.; Włoch, A.; Wnęk-Gozdek, J.; Demeshkant, N. Evaluation of the functionality of a new e-learning platform vs. Previous experiences in e-learning and the self-assessment of own digital literacy. *Sustainability* **2020**, *12*, 10219. [CrossRef]
70. Lăzăroiu, G.; Neguriţă, O.; Grecu, I.; Grecu, G.; Mitran, P.C. Consumers' decision-making process on social commerce platforms: Online trust, perceived risk, and purchase intentions. *Front. Psychol.* **2020**, *11*, 890. [CrossRef]