

# A Practical Model to Measure E-Service Quality and E-Customer Satisfaction of Crypto Wallets

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## Abstract

The research explores a model to measure E-Service quality and E-Customer satisfaction of crypto wallet users. The purpose of this paper is to design a model for crypto wallets. The research method of this research is mixed method. First, qualitative research that conducted using thematic analysis, and then, main themes derived from interviews, which consisted of four main themes including: “Security and Trust”, “privacy”, “Ease of Use”, and “Price and transaction”. The data was collected using questionnaires from crypto wallet users by means of distribution of online questionnaire from Aug. 2020 to Sep. 2021 as Google forms through social media and online advertising in cryptocurrency websites. The research methodology in the second phase is a quantitative approach, and 9 hypotheses were raised in this study. 515 data was collected and after analyzing the responses and discarding incomplete, 404 data were retained to test the empirical model. The data collected was analyzed with smart-PLS software. The results demonstrate that “Security and trust”, “Price and Transaction”, “Privacy”, and “Ease of Use” are positively associated with E-Service Quality; and “Security and trust”, “Privacy”, and “Ease of use” are positively associated with “E-customer Satisfaction”. Results show that the “E-Service Quality” has a positive effect on variable “E-Customer satisfaction”. The finding indicates that “Security and trust”, “Price and Transaction”, “Privacy”, and “Ease of Use” are key factors of “E-Service quality”; while “Security and trust” and “Privacy” are key factors of “E-Customer satisfaction”.

## Keywords

Crypto Wallet, E-Service, E-Service Quality, E-Customer Satisfaction

## 1. Introduction

The number of cryptocurrencies demonstrates the importance of Blockchain which

now exceeding 1900 and day by day growing in number (CoinMarketCap, 2017). The momentous demand of cryptocurrencies increased the volume of the market of cryptocurrencies from 1.5 billion U.S. dollars in 2013 to over 795 billion U.S. dollars in 2018 (Xie, 2019). The number of existing cryptocurrencies exceeds 2000 types of cryptocurrencies in 2019 (Arias-Oliva et al., 2019). The idea of Bitcoin as a type of cryptocurrency, was defined by Satoshi Nakamoto in 2008, which allows the user to send and receive payments instantaneously by using a crypto wallet without the involvement of governments, financial institutions, or any other third party as a decentralized digital peer to peer payment system (Nakamoto, 2008). Bitcoin is a currency, a digital currency that uses blockchain to facilitate transaction management and processing (Dozier & Montgomery, 2019).

Cryptocurrencies hold digital currencies and virtual currencies. Bitcoin is the first Blockchain technology to use crypto money (Higginson et al., 2019). A virtual currency like Bitcoin doesn't require any existence of central authority to enable the transaction and its processing. Bitcoin was created in 2009, right after the Global financial depression that influenced the markets all over the globe (Farrell, 2019). One of the main reasons for creating Bitcoin was to overcome the financial crisis as they clearly demonstrated flaws in the traditional banking systems around the globe. Bitcoin was invented to facilitate the money transaction at the cheapest price per transaction internationally (Yadav et al., 2020). Cryptocurrencies as an innovative method of exchange, without any physical form, bring numerous potential benefits such as speedy transactions, cross-border usage, low transaction fees, transparency, high security, anonymity, and privacy, and hence are expected to bring enormous revolution in the future economic system (Nadeem et al., 2021). Nakamoto (2008) states that in permissionless and decentralized cryptocurrencies like Bitcoin, regulatory oversight and compliance are generally an explicit non-goal where such systems are particularly designed not to be controlled by a state, a bank or any other central authority.

Cryptocurrency blockchains' descriptions do not fit FinTech's requirements on aspects of security and privacy from transaction throughput to primitives (Eyal, 2017). It analyses the safeguarding process of the distributed database and implies a solution for the challenges of retaining the confidentiality of the information in them without tokens based on Blockchain (Eyal, 2017). Cryptocurrencies make financial transactions easy through elimination of the intermediaries, reduction of transaction costs, accessibility to everyone connected to the Internet, and greater privacy and security (Böhme et al., 2015; Richter et al., 2015).

## 2. Crypto Wallet

“A Crypto wallet is made up of software which contains private and public keys and uses blockchain to send and receive currency” (Yadav et al., 2020). The currency in these wallets is added in the form of coins which are different currencies with different values, like other currencies. There is a need for the creation of a crypto wallet to enable the user to send, receive and trade his cryptocurrency. The

currency is not stored at one location instead, they are all stored in the form of transaction records on the blockchain (Yadav et al., 2020).

These wallets store private and public keys which help the user have various operations such as sending or receiving cryptocurrency, monitoring cryptocurrency balance, trade the cryptocurrency on a portfolio using the crypto wallet (Yadav et al., 2020). This correspondingly ensures the privacy of the user by using a hexadecimal address of the crypto wallet. Even though the address of cryptocurrency to be exchanged to send or receive the cryptocurrency differs from one service provider to another (Yadav et al., 2020). To send or receive a cryptocurrency the user must share their crypto wallet's address to send or receive the cryptocurrency. The data and customers both are highly secured in the hands of the blockchain-based technology banking system (Yadav et al., 2020). Bitcoin Wallet, as a crypto wallet, is a digital wallet that uses digital currency as a value. It enables users to send and receive their digital money or keep it like a bank account (Guler, 2015). Bitcoin Wallet is software that provides services to users making it possible to transact worldwide payments for free. As in real life, Bitcoin Wallet must also be secured and not be used by unauthorized people. There are many aspects that should be taken into consideration (Guler, 2015).

“Cryptocurrencies, as one of the first products and advancements in blockchain technology, are virtual currencies that use cryptography for secure payments and investments. Blockchain's replicated and decentralized database acts as a global ledger tracking all cryptocurrency transactions between participants” (Kizildag et al., 2020). Thus, cryptocurrency technology enables tracking the ownership of assets besides right-to-use in the events of assets (equities and stocks) which are sold, bought and exchanged in capital markets (Biella & Zinetti, 2016).

Onder and Treiblmaier (2018) state that as cryptocurrencies allow for the easy interchange of money without the need for trusted third parties, the widespread adoption of these will enable the emergence of new forms of customer-to-customer transactions in markets. As Blockchain provides the free trade feature, thus it can potentially increase the service quality of loyalty programs because of point-to-point transmission (Dogru et al., 2018). Cryptocurrencies are attractive based on various technological and financial advantages; cryptocurrencies provide peer-to-peer transactions, real-time and speedy transactions with electronic history, cross-border usage, low transaction costs, privacy, and anonymity, among others (Baur et al., 2018; Philippas et al., 2019). A major development in the rise of cryptocurrencies and other crypto assets has been the emergence of crypto exchanges. It enables anyone to open accounts and trade crypto assets both in contradiction of each other and in contradiction of fiat currencies by using crypto wallets (Giudici et al., 2020). Cryptocurrency has been mentioned frequently as a replacement for currency, which ensures the integrity of transactions besides the low maintenance cost (Frank, 2018).

Allen, S., et al. in the study conducted in 2020 state that “Digital wallets are the software applications through which users interact with a system of digital assets,

such as currency". A digital wallet usually allows users to view their balance in their accounts, make payments, and receive or send currency from other users. It also may be used to trade assets or execute other financial transactions. The design and functionality of digital wallets are part of crucial functions of them as it is not just for usability but also for security. Software wallets known as crypto wallets for decentralized cryptocurrencies often resemble the money transfer applications in terms of user's experience (Allen et al., 2020).

Cryptocurrency wallets differ in one crucial matter, and it is the cryptographic keys that authorize funds transfer which might be stored on the user's personal device rather than being entrusted to a remote service. The asset of a cryptocurrency wallet is like cash while in principle eliminating the user's need for dependency on and trust in a centralized financial provider. This dependence on the wallet device rather than a financial provider for key custody presents the likewise cash-like downside of exposing the user to the risk of unrecoverable financial loss in the case of loss or compromising of wallet or device hosting. Motivated in part by the tremendous security sensitivity of digital wallets, they similarly come in special-purpose hardware formats that function quite differently and take advantage of the hardware security practices.

One of the popular features of cryptocurrency wallets nowadays is multisig (multiple signatures) transactions. The fundamental goal of joint Multisig transactions is joint control. Threshold signing and multisig transactions are different embodiments of the threshold trust approach to decentralization. As multisig transactions do not require the signing key to be generated jointly, or even to use the same cryptographic algorithm, they are simpler to implement.

They display a subtle privacy-versus-transparency trade-off, nevertheless: a threshold signature does not disclose which specific  $k$  out of the  $n$  shareholders signed the transaction, while with multisig transactions the set of  $k$  signers authorizing the transaction is obviously visible on the ledger. In the case of requirement for stronger privacy or group anonymity of the signers, threshold signing might be better. In a case that makes each signer individually accountable for the transactions they sign and to deter possible attacks in which a threshold of  $k$  signers might secretly collude to authorize a transaction improperly, multisig might be the choice.

At both threshold signing and multisig mechanisms, a balance between security and availability is reached whereas it can be parameterized by varying  $k$  and  $n$  and different other enhancements (Möser et al., 2016; Zhang, 2019). However, its need for multiple participating users or devices makes it less desirable for the wallets of individual users and it is considered as its limitation. A second and possibly complementary risk mitigation approach relies on notification and time delays before transactions are implemented and become irrevocable (Möser et al., 2016). Bitcoin vaults. The cash-like, irrevocable finality of cryptocurrency transfers might be attractive for some payments but nevertheless unfavorable for some larger, high-stakes transactions in which there is more important than speed. Definitely, there

is a tension between transparency and privacy, and it depends on users which one they choose as the major fact of their choice based on their need.

## 2.1. Price and Transaction

The way cryptocurrency transaction processing is proceeds, it boasts some payment-related transaction advantages interconnected to the cryptocurrency system (Abramova & Böhme, 2016). It provides facilities to its users like 24/7 accessibility, low transaction fees, speedy transactions, a decentralization system, and international remittances (Nadeem et al., 2020a). In traditional transaction systems, there are delays and to overcome this delay and to grab various potential advantages, e-commerce businesses rely on cryptocurrencies (Böhme et al., 2015).

As a result of cryptocurrencies' highly liquid form, cryptocurrencies decrease the authentication and transaction costs (Huhtinen, 2014). Conventional payment systems (e.g., debit/credit card) charge a certain amount of fee (Androulaki et al., 2013), while the cryptocurrency system has a lower transaction fee in comparison with other existing payment mechanisms. It results in making it useful for different consumers and besides the transactions can be unlimited (Alshamsi & Andras, 2019; Kasahara & Kawahara, 2017). A study on cryptocurrency systems shows that the cryptocurrency system protects its users from monopoly fees even if the system becomes a monopolist (Huberman et al., 2017). One of the other advantages of cryptocurrency is its possibility of usage for small transactions and day-to-day purchases of items (Kasahara & Kawahara, 2016). For example, a user can send a small fraction of the amount (like 0.00000001 Bitcoins) to others (Popper, 2017). The systems of some cryptocurrencies like Bitcoin record the payment history of its users, and this feature of Bitcoin aids its users to review their transaction history (Félix & Pablo, 2012; Shalini & Santhi, 2019). Also, the cryptocurrency system's balance can be shown in the local currency of the user, and it allows to connect the mobile device with the web wallet by scanning the Quick Response (QR) code (Alshamsi & Andras, 2019). Some of the advantages of cryptocurrency transactions are providing such facilities to its users as 24/7 accessibility, low transaction fees, high-speed transactions, decentralization system, and international transactions (Nadeem et al., 2020b). Cryptocurrency transactions are faster than other payment methods as they provide a direct online payment capability between the users (Shahzad et al., 2018). Krombholz et al. (2016) indicated that most of the Bitcoin users claimed that the decentralization characteristic is one of the main reasons they started to use Bitcoin. Cryptocurrency system allows worldwide usage and demands less time; however, the traditional payment system follows multiple procedural formalities which result in the delay of the transactions (Singh et al., 2013). To eliminate this delay, and to benefit from numerous potential advantages, e-commerce businesses rely on cryptocurrencies (Böhme et al., 2015).

## 2.2. Security and Trust

Security is described as the events, conditions, or circumstances with the possibility to cause economic hardship to network resources or data. It can be in the form

of restriction, modification, disclosure of data, violation of privacy, fraud, abuse, waste, and denial of services (Balta-Ozkan et al., 2013; Han & Yang, 2018; Yang et al., 2016). Various scholars described security as the protection of data or systems from intimidation interference and unlawful alteration, loss, or embezzlement (Bailey & Pearson, 1983; Santhanamery & Ramayah, 2018). For the prevention of the loss of users, online payment systems need rigorous and high-security arrangements. One of the biggest concerns of individual online buyers is the overall security arrangements of the systems that they use to send and receive money (Nadeem et al., 2021). A high level of security on an online system has a positive impact on the users which results in acceptance of the said system, while a low level of security on an online system has a negative impact on the users which results in rejection of the said system (Nadeem et al., 2021). Therefore, every online payment system shows strong commitment to its security arrangements to avoid any uncertain events (Nadeem et al., 2021). Trust is one of the essential and vital aspects to financial transactions and payments. Individuals and organizations need to assure that the transactions they make are processed and completed in a fair and safe manner, a requirement that places financial intermediaries like commercial banks and central banks in the business of trust (Nelms et al. 2018). Technology trust model suggested by Lankton et al. (2015) is focused on three distinct trust constructs: functionality, reliability, and helpfulness.

Different researchers describe the security and control of cryptocurrency as the overall security arrangements of the Bitcoin system (Abramova & Böhme, 2016). Cryptocurrency system is considered secure in comparison to other existing payment mechanisms (Kasahara & Kawahara, 2017), while it provides secure and instant services of worldwide fund transfer (Kawase & Kasahara, 2020). It is stated that one fundamental aspect of cryptocurrency is the mining process, which defines the overall security, stability, and reliance on the payment system (Nakamoto, 2008). It is additionally revealed that cryptocurrency has performed well without major setbacks from the time when it was launched (Bentov, 2017). The security of blockchain systems is important for potential users regarding their acceptability (Pilkington, 2016). Even though cryptocurrency system is considered safe, there are still threats that might affect the trust of users in Bitcoin security provisions (Conti et al., 2018) which can decrease the level of its usefulness. However, the cryptocurrency system is described as un-hackable, due to blockchain technology usage (Reiff, 2019). Nevertheless, there are different types of risks related to it in the trading process (Apostolaki et al., 2016; Krombholz et al., 2016; Reiff, 2019). For instance, there are likelihoods of losses of keys due to device failures and losses or thefts of Crypto wallets (Krombholz et al., 2016). and exploitations through viruses and trojans by criminals (Folkinshteyn & Lennon, 2016).

### 3. Literature Review

Almarashdeh (2018) studied the use of cryptocurrency in the context of digital payments. The study focused on factors affecting the adoption of bitcoin as a form

of payment. The Study's model is based on UTAUT and TAM and tested by using surveys of 161 participants. By analyzing the regression analysis, it shows that self-efficacy, transaction processing, securing and control, and perceived trust significantly affect intention to adopt of using bitcoin.

Smolarczyk (2018) indicated that the source of satisfaction in digital payments is founded on convenience, efficacy, security, and problem-solving. Convenience is founded on ease of use, payment process speed, money transfer speed, and profitability.

Trivedi and Yadav (2018), in a survey, examine the relationship between online repurchase intention and variables such as security, privacy concerns, trust and ease of use, mediated by e-satisfaction. The results of the study indicate that security, privacy concerns, trust and ease of use have a positive significant relationship with repurchase intention. The findings also show that e-satisfaction has a mediation effect between security and repurchase intention as well as trust and repurchase intention. Additionally, a partial mediation effect of e-satisfaction is being noted between ease of use and repurchase intention as well as privacy concerns and repurchase intention. The findings show that security, trust, ease of use and privacy concerns are the main factors that have the most impact on consumer purchasing behavior.

Casino et al. (2019) cluster the prerequisites and determinants of variable "Trust" of Blockchain database consisting of lack of trusted third parties, accountability, immutability, multiple non-trusting writers, and peer-to-peer transactions. Accordingly, the prerequisites and determinants of attribute "Context" of Blockchain database consist of traceability of transactions, verifiability of transactions, data/transaction notarization, data transparency, security, and privacy, where at our research, we cluster security and Trust as one variable and privacy another variable. Prerequisites and determinants of attribute "Performance" of Blockchain database consist of latency and transaction speed, maintenance costs, redundancy, and scalability, where in our research, we classify it as price and transaction.

Agrawal et al. (2014) measure E-Service quality by variables reliability, responsiveness, ease of use, personalization, security and trust, website aesthetic, efficiency, fulfillment, and contact. In our research, according to the study of Agrawal et al., we classify "Security and Trust" and "Ease of use" as two of our research variables.

### **3.1. E\_Service Quality**

Service is described as an interpersonal relationship between the organization and the customer (Price et al., 1995). A critical moment of truth involves either satisfying or dissatisfying the customer (Albrecht & Zemke, 1995). Quality can be unified into one concept of consumer-perceived quality, wherever quality can be defined just by customers and occurs where an organization supplies goods and services to a requirement for satisfying their needs (O'Neill & Palmer, 2001). Service quality is defined as the delivery of excellent service relative to customer expecta-

tions (Zeithaml & Bitner, 1996). The service outcome quality dimension proposed by the European school of thought (Gronroos, 1984) is frequently added to the SERVQUAL approach (Richard & Allaway, 1993). Other researchers proposed a three-component model of service quality (Rust & Oliver, 1994) suggesting that service quality is comprised of the service product, service delivery, and the service environment dimensions. The multilevel model advanced by Dabholkar et al. (1996) expresses that service quality springs from three primary dimensions and these spring from different sub-dimensions. Parasuraman et al. (1985) studied the needs for a service organization in learning more about the customers' expectations and perceptions through a rigorous marketing and research-orientated approach. According to Parasuraman et al. (1985), only customers can judge the service quality received. Furthermore, the quality of a service is determined by the difference between what a consumer expects and the perceived level of actual performance. These findings have provided a structure for the development of a quantitative technique that helps to measure service quality, which is known as SERVQUAL. Based on the study of Palmer (2014), the SERVQUAL technique can be used by companies to measure their customer's expectations and perception based on a generic 22-item questionnaire, which is designed to cover five wide-ranging dimensions of service quality namely, tangibles (appearance of physical elements), reliability (dependability, accurate performance), responsiveness (promptness and helpfulness), assurance (competence, courtesy, credibility, security) and empathy (easy access, good communications, customer understanding). In the area of personal online banking service quality, Lei and Gao (2013) designed a version of the SERVQUAL model framework, which included 7 dimensions of electronic service quality namely: usability, reliability, information quality, individualization, responsiveness, security and tracking services. E-SERVQUAL is a derived of the more broadly known SERVQUAL, Ingle and Connolly (2007) stated that E-SERVQUAL was developed precisely for online retailing companies to support the measurement of E-Service more effectively. E-SERVQUAL's diverse dimensions have demonstrated to be a very reliable framework for several previous findings in the arena of marketing and more specifically in E-Service. It has been frequently used by researchers like Rullis and Sloka (2011), White and Nteli (2004), Lei and Gao (2013) and Quan (2010), and its adaptability contributed significantly when it was deployed in the study by Agrawal et al. (2014) on the growing Indian market. E-S-QUAL measurement model designed by Parasuraman et al. (2005) provided a fundamental measuring model for service quality for online shoppers in which the main E-S-QUAL scale developed a 22-item scale of four dimensions consisting of: efficiency, fulfillment, system availability, and privacy. The second scale, E-RecS-QUAL, is applicable only for customers who had nonroutine purchases in a way that includes 11 items in three dimensions consisting of responsiveness, compensation, and contact.

### 3.2. E\_Customer Satisfaction

However, when customers are satisfied, they are likely to participate in favorable

behavior toward the service provider. These behaviors can be positive word-of-mouth advertising, enthusiasm for recommending, revisiting intentions, decreased price sensitivity over time and their readiness to participate in research to help the organization provide better service. In 1997, Oliver further clarified satisfaction when he declared satisfaction is the consumer's fulfillment response. Oliver, R., describes service quality as the judgment of a product or service feature, interchangeably the product or service itself which provided a pleasurable and acceptable level of consumption-related fulfillment. It may include levels of under-or-over fulfillment (Oliver, 1997). Customer satisfaction measures how well the customers' expectations are met by service experience while customer loyalty measures the probability of customer revisiting and recommending (Bowen & Shoemaker, 1998). The deficiency of quality service or meeting customers' expectations will result in a deficiency in customer satisfaction (Ramaswamy, 1996). The continuous customer usage of services that are provided for customers has relied on their preceding satisfaction levels, their appraisal of payment levels, and prices (Bolton & Lemen, 1999).

Numerous studies have explored factors affecting satisfaction in the context of digital banking. It was discovered that accessibility, convenience, efficiency, responsiveness, security and privacy, reliability, tangibility, assurance, usage, competence, credibility, ease of use, trustworthiness, security, e-Quality, information, interface design quality, customer value, openness to experience, customer service, and online system attributes, significantly affect customer satisfaction of using digital banking (Alkhowaiter, 2020). Alqathani et al. (2014) found that usability, usefulness, telecommunications infrastructures, security, hacking and fraud, availability, trust, payment gateway, awareness, cost and promotion, privacy, cyber-law, postal services, government e-readiness, and Arabic language support have a significant effect on adoption of digital payments.

By considering the literature on marketing, service quality, and customer satisfaction, these questions are raised:

What is an applicable model for the measurement of E-Service Quality and E-Customer satisfaction at crypto wallets? How is the relationship between variables?

And we tend to answer these questions in our research. Based on the results of thematic analyses which gave us four main themes of the first phase of our research including: Security and Trust, Privacy, Ease of Use, and Price and Transaction, and past literature, we aim to design the applicable E-Service Quality and E-Customer Satisfaction model and identifying the relationship among them by using structural equation modeling; while for investigating E-Service Quality and E-Customer satisfaction; we have proposed and used four main themes that had been derived at first phase of study.

#### **4. Research Methodology**

Research methodology of this research in terms of purpose is practical since it uses

the firsthand data and designs a new model which will be used in the measurement of E-Service Quality and E-Customer Satisfaction of crypto wallet users. That means this study suggests a model for the measurement of E-Service Quality and E-Customer Satisfaction of Crypto wallet users which is practical. Also, this study is exploratory in its matter of research methodology. First, we used the qualitative thematic method to derive main themes of the study and then we used the quantitative method to examine our conceptual model. After identifying main themes which consisted of four main themes including: Security and Trust, Privacy, Ease of Use, and Price and Transaction, conceptual research model was designed based on main themes. We used the snowball method for the qualitative part of the research and stopped interviews when they became repetitive and reached the saturation point. The second part of the research is the quantitative part of the research which we used structural equation modeling by the analysis of the data which was collected by means of a designed questionnaire that was distributed online by using Google Forms among 515 crypto wallet users. The validity of the questionnaire was confirmed by experts consisting of five university professors and the reliability of the construction was measured by using Cronbach's alpha test. The construct validity of questionnaire was tested using Cronbach's alpha test. After the announcement of the questionnaire's consistency by five experts, a pre-test was done. Twenty-five questionnaires were distributed, and the analysis of construct validity of the pre-test was measured by Cronbach's alpha which was 0.93 and is above 0.90 which means it is acceptable. For data analysis, Smart-PLS software is used.

#### 4.1. Structural Equation Model

Modeling methods are used for studying the phenomena that require the utilization of complex variable sets. Structural Equation Modeling (SEM) is selected when studying the causal relations and the latent construct among the variables in question. Since it can be used to analyze complex theoretical models and their practicability. The objective of SEM is to explain the system of correlative dependent relations between one or more manifest variables and latent constructs in a simultaneous manner. It aims to determine how the theoretical model that designates relevant systems is supported by sample data, like estimation of relations between the main constructions. Because there is no single criterion for the theoretical model fit evaluation obtained because of SEM, a wide-ranging selection of fit indices was developed (Schermelleh-Engel & Moosbrugger, 2003; Sugawara & MacCallum, 1993). Studies conducted through SEM were undertaken by using empirical and non-empirical data to develop and confirm theory (Bentler & Dudgeon, 1996; Wang et al., 2018; Bentler, 1994). Simulation studies were conducted to test the robustness of SEM. The reason is that the assumptions required typically cannot be verified in practice. Because these studies were conducted in order to verify the hypothesis, a known theoretical model was taken as a reference and the behaviors of the most used techniques in particular conditions were observed.

The parameter estimations acquired through the estimation techniques based on different distributional conditions and sample size, standard errors and the bias of model fit indices were researched in the studies conducted. In the second stage of this study, we use SEM for the investigation of “Security and Trust”, “Price and transaction”, “Privacy”, and “Ease of use”.

## 4.2. Sample

The statistical population of this study is the online crypto wallet users. The sampling method which was used in this study random sampling by distributing the questionnaire online via Google Forms.

## 4.3. Data Collection

The data collection tool uses distribution of questionnaires using online distribution besides of library method which includes document reviews, books research reports, and papers and internet searches to review and formulate the literature of the research topic. A questionnaire was designed based on the conceptual model of the research and after pre-testing, it was distributed online on the internet among the crypto wallet users. It was distributed on social media like Twitter, Telegram groups, Instagram, Facebook, some crypto-claiming websites, and some crypto wallet users as an email communication with a request of circulating the same questionnaire around the circle of friends who use crypto wallets. Based on Cochran’s formula as our statistical population is an infinite population, by considering 95% of confidence and  $p = 0.05$ , which gives us a Z value of 1.96, So a random sample of 385 responses in our target population should be enough to give us the confidence levels we need (Cochran, 1963: p. 75). The questionnaire consisted of 48 questions, with responses on a five-point Likert Scale (1 indicates very low; 5 indicates very high). There was no restriction on the number of respondents. As a result, 515 responses were collected. Subsequently, responses were analyzed to discard incomplete or incorrectly filled responses. As a result, 404 were retained to test the empirical model.

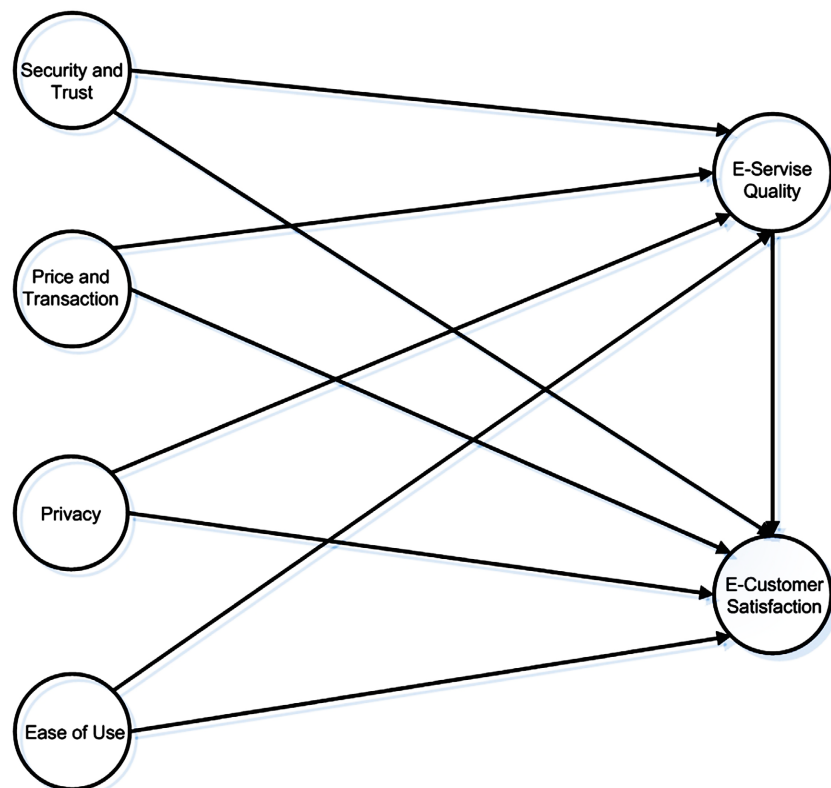
This research is done by following these steps:

First, we used documentary study methods for data extraction from cryptocurrency, E-Service Quality, and E-Customer Satisfaction literature and thematic analyses of theories in this area. We conducted deep interviews with twenty-one crypto wallet users and the interview stopped when the saturation of repeating themes occurred. The themes consist of: Transaction, trust, safety, Ease of Use, Cyber security, Technology, Customer support, Backups, App lock, Contact, Customer service, Responsiveness, Stability, Convenience, Price, Innovation, Process time, Duration of transaction, Acceptability, Accessibility, Security, and availability. Among the themes, four main themes of “Security and Trust”, “Price and Transaction”, “Privacy”, and “Ease of Use” were identified. Our derived main themes were consistent with the studies of Agrawal et al. (2014) and Hasim et al. (2020) which we considered as our base study model for the quantitative part of our research. After identifying the main themes, a conceptual research model was

designed based on the main themes. Second, the questionnaires were designed, and the consistency and validity of the questionnaire were assessed and consequently, it was pre-tested. Third, the questionnaire was distributed with the aim of data collection. The territory of the research, from time framework, is from April 2019 to October 2021 and its duration is approximately two and half years. The location territory of this research is worldwide as the data was collected online through the internet and the thematic territory of this research is cryptocurrency, E-Service quality, E-Customer satisfaction, and marketing.

#### 4.4. Conceptual Framework

As mentioned before, the aim of this research is to measure the effect of “Security and trust”, “Price and Transaction”, “Privacy”, and “Ease of Use” on “E-Service Quality” and “E-Customer satisfaction” of crypto wallet users. It is hypothesized that Security and trust”, “Price and Transaction”, “Privacy”, and “Ease of Use” are antecedents to “E-Service Quality” and “E-Customer satisfaction”. The different constructs and their relationships as research’s model are shown in **Figure 1** and are explained in more detail in the following sections.



**Figure 1.** Conceptual model of the research.

As a result, nine Hypotheses are raised that are followed below.

##### 4.4.1. Security and Trust

One of the major concerns of e-business is security. It is defined as a “circum-

stance, condition, or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, denial of service, and/or fraud, waste, and abuse” (Kalakota & Whinston, 1996: p. 123). Online consumers are always reluctant to disclose their personal and financial credentials without security satisfaction. To develop high-level security satisfaction, online business organizations must develop security features (encryption, security statement, third-party affiliation, etc.; Jarvenpaa & Todd, 1996). Security can affect online customer trust. The focus of e-commerce is the security of computers, credit cards and financial information (Bart et al., 2005). The perception of online consumers is that online modes of payment are not always secure and that data can be captured (Jones & Vijayarathy, 1998).

A high level of perceived security is also believed to bring more comfort to users (Hartono et al., 2014); they can experience greater ease of use when they feel more comfortable with the technology (Usoro et al., 2010).

Security and privacy are the two important terms that are well connected with the existing trends in cryptocurrencies. Cryptocurrency adds security to the transaction flow and regulates the formation of supplementary units of currency (Navamani, 2021).

The literature shows that security, privacy concerns, trust and EOU may lead to e-satisfaction for consumers, and consequently, repurchase intention might be increased (Palvia, 2009; Ismail & Safa, 2014). Security is one of the main concerns of consumers in purchasing online; they look for an authentication mechanism used by an e-business as a measure of trust (Bart et al., 2005).

Mayer et al., in a study, conducted in 1995 describe trust as the willingness of an individual to be vulnerable to the actions of an alternative party based on the expectation that the other will act a certain action important to the trustor, nevertheless of the ability to monitor or control that other party. The underlying blockchain technology used at cryptocurrencies is said to be “trustless” since it has been designed to avoid a “trusted third party.” Aglietta and Orléan underline the importance of trust in money and the monetary system. Malherbe et al. (2019) demonstrate that Bitcoin is characterized by: 1) methodical trust throughout the existence of an objective proof of payment; 2) hierarchical trust as the result of the concentration in the mining process; and 3) ethical trust structured based on the elimination of banks and the state, although the early ethical commitment is unstable. As a result, trust has now materialized in the form of a technical institution, the blockchain. Agrawal et al. (2014) consider “security and trust” as an independent variable for the measurement of E-Service quality.

H1: “Security and Trust” is positively associated with “E-Service Quality”.

H2: “Security and Trust” is positively associated with “E-Customer Satisfaction”.

#### **4.4.2. Price and Transaction**

Kotler (2017) states that price is the overall amount that is exchanged for a cus-

customer to benefit from the purchased product or service. Price plays a crucial role in business, and it is one of the important factors that determine a product or service (Ilyas & Nayan, 2020). One of the definitions of price in marketing is the gained profit and revenue when this pricing meets customer demand. Identifying of customer's real needs and demands by businesses, drive customers to buy the product or service, regardless of its price. To ensure that the products and services meet the real needs of the right customers, collection of information and competitor's analysis should be done by companies (Larsson & Broström, 2019). Pricing can be penetration or skimming and companies' prices are based on their financial objectives and their long-term or short-term profit considerations (Hou et al., 2020). Specific products or services with higher prices are improvised to improve customer retention and customer satisfaction. Specific customers are eager to pay more for high-quality products or services (Kumar et al., 2000). To achieve target revenue and profit with a sustainable continue in the marketplace, service providers consider a reasonable price for their services (El-Adly, 2019). As a result, we have two hypothesizes H3 and H4:

H3: "Price and Transaction" is positively associated with "E-Service Quality".

H4: "Price and Transaction" is positively associated with "E-Customer Satisfaction".

#### 4.4.3. Privacy

Privacy can be comprehended as the "willingness of consumers to share information over the Internet that allows purchases to be concluded" (Belanger et al., 2002: p. 248). Privacy typically concerns the personal information of an individual online. To tackle privacy concerns, online retailers can develop privacy policies in terms of notice, disclosure and preference/consent of online consumers (Bart et al., 2005). The study results of Benassi (1999) recommend that some privacy concerns, like the requirement for secure authentication via third parties or rules and regulations created by an effective e-business infrastructure, might gain the trust of consumers in the online marketplace. A number of studies have identified the high impact of privacy on online intention to purchase and repurchase (Cranor et al., 2000). It has been noted that even if e-retailers adopt scientific solutions to privacy concerns from the technological and legal perspectives, consumer perceptions around privacy nevertheless demand the highest level of trust to enable them to make transactions online (Chellappa & Pavlou, 2002). By considering these studies regarding privacy, it leads to this study's fifth and sixth hypothesis:

H5: "Privacy" is positively associated with "E-Service Quality".

H6: "Privacy" is positively associated with "E-Customer Satisfaction".

#### 4.4.4. Ease of Use

Ease of use is defined as "the degree to which an individual believes that by using a particular technology would be free of effort" (Davis, 1989: p. 320). According to the same study, ease of use has a strong influence on technology acceptance. If a technology is easy to use, it will become the preferred option.

By considering these studies regarding online ease of use, it leads to this study's seventh and eighth hypothesis:

H7: "Ease of Use" is positively associated with "E-Service Quality".

H8: "Ease of Use" is positively associated with "E-Customer Satisfaction".

#### **4.4.5. E-Customer Satisfaction**

E-customer satisfaction is best understood from the following definition: "the contentment of a consumer with respect to his or her prior purchasing experiences" (Anderson & Srinivasan, 2003: p. 125). E-Customer Satisfaction can mediate between its antecedents and consumer repurchase decisions from the same e-retailer (Agrawal et al., 2014). Factors such as security, privacy concerns, trust and ease of use can be the source of a consumer's E-Customer satisfaction; hence, E-Customer satisfaction can mediate the relation between these factors and repurchase intention (Agrawal et al., 2014). This leads to the last hypothesis of this study:

H9: "E-Service Quality" is positively associated with "E-Customer Satisfaction".

Following the hypotheses that are raised, we measure the variables and test them to continue.

## **5. Data Analyses**

### **5.1. Reliability and Validity of Construct**

We used a questionnaire to collect the data and investigate the share of each variable. The consistency of the questioner was announced by four experts at the average of 91%. All items were measured with a five-point Likert-type scale (1 = very high, 5 = very low). For data analyses, quantitative analyses are done by Partial Least Square (PLS) software that is considered as appropriate method for this research due to non-normality of the data and the sample made available for structural equation modeling based on covariance and variance (Hair et al., 2014; Henseler et al., 2009; Ringle et al., 2012). The construct validity of questionnaire was tested using Cronbach's alpha test. After the announcement of the questionnaire's consistency by four experts, a pre-test was done. Ten questionnaires were distributed and the analysis of construct validity of pre-test which was measured by Cronbach's alpha which was 0.755 and is above 0.70 which means it is acceptable. The questionnaire consisted of 48 questions which for each variable different questions were considered. The questionnaire was distributed online, and 515 data were collected. After eliminating incomplete data, 404 data was used to analyze. Overall Cronbach alpha of the questioner was 0.771 which shows a high quantity of validity. In addition, all constructs used in the final analyses have acceptable Cronbach's Alphas except variable loyalty (Nunnally, 1978). The constructs are theoretically distinct and measured using either validated scales or questions drawn from the underlying literature. The reliability and validity of constructs are indicated in **Table 1**.

**Table 1.** Reliability and validity of the research data.

Variable	Cronbach's $\alpha$	Rho-A	Composite reliability
E-Customer Satisfaction	0.776	0.777	0.775
E-Service Quality	0.716	0.723	0.715
Ease of Use	0.777	0.779	0.775
Price and Transaction	0.821	0.821	0.820
Security and Trust	0.732	0.735	0.734
Privacy	0.810	0.811	0.810
Loyalty	0.512	0.513	0.512

From the results, we can conclude that the reliability and validity of the constructs are acceptable except for loyalty. The internal consistency of the constructs was evaluated by the Cronbach  $\alpha$  coefficient. As noted above, all scales met the recommended reliability coefficient of 0.70 (Nunnally, 1978) except loyalty and as a result, we eliminated the variable Loyalty from our conceptual model. The composite reliability of all latent variables is higher than 0.7, the value that is considered satisfactory by Hair et al. (2010). So, as the amounts of composite reliability, and Rho-A all are above the acceptable amounts, this means the reliability and validity of the constructs.

## 5.2. Hypothesis Testing

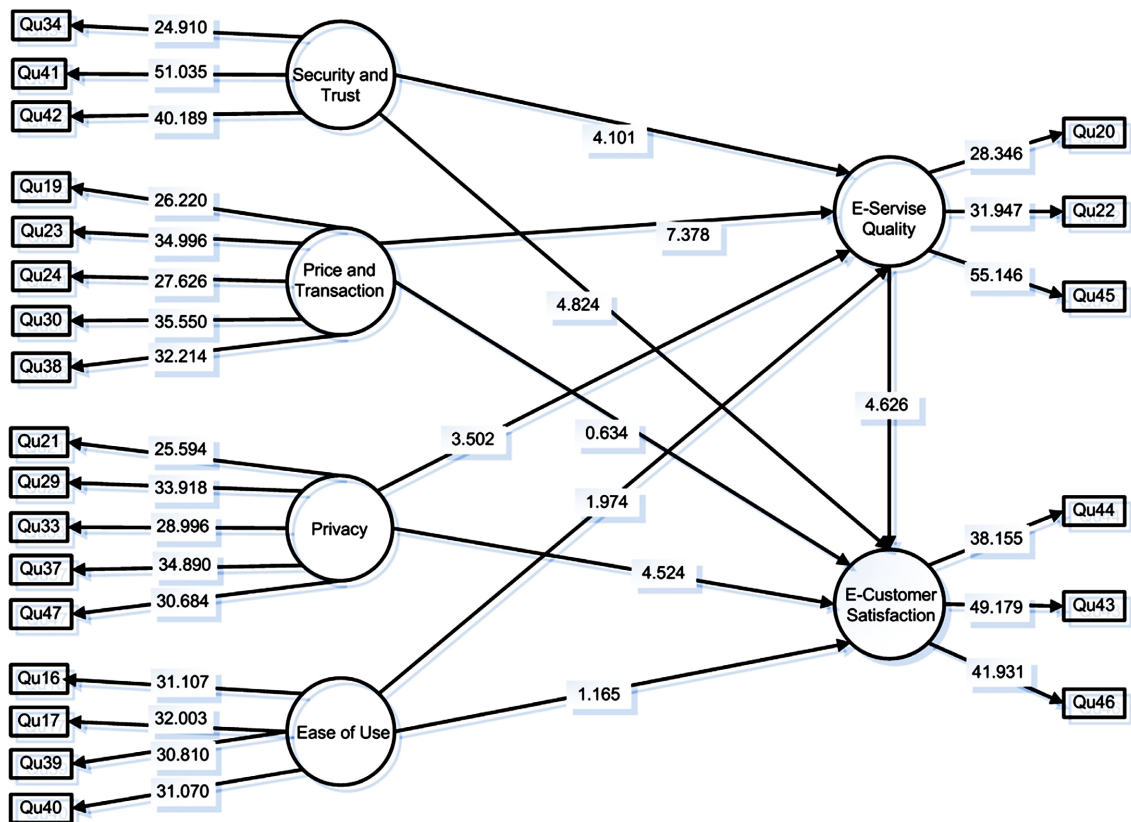
The hypotheses were evaluated through a structural equation model analysis using smart-PLS. In the present structural model, the maximum number of paths directed at a latent variable is 9 demonstrating that 90 is the minimum number of observations required to estimate the path model according to the "rule of thumb" generally used (Hair et al., 2013; Barclay et al., 1995). A small  $p$ -value (typically  $\leq 0.05$ ) indicates strong evidence against the null hypothesis, so you reject the null hypothesis. It is noted that values above 0.5 have been recommended for average variance extracted (Chin, 1998; Henseler et al., 2009; Ringle et al., 2012) and the Average Variance Extracted (AVE) amounts of our research are higher than the suggested amount are acceptable. Convergent validity explains which items truly represent the intended latent construct and indeed correlate with other measures of the same latent constructions (Hair et al., 2006). As Fornell and Larcker (1981) suggest, Convergent validity is assessed by the Average Variance Extracted (AVE) of each latent construct. On the other side, discriminant validity refers to the extent to which a certain latent construct is different from another latent construction (Duarte & Raposo, 2010). At our research, discriminant validity is ascertained by using AVE, as Fornell and Larcker (1981) suggest. It is achievable by comparison of the correlation among the latent constructs with square roots of AVE (Fornell & Larcker, 1981). Also, Fornell and Larcker (1981) suggest that the square roots of the AVEs should be greater than the correlation among the latent variables for achieving satisfactory discriminant validity. In our study, the square roots of the AVEs are all greater than the correlation among the latent variables which

means sufficient discriminant validity. Also, all the t-values were significant and more than 1.96 amount ( $p < 0.005$ ) as shown in **Table 2** (Fornell & Larcker, 1981), also, all the amounts of  $R^2$  are acceptable as shown in **Table 2**. All the paths depicted in the research's model are supported and the t-values associated with them were positive and significant ( $t\text{-value} > 1.96, p < 0.005$ ).

**Table 2.** Hypothesis testing.

Path Coefficients	Standard Deviation (STDEV)	T-value	p-value
E-Customer satisfaction to E-Service Quality	0.060	4.646	0.000
Ease of use to E-Customer satisfaction	0.048	1.147	0.251
Ease of use to E-Service quality	0.045	1.967	0.049
Price and transaction to E-Customer satisfaction	0.062	0.635	0.525
Price and transaction to E-Service quality	0.053	7.410	0.000
Security and Trust to E-Customer satisfaction	0.055	4.798	0.000
Security and Trust to E-Service quality	0.059	4.112	0.000
Privacy to E-Customer satisfaction	0.062	4.456	0.000
Privacy to E-Service quality	0.057	3.474	0.001

T-values of the research's model are shown in **Figure 2**.



**Figure 2.** T-Values of research's model.

### 5.3. Model Fit

The analysis indicates that all variables have significant explanatory power. We use the Chi-square, the net fit index (NFI), and the Standardized Root Mean Square Residual (SRMR) as indicators of model fitness. An insignificant Chi-square (Joreskog, 1969), an NFI close to 1 (Bentler, 1990), and an SRMR of less than 0.05 (Kline, 2011; Hu & Bentler, 1999; Schermelleh-Engel & Moosbrugger, 2003; Iacobucci, 2010) indicates a good fit. As shown in **Table 3**, the base model is reasonably well-fitting. Also, the Blindfolding test is used for calculating Stone-Geisser's Q2 value (Stone, 1974; Geisser, 1974), which represents an evaluation criterion for the cross-validated predictive relevance of the PLS path model. The results show that the redundancy Q2 value is positive and above zero, suggesting the predictive relevance of the model (Chin, 1998; Henseler et al., 2009). We can conclude from the results that all five hypotheses are accepted. **Table 3** shows the summary of hypotheses testing. From the results, we can come to the conclusion that our research's model is in good fit.

**Table 3.** Research's model fit.

Indicator	Amount	Rho-A	Composite reliability
SRMR	0.039	0.777	0.775
Chi-square	464.534	0.723	0.715
NFI	0.908	0.779	0.775
Q2 E-Customer satisfaction	0.459	0.821	0.820
Q2 E-Service Quality	0.437	0.735	0.734

Based on the results, seven hypotheses are supported while two hypotheses are not supported. **Table 4** below shows the summary of hypotheses testing.

**Table 4.** Summary of hypothesis testing.

Hypothesis	Statement	Rho-A	Finding
H1	"Security and Trust" is positively associated with the "E-Service Quality".	0.777	Supported
H2	"Security and Trust" is positively associated with the "E-Customer Satisfaction".	0.723	Supported
H3	"Price and Transaction" is positively associated with the "E-Service Quality".	0.779	Supported
H4	"Price and Transaction" is positively associated with the "E-Customer Satisfaction".	0.821	Not Supported
H5	"Privacy" is positively associated with the "E-Service Quality".	0.735	Supported
H6	"Privacy" is positively associated with the "E-Customer Satisfaction".	0.811	Supported

**Continued**

H7	“Ease of Use” is positively associated with the “E-Service Quality”.	0.513	Supported
H8	“Ease of Use” is positively associated with the “E-Customer Satisfaction”.		Not Supported
H9	“E-Service Quality” is positively associated with the “E-Customer Satisfaction”.		Supported

**6. Conclusion**

The results of this study show that Security and Trust, Privacy, Ease of use, and Price and Transaction have a positive significant relationship with E-Service Quality. The findings also reveal that Privacy and Security and Trust have a positive significant relationship with E-Customer satisfaction. Additionally, E-Service quality has a positive significant relationship with E-Customer Satisfaction. It is important that service providers for crypto wallet owners consider the importance of Security and Trust, Privacy, Price and transaction, and ease of use to reach high E-Service quality and E-Customer Satisfaction.

The aspects that make this study different from previous studies are first, the statistical population of the research which is crypto wallet users; and second, the conceptual designed model of the research. Few studies have been done in this area and there is still a need for more studies in this growing area of knowledge. The results highlight that “Price and Transaction” have a strong effect on E-Service Quality, while “Security and Trust” has a less strong effect, and then “Privacy” is after “Security and Trust” in the order of the effect. “Ease of Use” has the least effect on E-Service quality. “Security and Trust” and “privacy” both have a strong effect on E-Customer Satisfaction while “Price and Transaction” and “Ease of Use” don’t have an effect on E-Customer Satisfaction. E-Service Quality has a strong positive relationship with E-Customer Satisfaction. As we can see from the results in **Table 3**, the fit indexes of the designed model of the research are high.

**7. Discussion and Implications**

Despite three decades of study and active discussions, conceptual work on service quality and customer satisfaction can be described as differing. Both the measurement of service quality and customer satisfaction are two important areas of study because they focus on measuring two important aspects of the service industry and helping it to collect and analyze the data quantitatively. In this research, we provided qualitative, quantitative, and empirical evidence that customers form E-Service Quality perceptions based on their evaluations of four primary dimensions of “Security and Trust”, “Privacy”, “Price and Transaction”, and “Ease of use”, while customers form E-Customer satisfaction perceptions based on their evaluations of two primary dimensions of “Security and Trust” and “Privacy”. Based on these findings, it appears that the conceptual model of the research to measure E-Service Quality and E-Customer Satisfaction is appropriate.

Our research achieves two important objectives. First, it consolidates major E-Service Quality and E-Customer Satisfaction into a single and comprehensive framework with a strong theoretical base. Second, it answers the call for a new direction in need of a model that helps measure E-Service Quality and E-Customer Satisfaction of crypto wallet users and may help ease of use with this measurement. These advances are most important because higher levels of service quality relate to numerous key organizational outcomes, together with high market share (Buzzell & Gale, 1987), enhanced profitability relative to competitors, superior customer loyalty (Zeithaml & Bitner, 1996), the recognition of a competitive price premium (Zeithaml & Bitner, 1996), and an augmented probability of purchase (Zeithaml & Bitner, 1996).

Our study model can greatly assist crypto wallet service providers in understanding how their customers judge E-Service Quality experiences and consequently E-Customer satisfaction. Basically, we address four fundamental factors such as what identifies E-Service Quality perceptions, how service quality perceptions are shaped, and how vital it is where the service experience takes place. These four factors require managerial attention in efforts to improve consumer perceptions of E-Service Quality and E-Customer Satisfaction. Therefore, our framework can guide managers as they wish to improve customers' service experience. The potential applications of this study are various. From a competitive point of view, the identified variables can be used to compare service levels with competitors' offerings.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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