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A Readiness Model and Factors Influencing Blockchain Adoption in Malaysia's Software Sector: A Survey Study

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Abstract: The technology of Blockchain may open up new potential for innovation and distinction. It can enable the software sector to develop more safe and transparent systems that can function in an environment without trust. The adoption rate still needs to be higher despite the potential advantages; the relatively low adoption rate may be attributable to issues such as a lack of awareness, the difficulty of adoption, and ambiguity surrounding legal and regulatory frameworks. Considering technical, organizational, and environmental aspects, this study aims to determine the primary factors impacting the readiness of software firms to adopt Blockchain technology. The research on adopting Blockchain technology in the Malaysian software sector is limited. Using a quantitative method, the researchers used structural equation modeling to analyze 251 survey responses from the Malaysian software sector. In light of the findings, eight hypotheses were considered significant, and one hypothesis was rejected. At the same time, the R^2 indicated that all these variables explained 71% of the dependent variable's variance, which is considered substantial. Overall, it makes it easier for firms in the software sector to use Blockchain technology, which would increase the overall competitiveness of Malaysia's software sector in the international market.

Keywords: Blockchain; software sector; software development process; software process improvement; Malaysia

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1. Introduction

Software firms are realizing the vital need to adopt Blockchain technology due to its numerous options for innovation and differentiation. With Blockchain technology, developers can create distributed applications without communicating via a single server. As a result, programmers can now create trustworthy apps that are open to scrutiny [1]. Smart contracts (SCs), which are pre-programmed agreements, can also be added to the Blockchain and made to execute automatically. Because of this, many corporate procedures can be streamlined and automated, cutting out the intermediaries and saving money [2]. In addition, Blockchain technology can enhance data security, privacy, and management—all of which are critical components of modern software engineering [3]. Blockchain technology can improve software firms' productivity, safety, and market access.

Adoption of Blockchain technology has been studied across a diverse range of sectors, including supply chains [4–13], logistics [5,14,15], businesses based on Bitcoin [16–18], banking [19–22], accounting and auditing [23,24], shopping cart systems [25], tax systems [26], education systems [27], construction [28–30], and multiple sectors [31–43].

However, there is a lack of studies that discuss Blockchain adoption by the software development industry, the related factors, and the offered adoption framework, and how this will alter the software development process, as mentioned before in previous studies [44–46].

Nonetheless, the prevalence of Blockchain adoption studies in these sectors indicates this technology's potential benefits, such as increased efficiency and enhanced security. However, the absence of any studies in the software sector is notable. Given the significant role that software firms play in modern business operations, the lack of research in this area is a significant research gap. More research on Blockchain adoption in software firms could reveal how ready firms are to use Blockchain technology and what factors influence their adoption decisions. This information may assist software developers in deciding whether to utilize Blockchain technology and maximize its benefits.

Despite its success in other countries and sectors, Blockchain has not yet passed its infancy in Malaysia [19]. Malaysians are unfamiliar with Blockchain technology and lack applicable rules. Malaysians are more interested in Blockchain as the world pursues different technological breakthroughs. Despite lacking local laws, the government is open to using Blockchain in renewable energy, palm oil, and Islamic finance sectors [19]. Blockchain technology has been applied in several domestic areas, but the literature suggests that the software sector and firms in this field are not paying enough attention.

This study examines Malaysian software firms' technological, organizational, and environmental readiness to embrace Blockchain technology. The study seeks to uncover the main variables and concerns that affect software firms' Blockchain technology adoption and provide insights into the Malaysian market. This study could fill the research vacuum in Blockchain technology adoption in the software sector. Decision makers and practitioners may support Blockchain technology adoption and optimize sector advantages by assessing software firms' preparedness to embrace it. This study can also contribute to Blockchain adoption in the software sector and shed light on the Malaysian market. This study may help the software sector adopt Blockchain technology and boost Malaysia's worldwide competitiveness.

Software firms may improve their productivity, cost effectiveness, and competitiveness by adopting new technologies such as Blockchain. However, such technologies include hazards, so firms must carefully assess their adoption decision. This study seeks to understand Malaysian software firms' Blockchain technology adoption and preparedness. This report will help Malaysian software firms create Blockchain adoption plans and procedures. The study will also inform Malaysian software sector policymakers and stakeholders about Blockchain technology adoption determinants.

2. Literature Review

Satoshi Nakamoto, who founded Bitcoin under a pseudonym, demonstrated how Blockchain, a decentralized peer-to-peer system with a centralized record, could solve transaction order and double-spending more than ten years ago [8,47–49]. Bitcoin divides transactions into predetermined blocks with identical timestamps. Miners, or network nodes, link blocks chronologically by providing the previous block's hash [50]; this makes Blockchain transactions trustworthy and verifiable.

The advent of Blockchains has disrupted traditional business practices by enabling decentralized operations and transactions without the need for centralized systems or trusted intermediaries to verify them. Blockchain architecture and design inherently possess characteristics such as transparency, resilience, audibility, and security [51]. A Blockchain functions as a decentralized database composed of a sequential list of blocks, with each block immutable once committed. This is particularly beneficial for the banking sector as it allows multiple institutions to collaborate on a single Blockchain to process customer transactions while maintaining transparency and audibility. Blockchain technology is also advantageous for businesses as it enables decentralized design, reduces transaction costs, and allows secure, transparent, and sometimes speedier transactions.

The importance of Blockchain is emphasized by the sheer number of available cryptocurrencies, which currently stands at over 1900 and is continually increasing [52]. Blockchain technology is also advancing quickly as it is applied to various sectors outside cryptocurrencies, with SCs playing an important role. SCs are computerized transaction protocols that execute contract terms, allowing contractual requirements to be translated into embeddable code and reducing external involvement and risk [53]. As a result, SCs are decentralized scripts stored on the Blockchain without relying on a trusted authority, enabling automatic fulfillment of the agreement's contents, even without trust. Blockchain-oriented software (BOS) allows SCs to support more complex processes and interactions, generating a new paradigm with nearly unlimited potential applications.

Blockchain technology adoption is a rapidly growing area of interest in various sectors, including banking and finance, supply chain management, and retail. Several factors influence the adoption of Blockchain. A study identified security risks as [54] a significant factor impacting the adoption of Blockchain authentication technology in Malaysian banks and financial organizations. Regulatory support also plays a crucial role in influencing Blockchain adoption in the banking and financial industry. Moreover, technology latency is another factor that can impact the adoption of Blockchain authentication technology in Malaysian banks. Technology complexity also significantly influences Blockchain authentication adoption in Malaysian banks and financial institutions [54].

Perceived usefulness is an essential determinant of the behavioral intention to adopt Blockchain technology in the supply chain management of manufacturing industries in Bangladesh. Furthermore, trading partners' pressure and competitive pressure also play pivotal roles as determinants of the behavioral intention to adopt Blockchain technology in the supply chain management of manufacturing industries in Bangladesh [55].

Therefore, Blockchain technology has gained considerable momentum [56]. According to a survey, over 33% of C-suite executives are either considering or have already used Blockchain technology [57]. Researchers and programmers have also explored Blockchain's potential and developed numerous applications across various sectors [58].

2.1. Blockchain Adoption

2.1.1. Attitude towards Blockchain

"Attitude" refers to a user's positive or negative feelings toward a new technical invention [59]. Attitudes can be either favorable or unfavorable. Researchers identified genuine conduct, which they characterized as a user's belief system or tendency to use and study technological systems, by applying reasoned action to identify genuine behavior. It seems that the attitude comparable choice method [60] does not reveal how an individual decides whether to engage in various behaviors by considering their attitudes toward the available options when people are forming their behavioral intentions. People do consider their attitudes toward each option.

2.1.2. Trust

When a customer interacts with a piece of technology, trust refers to the feelings of ease, confidence, and safety the customer experiences [61]. Building trust requires having faith in a business partner, keeping communication channels open and consistent, and maintaining an open communication channel. Trust describes the relationship that exists between a buyer and a seller. Trust is a property of trustworthy relationships that can assist in limiting risks by providing additional protection and monitoring for customers to strengthen the customers' position in any potentially unfavorable activities [62]. Customers are less ready to take chances when they lack faith in a firm, which increases the likelihood of defecting to a competing brand. Trust is the only viable choice when taking risks over which one has no control and that cannot influence the outcome. Regarding Blockchain technology, the customer's perception of risk ought to be kept to a minimum, while the level of trust ought to be kept high.

2.1.3. Intention to Use Blockchain

Intention refers to a user's expected likelihood or potential to engage in a specific activity, such as adopting new technology. It plays a crucial role in establishing welldefined user acceptance metrics in the early stages of application development. It also aids customers in adopting effective technologies and rejecting ineffective ones, reducing the risk of providing technologies that may ultimately be rejected [59]. The intention results from a user's subjective reasoning, which motivates them to execute and use a technical system by believing in intentional behavior.

2.2. Influential Factors to Blockchain Adoption

Many influential factors have an impact on Blockchain adoption in software firms.

2.2.1. Trialability

The concept of trialability refers to an innovation's capacity to undergo limited testing before full deployment [63]. According to [64], allowing individuals and organizations to try an innovation before adopting it increases the likelihood of successful adoption. Studies conducted by [65] showed that trialability is a critical factor in business application adoption. Similarly, [66] found that trialability significantly impacts technology adoption, as demonstrated in their study on e-commerce adoption. Another study [67] emphasized the importance of a testing phase before implementing Blockchain SCs.

Analyzing these new contractual systems and technologies will be vital to create user trust as businesses transition from traditional contracts to SCs on Blockchain. This transition will take place as businesses move away from traditional arrangements. Trials are a valuable tool for reducing the likelihood of errors and problems [67]. The relevance of trialability in accepting technical breakthroughs [65,66] has been proven in earlier research. Therefore, it is evident that trialability will also impact the adoption of Blockchain technology in the software sector. Therefore, this study hypothesized that:

H1. *Trialability has a significant impact on Blockchain adoption in the Malaysian software sector*.

2.2.2. Security

Security protects confidential information and transactional data when transmitted [68]. Blockchain technology provides strong information security [69] and allows users to carry out transactions without revealing their identity, thanks to its secure database [70] and privacy-preserving design. Previous research has identified security threats as a significant factor affecting technology adoption [71,72]. As a result, this research proposed the hypothesis that:

H2. *Security has a significant impact on Blockchain adoption in the Malaysian software sector*.

2.2.3. Complexity

"Complexity" refers to the difficulty of understanding and learning to use a new technology [73]. In the case of Blockchain applications, scalability [74] and selfish mining [75] are the primary sources of complexity. The literature identifies threats to information security as a factor that impacts the adoption of technology [71,72]. As a result, this study put forward the hypothesis that:

H3. *Complexity has a significant impact on Blockchain adoption in the Malaysian software sector*.

2.2.4. Cost

The term "cost" refers to the amount of money that could be saved by adopting Blockchain technology. With the potential to reduce the cost of processing in banks, Blockchain can disrupt the financial services sector and provide cost-effective solutions [52]. It is also expected to offer cost and risk reduction benefits in supply chain management [18], which aligns with the objectives of cost reduction in supply chain management [21]. Consequently, this study suggested the hypothesis that:

H4. *The cost significantly impacts Blockchain adoption in the Malaysian software sector*.

2.2.5. Innovativeness

The characteristic of innovativeness refers to the readiness of individuals to try new things, which positively affects their adoption behavior [53]. Studies have shown that innovativeness predicts individual attitudes and acceptance of technology [7]. Additionally, innovativeness measures a firm's ability to adopt new technologies when implementing IT [76]. Being an innovator and having a forward-thinking mindset is a desired trait [77]. The benefits of the technology are used to measure innovativeness [78]. Based on these findings, this study hypothesized that:

H5. *Innovativeness has a significant impact on Blockchain adoption in the Malaysian software sector*.

2.2.6. Facilitating Conditions

The idea of enabling conditions refers to an employee's impression of the technical infrastructure that supports the usage of a system within a firm. This perception can either help or hinder the employee's ability to successfully use the system. In addition, it involves having a grasp of the resources that are open to businesses to facilitate the use of Blockchain technology. It is more probable that consumers will have a favorable experience when using Blockchain technology and will become more invested in it if they perceive a sufficient degree of technical, organizational, network, and human support while using Blockchain technology. The implementation of Blockchain technology, which saves a copy of each transaction, fortifies the system and makes transaction monitoring more efficient for everyone involved [79,80]. Thus, this study hypothesized that:

H6. *Facilitating conditions have a significant impact on Blockchain adoption in the Malaysian software sector*.

2.2.7. Market Dynamics

The term "market dynamics" alludes to the continuous shifts in the market and the intense competition that exists [81]. It is recommended that a Blockchain maturity model be used, which takes into account market factors and is based on a five-stage taxonomy model, and that feasibility studies be conducted before the implementation of Blockchain technology [82]. Both of these things should be done to increase Blockchain adoption. When discussing competitive pressure, we refer to the pressure within an organization and the desire to gain a competitive advantage. This drives businesses to adopt new technologies to combat the pressure from upstream and downstream competitors and new developments in business models and sector standards [83]. It has been reported that problems relating to the law and the practical implementation of decentralized systems are still unresolved, and there is a need for the immediate establishment of sector standards [84]. In addition, there is a need for immediate action to be taken to address the need for immediate sector standards. According to research [85,86], the regulatory environment has been highlighted as a crucial aspect that plays a role in adopting Blockchain technology. Therefore, this study hypothesized that:

H7. *Market dynamics have a significant impact on Blockchain adoption in the Malaysian software sector*.

2.2.8. Regulatory Support

The government creates regulatory frameworks to oversee technology service providers and customers and ensure they comply with obligations and avoid violations, referred to as the regulatory framework and government assistance [87]. E-commerce and service quality monitoring rely on government regulations and laws to legalize and deploy new technologies within a country's legal framework. These laws are crucial to ensure all procedures are conducted fairly and efficiently. The same applies to customer attitudes toward Blockchain technology and cryptocurrencies. Regulation is necessary to limit or alleviate any resulting ambiguity, which may affect consumers' willingness to trust and securely use the technology.

However, the global spread of cryptocurrencies faces further challenges, such as inadequate regulatory laws [88]. Therefore, this study hypothesized that:

H8. *Regulatory support significantly impacts Blockchain adoption in the Malaysian software sector*.

2.2.9. Partner Readiness

The degree of integration with currently active organizational partners is a crucial factor in determining whether or not the introduction of Blockchain technology will be successful [15]. It is impossible to successfully implement a Blockchain project if the partners' connections are inadequate [89]. The practical implementation of the Blockchain project requires the cooperation and desire of partners to participate in the project. According to research, an organization that implements an innovation expects that its partners will likewise implement an innovation process comparable to its own and fully utilize the innovation on an inter-organizational level [90]. Based on this, this study hypothesized that:

H9. *Partner readiness has a significant impact on Blockchain adoption in the Malaysian software sector*.

The study hypotheses are presented in the research framework, as seen in Figure 1.

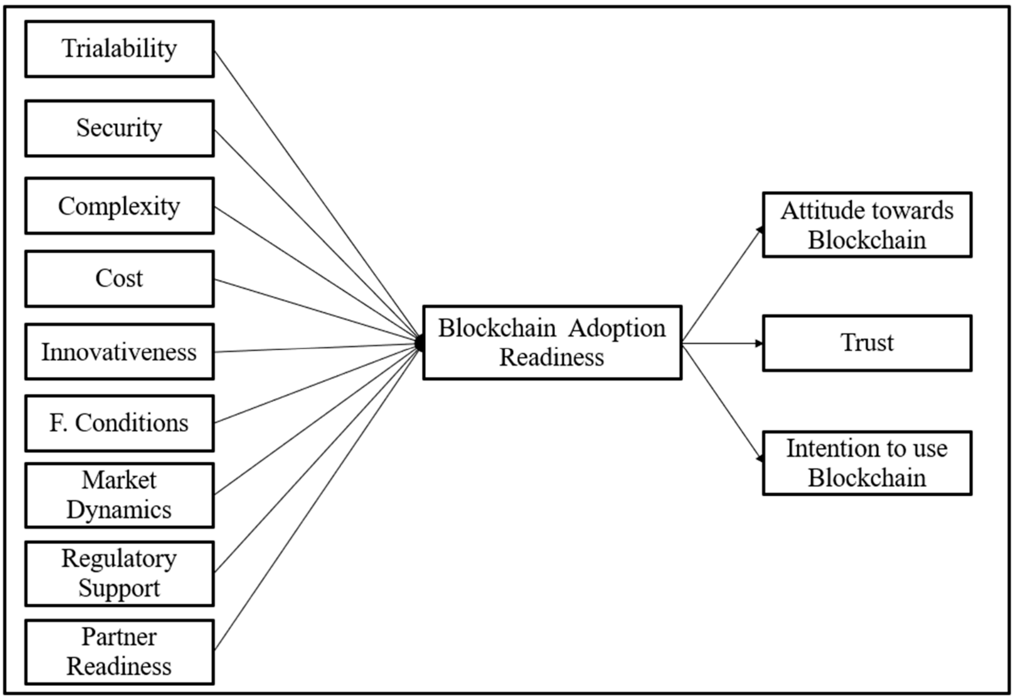

Figure 1. Research framework.

2.3. Theoretical Underpainting

The TOE was explained in the processes of the technological innovation book [8,91]. The TOE can be considered a theory for the organization level that describes the three different aspects of a company's context that affect adoption decisions. These three contexts are described as technological, organizational, and environmental, which are theorized to affect technological innovation [49,92]. Considering technological, organizational, and environmental circumstances, the TOE can provide a unique viewpoint on IT adoption [93]. Investigating contingent factors affecting company choices is one of the most specific methods for understanding creativity [94]; to justify outcomes in organizations, such concerns may be classified as infrastructure, TOE, and organizational effect [8,91]. The TOE may be used to systematically examine an organization's innovation effect. According to the study in [48,95], the TOE distinguishes intrinsic creative features, organizational capabilities, motivations, and broader environmental factors of innovation.

Various researchers have used the TOE to investigate a variety of IS and IT innovations [96–99]. The TOE deals with technology acceptance and other dynamics related to organization and environment [91]. The other adoption frameworks are not as comprehensive as the TOE due to the additional organizational and environmental factors included in the TOE. The TOE was adopted to identify the organization's technology and external environment as valuable elements in adoption [8,100]. Similarly, the usefulness of this framework in small enterprises using a perception-based electronic data interchange adoption model with some determinants was proposed [101]. Therefore, the TOE favors the study of Blockchain adoption in the software development industry.

This study discusses a new Blockchain adoption framework based on integrating the TOE and uses it to determine the factors of Blockchain adoption by software development companies in Malaysia. Moreover, this includes factors for technological readiness, i.e., trialability, security, and complexity; factors for organizational readiness, i.e., cost, innovativeness, and facilitating conditions; and factors for environmental readiness, i.e., market dynamics, regulatory support, and partner readiness. These factors influence Blockchain adoption readiness, which can be determined by three factors: attitude toward Blockchain, trust, and intention to use. Additionally, it is categorized into the broad theoretical field of technology adoption, and, based on the technology adoption research, the factors that may affect the adoption of technology are organizational factors, technological factors, and environmental factors. These characteristics show a solid connection with technology adoption in previous research.

Accordingly, it is significant that Blockchain adoption research takes the abovementioned factors that influence Malaysian software development companies' decisions to adopt Blockchain. This study tries to provide essential insights and beneficial guidelines for these companies to decide on Blockchain adoption and to improve their successful adoption.

3. Methods

The quantitative research design was used for this study as data were collected through a questionnaire survey using a cross-sectional design. This study's research design began with the exploratory phase, which included reviewing and comprehending the existing literature and research trends in the investigated environment. This crucial step was vital in transforming the considered theories into a conceptual framework. As a result of the literature review, hypothesized correlations were established between the components with a known association. This research study's conceptualized research framework integrates relevant constructs from previous studies employed in the Blockchain.

For model validation, data were collected from Malaysian software firms. SPSS version 25.0 and SEM-PLS with SmartPLS version 3.3.3 were used to evaluate the obtained data. SPSS is mainly used for descriptive statistics and measurement, whereas SmartPLS handles structural equation modeling approaches for testing hypotheses. Figure 2 depicts the research methodology utilized for this study.

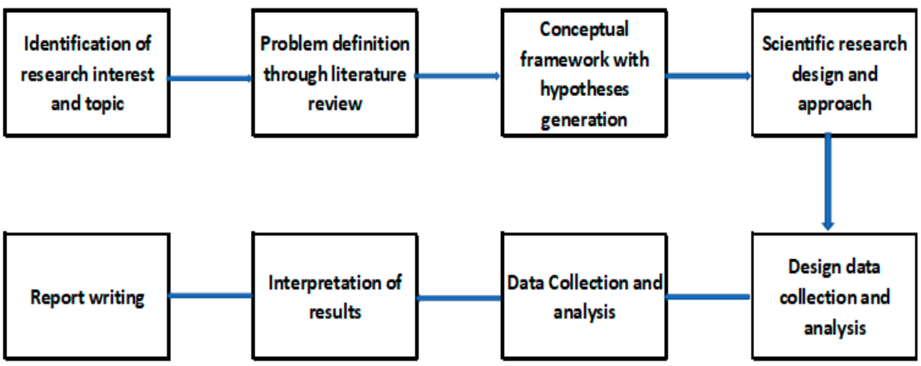

Figure 2. Overview of research design.

3.1. Survey Development

The literature on research design elucidates the principles, methodologies, and practices for social science research and the particular aspects of survey-based research. Theoretical parts of research are quantitatively supported by survey-based research. Additionally, this subjective investigation comprises participants from several investigated population groups. After evaluating a sample picked from the wider population, the study's findings are extrapolated to the larger population [102]. In such a study, independent and dependent variables are taken from the literature and mapped into a framework to analyze their effect according to the researcher's hypotheses. With questionnaires or interviews, a survey is created and carefully evaluated against observations from the actual world.

A questionnaire is a type of research tool that consists of several questions presented in a particular order and sometimes known as items, designed to elicit responses/perceptions from study participants. This standardized data collection method may contain structured or unstructured questions that are simple to read, comprehend, and reply to, as well as being substantive. For theoretically acceptable findings, it is essential to implement a dependable sampling plan and technique [103].

The survey technique collects data aggregated into a composite score for statistical analysis and produces significant findings for conceived components and their relationships. Consequently, it is vital to verify the accuracy of established variables. Research studies indicate that adopting dependable and verified items from prior research is feasible since it saves time in designing and assessing measuring instruments [104]. It is also recommended to adopt items that can be matched with research aims and, as such, should be updated based on the research questions and concerns raised [105]. In this research study, the researcher carefully accepted items with verified, highly significant values and changed others to meet the needs of the study. In Table 1, factor definitions and item sources are listed. Also, the questionnaire items are listed in Appendix A.

Table 1. Research framework factors and operational definitions.

Measurement Variable	Operational Definition	Adopted From
Trialability (TA = 4 items)	The degree to which a Blockchain can be tested on a limited basis	[99]
Security (SC = 4 items)	The degree to which users believe in the security of Blockchain	[7,23,98,106]
Complexity (CM = 4 items)	The degree to which users find the Blockchain or its implementation is complex	[99,107]
Cost (CS = 4 items)	The degree to which users find the Blockchain saves cost	[98,107]
Innovativeness (I*N* = 4 items)	It is a personal feature that influences people to try out Blockchain	[7,108]
Facilitating conditions (FC = 4 items)	The degree to which users find that there are available infrastructures aimed at supporting Blockchain adoption	[5,15,19,27,33]
Market Dynamics (MD = 4 items)	The degree to which users find the market continuously changing its state with Blockchain adoption	[107]
Regulatory support (RS = 4 items)	It refers to policies and laws that play an essential role in promoting the adoption of Blockchain.	[107,109]

Table 1. *Cont.*

Measurement Variable	Operational Definition	Adopted From
Partner readiness (PR = 4 items)	The degree to which users find their partners' willingness and cooperation to be part of the Blockchain initiative.	[4,98]
Attitude towards Blockchain (AB = 4 items)	It is a personal feature that influences people's general productive response to utilizing Blockchain	[5,6,16,23,108]
Intention to use Blockchain (IB = 4 items)	It refers to the user's perceived likelihood or probability to engage in a particular behavior experience the Blockchain	[6,7,15,16,19,25,27,31,99]
Trust (TR = 4 items)	It refers to the level of comfort and confidence that users have in using Blockchain.	[15,16,23,27,110]

3.2. Sampling

Sampling is essential to behavioral research as it involves gathering data to validate a proposed research framework. The selection of participants, objects, or events for investigation is referred to as sampling. To ensure accuracy, the sample should accurately represent the population being studied [104]. Sample selection requires considering various factors such as available resources, analysis type, estimated accuracy, number of comparisons, and variables to be investigated. Population refers to the total population of individuals, events, or objects potentially contributing to research findings. Elements refer to single members of the population, and all elements should have an equal chance of being chosen in the research. A sample is a portion of the whole population, and the results of the sample can be generalized to the entire population. In survey research, researchers must select an appropriate sample from a narrowly targeted population related to their study interests [103,111].

In this study of the software sector in Malaysia, the study population was identified as all firms in Malaysia that have been granted MSC (Multimedia Super Corridor) Malaysia accreditation [112].

MSC is the government initiative to build a vast industrial park for knowledge transmission and multimedia development. It was designed to deliver a network of sophisticated ICT services. Investment in ICT-related activities has received a total of MYR 2.3 billion (about USD 0.7 billion) [113]. It had four objectives: to increase national production, to provide the optimal multimedia settings for world-class corporations operating in a regional hub, to produce a profit from information-age businesses, and to propel the country into a knowledge-based information society [114]. MSC aims to bring together domestic and international investors [115].

A total of 4726 businesses have been granted MSC Malaysia accreditation, and only 2708 were accredited as of December 2021 [116]. Due to the impracticality of collecting data from every element of the population, a sample of 406 firms was selected using the simple random sampling method. The minimal sample size was determined using G*Power, and the recommended sample size was 85. However, given the complexity of the research framework, it was recommended to increase the statistical power of the investigation, and a sample size of 200 or more was considered appropriate for complex frameworks [117]. The researcher determined the sample size using a mathematical technique based on the degree of confidence, standard deviation derived from the pilot study, and margin of error (%) [118].

$$n = \left(\frac{Z\alpha/2 \times \sigma}{e}\right)^2 \ldots \quad (1)$$

n = Sample size
$Z\alpha/2$ = Confidence interval
σ = Standard deviation
e = Margin of error

This study used a 90% confidence interval (z = 1.64), and the margin of error was estimated as 5%, i.e., e = 0.05. Standard deviation (σ) was derived from the pilot study as 0.44. The sample size was then calculated as follows:

$$n = \left(\frac{1.64 \times 0.44}{0.05}\right)^2$$
$$n = 208.282$$

This computation suggests that the minimum sample size should be n = 208. Considering that Blockchain is still a new technology and the probability of a low response rate, invitations were distributed to 406 firms using the SRS approach to prevent a lower response rate than anticipated. A total of 259 firms from this sampling frame participated in the survey. After data filtering, 251 acceptable replies were retained for data analysis.

Participant sampling in this research study was conducted using a rational procedure. The 406 targeted companies were selected randomly using the SRS method in Microsoft Excel. The researcher acquired the e-mail addresses of these companies from different resources such as experts and faculty members at Universiti Teknologi PETRONAS, companies' websites, and companies' landline phones to carry out the data collecting procedure. The researcher gathered data by self-administration utilizing electronic survey delivery and collecting techniques [119]. A total of 406 online questionnaire invitations were sent since the researcher anticipated a lower response rate. A total of 251 useable surveys were received, with a 61.8% response rate.

3.3. Structural Equation Modeling (SEM)

SEM is a statistical technique that enables researchers to analyze complex relationships between multiple variables. It is a multivariate analysis method that uses a hybrid methodology, factor analysis, and regression analysis to test hypotheses and evaluate theoretical models [120].

In SEM, researchers construct a structural model that explains the relationships between observed variables and latent constructs, which are not directly observed but are measured through multiple indicators. The model can be used to test if the data fit the theoretical model, evaluate the significance of the correlations between the variables and the direction of those relationships, and make predictions about the system's behavior [121].

The advantages of SEM include the ability to model complex relationships, evaluate the validity and reliability of measures used to assess constructs, test theoretical models and determine whether the data support the hypotheses, handle missing data and provide less-biased estimates, and test causal relationships between variables, which is essential in determining the directionality of effects. Generally, SEM is an effective tool for analyzing data and testing theoretical models in a wide range of research fields [122].

The study employed SmartPLS version 3.0, using partial least squares (PLS) as a statistical technique to examine the measurement and structural models. This approach was chosen because it does not need the data to have a normal distribution, which is often not the case for survey data, as noted in previous research [123,124]. Smart PLS-SEM has been widely used in various sectors, such as education [125], waste management [126], and construction management [127–129].

4. Results

The analysis was performed using SPSS v23 and Smart-PLS statistical tools. This section provides the descriptive statistics of the respondents. SEM is presented as a significant part of this section. Under SEM, this section reports the measurement scales in terms of reliability and validity (i.e., construct validity and reliability, convergent validity, and discriminant validity). Then, the overall structural model is reported and explained, including in terms of R-square, F-square, Q-square, and VIF. In addition, the analysis of path coefficients (direct effects) is reported.

4.1. Demographic Characteristics

The respondents exhibited varying demographic characteristics, as shown in Table 2 and supported by the sample profiles' descriptive analysis results. Descriptive statistics were used to analyze the demographic variables. The survey measured seven demographic variables, namely, gender, age groups, educational level, position, year of experience, Blockchain awareness, and Blockchain adoption. The information on the respondents' demographics is presented in Figure 3. The data reveal that most respondents are male, accounting for 67.73% (*n* = 170) of the sample, while female respondents account for 32.27% (*n* = 81). Age-wise, respondents are classified into three groups: below 40 years old, between 40 and 50 years old, and above 50 years old, with only 43.43% (*n* = 109) of respondents being below 40 years old, 25.50% (*n* = 64) being between 40 and 50 years old, and 25.50% (*n* = 64) being above 50 years old.

Table 2. Internal consistency and convergence validity results.

Constructs	Items	F. L	CA	CR	AVE
Attitude towards Blockchain	AB1	0.968	0.982	0.987	0.949
	AB2	0.982			
	AB3	0.974			
	AB4	0.974			
Complexity	CM1	0.968	0.975	0.981	0.930
	CM2	0.967			
	CM3	0.964			
	CM4	0.957			
Cost	CS1	0.956	0.936	0.955	0.844
	CS2	0.965			
	CS3	0.939			
	CS4	0.804			
Facilitating Conditions	FC1	0.971	0.977	0.983	0.935
	FC2	0.974			
	FC3	0.964			
	FC4	0.960			
Intention to Use	IB1	0.967	0.982	0.987	0.949
	IB2	0.984			
	IB3	0.969			
	IB4	0.977			
Innovativeness	IN1	0.976	0.984	0.988	0.954
	IN2	0.985			
	IN3	0.975			
	IN4	0.971			
Market Dynamics	MD1	0.979	0.987	0.991	0.964
	MD2	0.984			
	MD3	0.981			
	MD4	0.983			

Table 2. *Cont.*

Constructs	Items	F. L	CA	CR	AVE
Partner Readiness	PR1	0.983	0.986	0.990	0.959
	PR2	0.981			
	PR3	0.976			
	PR4	0.978			
Regulatory Support	RS1	0.965	0.979	0.984	0.941
	RS2	0.982			
	RS3	0.967			
	RS4	0.965			
Security	SC1	0.968	0.976	0.982	0.933
	SC2	0.980			
	SC3	0.966			
	SC4	0.950			
Trialability	TA1	0.959	0.895	0.929	0.769
	TA2	0.965			
	TA3	0.637			
	TA4	0.906			
Trust	TR1	0.962	0.955	0.968	0.884
	TR2	0.975			
	TR3	0.960			
	TR4	0.860			

Notes: CR: composite reliability; AVE: average variance extracted; CA: Cronbach's alpha.

Regarding educational qualifications, respondents have different academic levels, with only 10.76% (n = 27) having a Ph.D. background, 25.90% (n = 65) having a master's degree, and 63.35% (n = 159) having a bachelor's degree. The data also classified respondents based on their professional position, with 14.34% (n = 34) of respondents being CIOs/CTOs, 25.50% (n = 64) being senior managers, 39.84% (n = 100) being middle-level managers, and 20.32% (n = 51) being decision makers.

Regarding work experience, respondents were categorized into three groups: less than 5 years, between 5 and 10 years, and above 10 years. The data show that 16.73% (n = 42) of respondents had less than 5 years of experience, 40.64% (n = 102) had between 5 and 10 years of experience, and 42.63% (n = 107) had more than 10 years of experience. Furthermore, respondents were grouped based on their Blockchain awareness, with 58.57% (n = 147) being beginners, 30.28% (n = 76) being intermediate, and 11.16% (n = 28) being advanced.

Lastly, respondents were categorized based on their Blockchain adoption, with only 7.93% (n = 45) having already adopted Blockchain and needing improvement, while 49.00% (n = 123) were planning to adopt Blockchain, and 33.07% (n = 83) were considering adoption in the future.

4.2. Assessment of the Measurement Model

The measurement model evaluation step investigates the composite reliability and Cronbach's alpha to assess construct reliability. Then, discriminant validity was examined to ensure that the items had sufficient capacity to converge with their constructs. In the case of discriminant validity, all constructs are different and distinct from one another. According to [130], the outer measurement model is evaluated for factor analysis to see if the observed variables are loaded on their underlying latent variable. Table 3 shows the measurement model criteria for model fit.

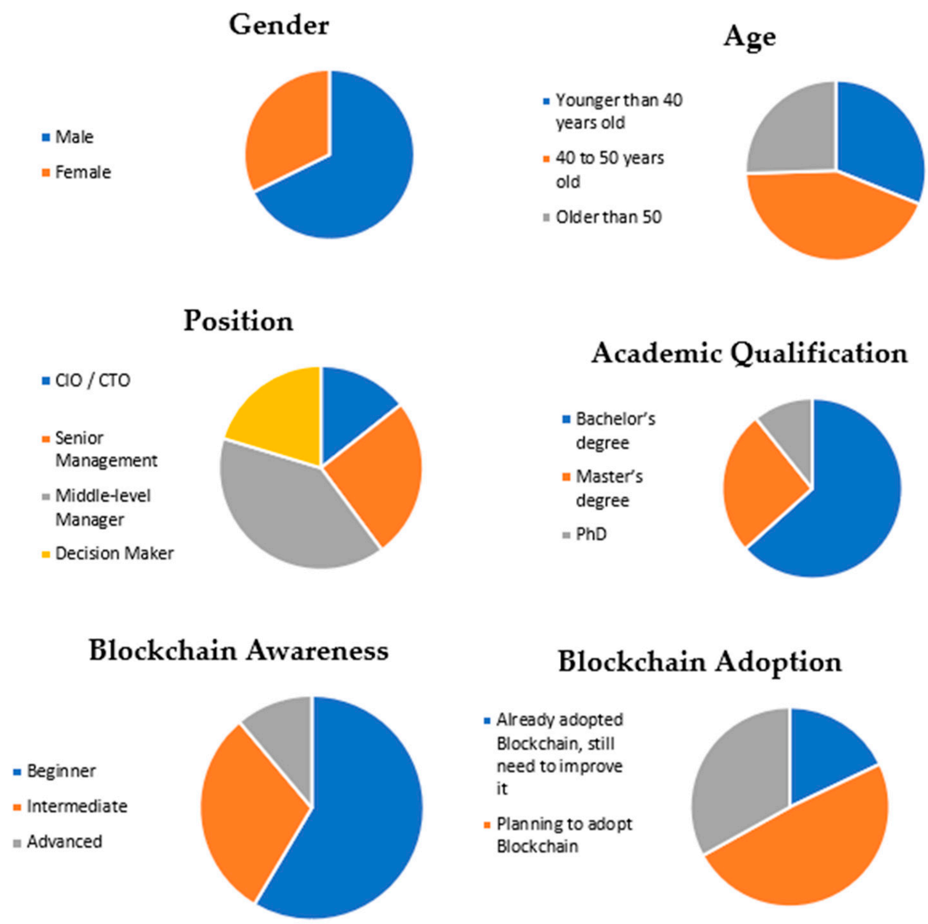

Figure 3. Respondents profiles.

Table 3. Discriminant validity—Fornell and Larcker criterion.

Constructs	A	B	C	D	E	F	G	H	I	J	K	L
A. A. T. Blockchain	0.974											
B. Complexity	0.428	0.964										
C. Cost	0.662	0.422	0.918									
D. F. Conditions	0.560	0.404	0.528	0.967								
E. Innovativeness	0.575	0.422	0.663	0.604	0.977							
F. Intention to Use	0.611	0.337	0.589	0.620	0.692	0.974						
G. Market Dynamics	0.563	0.464	0.567	0.566	0.586	0.627	0.982					
H. Partner Readiness	0.549	0.498	0.656	0.544	0.545	0.521	0.569	0.980				
I. Regulatory Support	0.524	0.557	0.587	0.552	0.549	0.557	0.616	0.553	0.970			
J. Security	0.571	0.552	0.575	0.589	0.638	0.548	0.532	0.558	0.584	0.966		
K. Trialability	0.476	0.324	0.466	0.574	0.572	0.561	0.577	0.469	0.391	0.576	0.877	
L. Trust	0.607	0.355	0.528	0.651	0.503	0.667	0.615	0.593	0.570	0.550	0.541	0.940

The off-diagonal values are the correlations between latent variables, and the diagonal is the square root of AVE.

4.2.1. Construct Validity and Reliability

The first criterion for analyzing item internal consistency is to check item level reliability. This is done by measuring whether the items are internally consistent. The underlying constructs, in particular, explain the item variance, which denotes item reliability. According to [130], the latent variable proves the standardized factor loadings, which must be more than or equal to 0.50 or 50%. The factor loadings should be more than 0.70, according to [131]. However, according to [132], the outer loadings should not be smaller than 0.4. Table 3 shows the analysis outcome of the measurement model, which shows that the outer loadings range from 0.637 to 0.985, which is higher than the minimal threshold condition [122,130,131,133].

Although item-level reliability is sufficient, a study [134] recommends examining construct reliability to analyze the items' reliability under it. Construct-level reliability supports internal links between items using the same constructs. Cronbach's alpha estimates the internal constancy for testing the uni-dimensionality of multi-item scales in the current study [135] and how well all of the assigned items are represented in their constructs [136]. Table 3 shows that Cronbach's alpha is higher than the recommended value of 0.70 [135] and the composite dependability is higher than the cut-off value of 0.7 [137].

The set of observable variables that captures the underlying theoretical notion is known as convergent validity [138]. Specifically, convergent validity establishes that the correlation between responses received via several measurements represents the same variable [139]. It suggests that the collection of elements should all represent the same overarching concept, as shown by the fact that they only have one dimension [131]. Convergent validity was investigated in this study using the widely used AVE approach [131,138,140]. The average AVE for each latent variable was more significant than 0.5 (50%), indicating that each construct can explain more than half of the variance in its measuring items [136]. The factor loadings are shown in Table 2 and Figure 4.

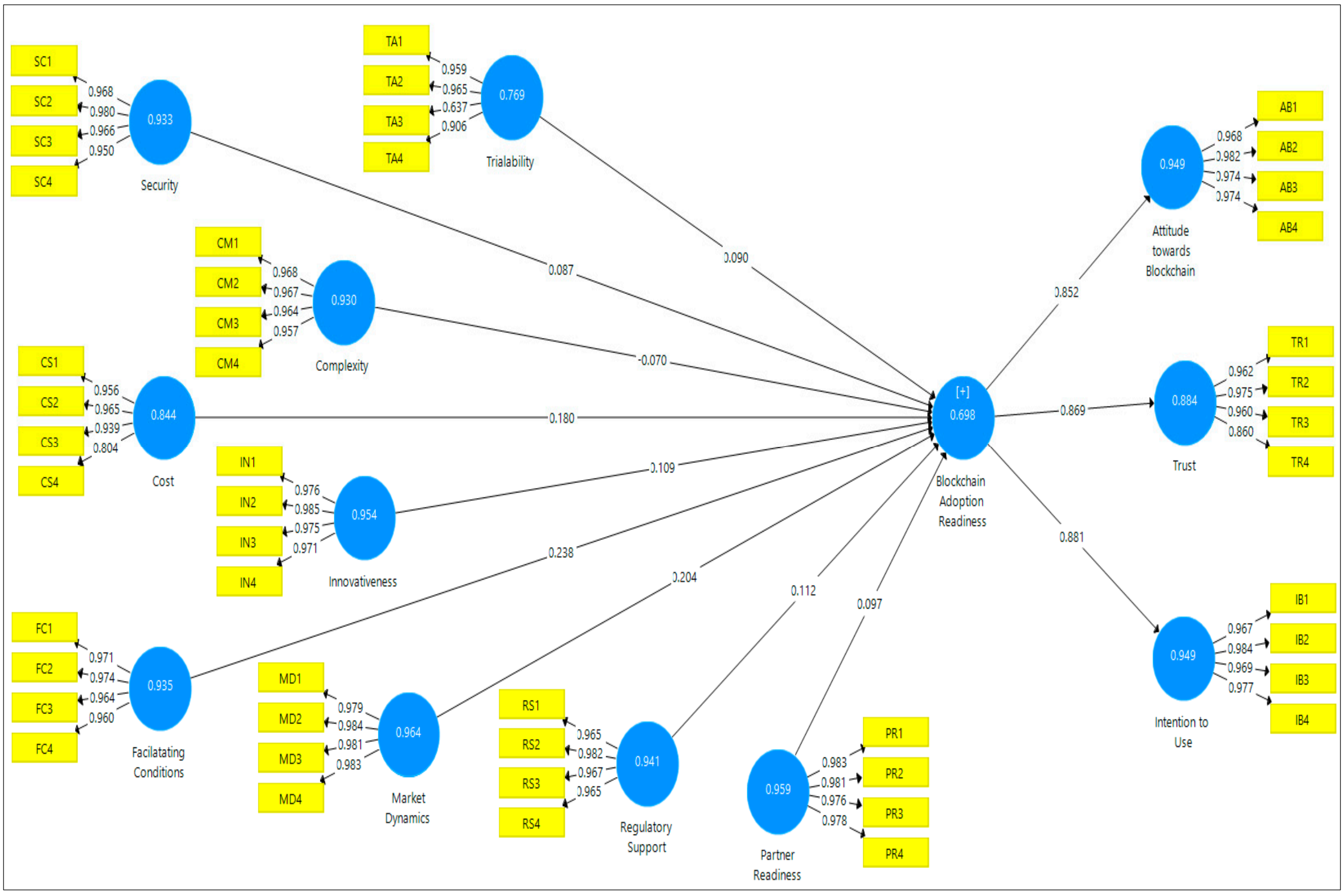

Figure 4. The AVE and factor loadings calculated through the PLS-Algorithm.

4.2.2. Measurement of the Discriminant Validity

According to [141], discriminant validity distinguishes between one construct and others. There are two methods for determining discriminant validity: Fornell–Larcker discriminant validity and the heterotrait–monotrait ratio (HTMT).

Fornell–Larcker

The Fornell–Larcker criterion suggests that the square root of AVE should be greater than its connection with other variables [136]. The Fornell–Larcker output is based on the diagonal square root of AVE and correlations below it. If the square root of AVE in any column is more significant than the correlations below it, discriminant validity exists. The diagonal cells of Table 3 indicate the square root of AVE and the correlations underneath. The discriminant was reached because the square root of AVE was more significant in each diagonal value than the corresponding correlations below it.

HTMT

HTMT is the criterion for determining discriminant validity using PLS-SEM. This method is considered superior to another way (Fornell–Larcker). The values of HTMT, according to Henseler et al. (2015) [142], must be less than 0.90. In this study, the height of the HTMT value was 0.692, as shown in Table 4, thus indicating discriminant validity was achieved because the value was less than 0.90.

Table 4. Results of the heterotrait–monotrait ratio (HTMT).

Constructs	A	B	C	D	E	F	G	H	I	J	K	L
A. A. T. Blockchain												
B. Complexity	0.438											
C. Cost	0.692	0.440										
D. F. Conditions	0.571	0.414	0.551									
E. Innovativeness	0.584	0.431	0.691	0.616								
F. Intention to Use	0.622	0.344	0.615	0.633	0.704							
G. Market Dynamics	0.572	0.472	0.589	0.576	0.595	0.636						
H. Partner Readiness	0.557	0.507	0.682	0.554	0.553	0.529	0.577					
I. Regulatory Support	0.534	0.569	0.612	0.564	0.559	0.568	0.626	0.563				
J. Security	0.583	0.566	0.602	0.604	0.651	0.560	0.542	0.569	0.597			
K. Trialability	0.494	0.337	0.491	0.594	0.592	0.582	0.597	0.488	0.393	0.601		
L. Trust	0.627	0.367	0.557	0.673	0.518	0.689	0.634	0.611	0.589	0.569	0.562	

4.3. *Assessment of the Structural Model*

After analyzing and fitting the measurement model, the structural model's validity must be assessed. Numerous criteria, such as R^2, β, f^2, Q^2, and collinearity, must be assessed while evaluating the structural model (inner VIF). The next stage is to look for a causal relationship between the independent and dependent variables after these criteria have been met. With a series of structural equations, the structural model served as an example of the theoretical model so that the inner path model could be investigated [143]. The following measurements were used to evaluate the structural model in this study: R^2 for endogenous variables, β, Q^2, f^2, and collinearity (inner VIF) [144]. The required thump role value and explanation for each benchmark are presented in a stepwise test of the structural model below.

4.3.1. Coefficient of Determination (R^2)

The coefficient of determination is a statistical tool that measures the variation in an endogenous variable that can be attributed to changes in other variables (R^2). If the R^2 value is between 0.02 and 0.12, the weak variation is clarified by exogenous variables; if the R^2 is between 0.13 and 0.25, the variation is considerable; and if the R^2 is greater than 0.25, the variance is significant [145]. Table 5, showing the R^2, was generated from this research. The R^2 for the endogenous variable Blockchain adoption readiness was 0.719, indicating that the exogenous variables explained 71.9 percent of the variation, which is substantial.

Table 5. R-square result.

Endogenous Variable	R Square	R Square Adjusted
Blockchain Adoption Readiness	0.719	0.709

Substantial > 0.25; Moderate > 0.12, Weak > 0.02 [145].

4.3.2. Effect Size (f^2)

Table 6 represents effect size, f^2. The f^2 value from 0.02 to 0.15 represents a small effect, the value from 0.15 to 0.35 represents a medium effect, and the f^2 values above 0.35 represent a significant effect [142]. The revealed results indicate that innovativeness, partner readiness, regulatory support, security, and trialability have a negligible effect on Blockchain adoption readiness. However, cost and market dynamics have a moderate effect on Blockchain adoption readiness. Furthermore, facilitating conditions affect Blockchain adoption readiness, as the value (0.366) is higher than 0.35.

Table 6. F-square result.

Exogenous Variables	Blockchain Adoption Readiness
Complexity	0.010
Cost	0.157
Facilitating Conditions	0.366
Innovativeness	0.077
Market Dynamics	0.165
Partner Readiness	0.075
Regulatory Support	0.080
Security	0.091
Trialability	0.064

Large: f^2 effect size > 0.35; Medium: 0.15 < f^2 effect size < 0.35; Small: 0.02 < f^2 effect size < 0.15.

4.3.3. Predictive Relevance (Q^2)

The Q^2 test is used to analyze the structural model's predictability. The Stone–Geisser suggestion is used to calculate the prediction ability (Q^2) [146,147]. If the value of Q^2 is more significant than zero, the model needs to be able to forecast the items determined by the dependent variables to follow their advice. To evaluate the predictive significance of the model, the Q^2 value needs to be greater than zero [130]. According to [130,148], the sample reprocessing technique makes assessing the cross-validation of the model simpler. If the Q^2 value is greater than zero, the model has predictive relevance [149]. A blindfolding test is performed to compute the Q^2 value of the model. Table 7 shows that the model has a good fit and high predictive relevance because Q^2 values are more significant than zero.

Table 7. Result of predictive relevance (Q^2).

Endogenous Variable	CCR Q^2 (=1 − SSE/SSO)	CCC Q^2 (=1 − SSE/SSO)
Blockchain Adoption Readiness	0.496	0.653

4.3.4. Direct Effect (Path Coefficient) Analysis

In Smart-PLS, the path coefficient is identical to the standardization in multiple regression analysis. Because PLS has no data normality constraints [130], it is suggested to use the bootstrapping technique to estimate t-statistics and confidence intervals. The structural model was run through a bootstrapping technique to determine the inner path outcomes and check for a meaningful association. The regression coefficient (β) was utilized to examine the separate hypothetical routes included in the study framework. The value of the structural model was investigated to determine whether the proposed hypotheses were accurate. According to the findings of a previous investigation, the minimum value of the path coefficient that should be returned by the model for a specific impact is 0.1 [150–152].

Table 8 shows the path coefficient evaluation outcome where, out of nine direct hypotheses, eight were supported and one was rejected. The supported hypotheses are statistically significant at 0.05, have the predicted sign directions, and have a route coefficient value (β) ranging from 0.087 to 0.238. The first hypothesis (H1) was related to trialability and Blockchain adoption readiness, where the relationship was found to be statistically significant as the *p*-value (0.038) was less than 0.05, and the t-value (2.079) was higher than 1.96, revealing significant relationships. In addition, the relationship is positive as the value of β = 0.090 showed a positive value. The second hypothesis (H2) also revealed a statistically significant relationship as the *p*-value (0.048) was less than 0.05 and the t-value (1.986) was higher than 1.96, confirming a significant effect. Thus, according to the result, it can be interpreted that security significantly influences Blockchain adoption readiness. The fourth hypothesis (H4) related cost and Blockchain adoption readiness, where the result revealed a statistically significant relationship between them as the value of *p* (0.000) was less than 0.05 and the value of t (3.628) was higher than 1.96. Furthermore, the relationship is positive as the beta value (β = 0.180) was positive. Similarly, the fifth hypothesis (H5) was also revealed to be statistically significant due to the *p*-value (0.033) being less than 0.05. The relationship was also found to be positive as the beta (β = 0.109) was revealed to be positive, which means that innovativeness has a significant positive effect on Blockchain adoption readiness. Furthermore, H6 also found a significant relationship between facilitating conditions and Blockchain adoption readiness because the *p*-value (0.000) was less than 0.5. In the same way, H7 was supported as the *p*-value (0.000) was less than 0.05 and the t-value (4.385) was higher than 1.96. This means market dynamics has a significant positive effect on Blockchain adoption readiness. Similarly, the eighth hypothesis (H8) was also found to be statistically significant due to the *p*-value (0.027) being less than 0.05. The relationship was also found to be positive as the beta (β = 0.112) was revealed to be positive, which means that regulatory support has a significant positive effect on Blockchain adoption readiness.

Similarly, the ninth hypothesis (H9) was also found to be statistically significant due to the *p*-value (0.043) being less than 0.05. The relationship was also positive as the beta (β = 0.097) was revealed to be positive, which means that partner readiness significantly affects Blockchain adoption readiness.

However, the third hypothesis (H3), the relationship between complexity and Blockchain adoption readiness, was found to be not significant as the *p*-value (0.080) was higher than 0.05 and the t-value (1.754) was less than 1.96. This means that complexity does not have a significant effect on Blockchain adoption readiness. Thus, all the mentioned results are presented below in Table 8 and Figure 5.

Table 8. Path coefficient results.

	Hypotheses	Beta/OS	SM	SD	T	P	Decision
H1	Trialability → B. Adoption Readiness	0.090	0.088	0.043	2.079	0.038	Significant
H2	Security → B. Adoption Readiness	0.087	0.090	0.044	1.986	0.048	Significant
H3	Complexity → B. Adoption Readiness	−0.070	−0.069	0.040	1.754	0.080	Non Significant
H4	Cost → B. Adoption Readiness	0.180	0.186	0.049	3.628	0.000	Significant
H5	Innovativeness → B. Adoption Readiness	0.109	0.107	0.051	2.137	0.033	Significant
H6	F. Conditions → B. Adoption Readiness	0.238	0.234	0.048	4.935	0.000	Significant
H7	Market Dynamics → B. Adoption Readiness	0.204	0.203	0.046	4.385	0.000	Significant
H8	Regulatory Support → B. Adoption Readiness	0.112	0.108	0.051	2.212	0.027	Significant
H9	Partner Readiness → B. Adoption Readiness	0.097	0.097	0.048	2.030	0.043	Significant

OS = original sample/SM = sample mean/SD = standard deviation.

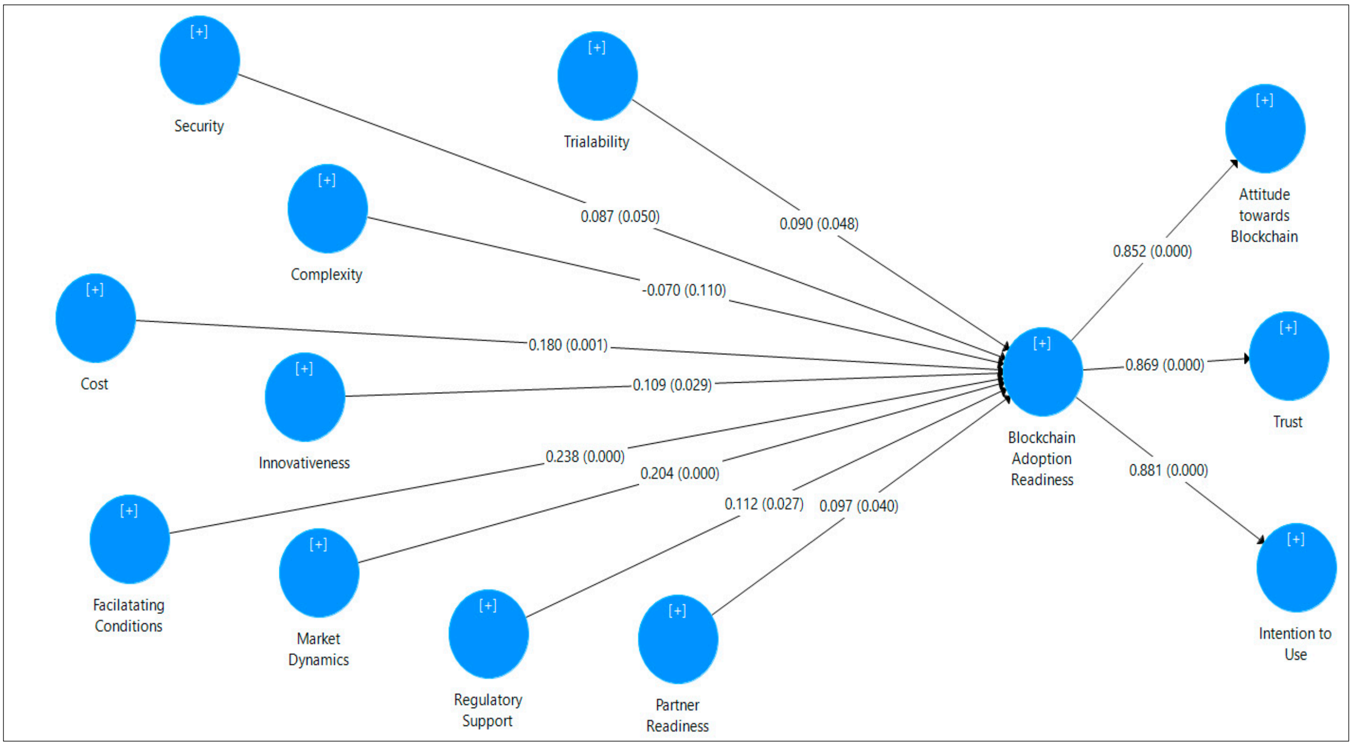

Figure 5. Structural model with path coefficients and p-values from the bootstrapping test.

5. Discussion

The first hypothesis of this study was about trialability and Blockchain adoption readiness among decision makers in the Malaysian software sector. The results for the hypotheses are discussed below:

H1: Trialability has a significant effect on Blockchain adoption readiness. This result aligns with previous studies [64–67]. The results indicated that trialability is essential to enhancing Blockchain adoption readiness for decision makers in the Malaysian software sector. This suggests that decision makers in the Malaysian software sector believe trialability is essential for Blockchain adoption readiness. Based on the results, the path coefficient from trialability → Blockchain adoption readiness was tested by SEM, and the outcome was $\beta = 0.090$, with a significance of $p < 0.038$ and CR = 0.929.

H2: Security has a significant effect on Blockchain adoption readiness. Consistent with [69,71,72], the results demonstrated that security significantly impacts Blockchain adoption readiness among decision makers in the Malaysian software sector. The organization ensures that different security mechanisms are available, allowing decision makers to understand how security empowers people to achieve Blockchain adoption readiness. The standard regression weight for the path from security training to Blockchain adoption readiness was calculated as $\beta = 0.087$, with a significance of $p < 0.048$ and CR = 0.982.

H3: Complexity has a significant effect on Blockchain adoption readiness. Complexity is one of the factors that contribute to Blockchain adoption readiness. However, the current study revealed that complexity showed no significant effect as a technological readiness factor; therefore, hypothesis H3 was rejected. The standard path coefficient from complexity to Blockchain adoption readiness was calculated as $\beta = -0.070$, with a significance of $p > 0.080$ and CR = 0.981. This demonstrates that most decision makers in the software sector feel that complexity does not affect their Blockchain adoption readiness. This result aligns with previous studies [32,107]. The best justification for the failure of this hypothesis is that decision makers in the Malaysian software sector agree that scalability, selfish mining, and lack of computing power [4] are the sources of complexity in relationship to Blockchain, which in turn provides an acceptable reason why the hypothesis H3 was rejected. Additionally, the rejection of this hypothesis was expected because much of the literature indicated that organizations considered complexity in technological readiness as one of the obstacles to Blockchain [35].

H4: Cost has a significant effect on Blockchain adoption readiness. Based on the SEM structure model, the path from cost to Blockchain adoption readiness was determined as $\beta = 0.180$, with a significance of $p < 0.000$ and CR = 0.955, which indicates that this hypothesis was significant. Therefore, this finding agrees with the conclusions of a prior study [32]. Although Blockchain technology has many potential applications, it is still in its infant phases of innovation, making it a challenge to be implemented in older computer systems. Additionally, Blockchain is assumed to impact management goals such as reducing cost [35].

H5: Innovativeness has a significant effect on Blockchain adoption readiness. Innovativeness is considered an essential construct to enhance Blockchain adoption readiness in organizations. The path coefficient from innovativeness to Blockchain adoption readiness was found to be $\beta = 0.109$, with a significance of $p < 0.033$ and CR = 0.988. These values mean this hypothesis is significant. The outcomes indicated that under organizational readiness, innovativeness among decision makers in the software sector is one of the critical factors impacting Blockchain adoption readiness. Thus, these results are consistent with previous studies [108,153]. The study demonstrated that innovativeness is a trait that both predisposes individuals to experiment with new forms of technology and positively influences the adoption behavior of new forms of technology [7].

H6: Facilitating conditions have a significant effect on Blockchain adoption readiness. The results of this path analysis supported the hypothesis. They suggested that facilitating conditions are an organizational readiness factor that significantly affects Blockchain adoption readiness among decision makers in the Malaysian software sector. SEM analysis found the path coefficient was $\beta = 0.238$, with a significance of $p > 0.000$ and CR = 0.983; these values supported the hypothesis. This result aligns with previous studies [27,33]. It was expected that facilitating conditions would positively influence Blockchain adoption readiness as Blockchain adoption readiness will require existing organizational and technical infrastructure to support it [5].

H7: Market dynamics have a significant effect on Blockchain adoption readiness. This hypothesis was supported since the path coefficient of the SEM analysis was $\beta = 0.204$, with a significance of $p < 0.000$ and CR = 0.991. As an environment readiness factor, the market dynamics have significantly affected Blockchain adoption readiness among decision makers in the Malaysian software sector. This finding aligns with previous studies [85,86]. This factor can overcome some problems, such as high costs in terms of both money and time [107]. The current analysis provided practical evidence that the decision makers considered market dynamics to be one of the critical factors that impacts Blockchain adoption readiness.

H8: Regulatory support has a significant effect on Blockchain adoption readiness. The results showed that a high degree of regulatory support significantly influences Blockchain adoption readiness among decision makers in the Malaysian software sector; thus, hypothesis H8 was significant. The path coefficient from regulatory support to Blockchain adoption readiness was calculated as $\beta = 0.112$, with a significance of $p < 0.027$ and CR = 0.984. This outcome is consistent with previous research [107,109]. According to the research on Blockchain adoption, government regulation can help promote Blockchain adoption and boost levels of trust. This is because government regulation is the only method to use Blockchain-based software [11] legitimately [16]. Therefore, this analysis shows precise results that support the hypothesis that regulatory support, as an environment readiness construct, has a substantial impact on Blockchain adoption readiness in the Malaysian software sector.

H9: Partner readiness has a significant effect on Blockchain adoption readiness. Under environment readiness, partner readiness was the last factor. In this hypothesis, partner readiness is considered to be an influential factor in Blockchain adoption readiness among decision makers in the software sector. The path coefficient of SEM from partner readiness to Blockchain adoption readiness was $\beta = 0.097$, with a significance of $p < 0.043$ and CR = 0.990. This result is consistent with previous studies [4,98].

Overall, according to the R^2, all these independent variables (attitude towards Blockchain, complexity, cost, facilitating conditions, intention to use, innovativeness, market dynamics, partner readiness, regulatory support, security, trialability, and trust) explain 71% of the variance of the dependent variable (Blockchain adoption readiness), which is considered to be substantial based on [145] guidelines. Furthermore, based on f^2 results, facilitating conditions significantly affect Blockchain adoption readiness as the value (0.366) is higher than 0.35, and cost and market dynamics have a medium effect on Blockchain adoption readiness, with a value of 0.157. Innovativeness, partner readiness, regulatory support, security, and trialability have negligible effects on Blockchain adoption readiness. Finally, there was no effect between complexity and Blockchain adoption readiness.

6. Conclusions

The conceptual framework was developed based on the literature research on Blockchain adoption. Multiple tested theories were mined for meaningful and relevant factors, which were then meticulously included in a research framework to investigate the effect of each hypothesized relationship on the software sector. This study aimed to validate the research framework necessary to assess Malaysian software firms' readiness to adopt Blockchain. The critical factors for this research framework were identified as trialability, security, cost, innovativeness, facilitating conditions, market dynamics, regulatory support, and partner readiness; also, BOS characteristics and issues related to the software development process were identified.

This research study theoretically and practically contributed to the literature on Blockchain adoption readiness in software firms. In terms of theoretical contribution, this study adds to the existing literature on Blockchain adoption readiness by identifying key technological, organizational, and environmental factors that influence the readiness of software firms in Malaysia to adopt Blockchain technology. Prior research on Blockchain adoption has primarily focused on identifying the barriers and challenges to adoption, such as lack of understanding, standards, regulations, and security concerns. However, this study takes a more comprehensive approach by identifying factors that positively impact adoption readiness, such as trialability, market dynamics, and regulatory support.

Regarding its practical contribution, the results of this research will provide valuable insights for software firms in Malaysia to understand the critical technological, organizational, and environmental factors that influence the readiness adoption of Blockchain technology. The proposed Blockchain adoption readiness framework will help firms identify their strengths and weaknesses in adopting Blockchain technology and develop strategies for addressing any challenges. Furthermore, the framework will help firms better understand the potential risks and benefits of Blockchain adoption and how to mitigate these risks. Therefore, it is crucial for software firms to understand the potential risks and benefits of Blockchain adoption and to develop strategies for addressing these risks. This research will help firms develop a deeper understanding of the critical technological, organizational, and environmental factors that influence the adoption of Blockchain technology and develop strategies for addressing these challenges.

Although this research provides many contributions, many limitations remain to be addressed in future research. The sample of this study is limited to Malaysian software firms. This may limit the generalizability of the findings to other software firms in different countries or sectors. Moreover, the study is limited to decision makers within these firms, and future research may consider the perspectives of other stakeholders, such as employees or customers. In addition, the number of factors considered in the framework is limited to nine, and these measure only the direct relationships; future research may explore additional factors that could contribute to Blockchain adoption readiness considering the roles of moderating and mediating variables.

A notable limitation of this study is that it does not explicitly delve into the inherent security variations among different types of Blockchain. While the research focuses on Blockchain technology, it does not comprehensively address individual Blockchains' varying levels of security and trustworthiness. Future research could consider exploring the security attributes of various Blockchains to gain a deeper understanding of their influence on adoption intentions and firms' overall readiness to embrace Blockchain technology.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data is available with a reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Questionnaire survey:

Trialability	
1	I intend to try out Blockchain in before deciding whether to adopt it in practice.
2	A trial period before adopting Blockchain will reduce the perceived risks.
3	Trying out Blockchain is not important in my decision to adopt
4	In the trial period, I will try to transform the saved records to Blockchain
Security	
1	Blockchain capacity is sufficient for high volume transfers
2	Exchange value/transactions recorded on Blockchain cannot be altered once they are added.
3	Blockchain adoption will make my company subject to potential fraud

4	I consider it safe to adopt Blockchain in my company
Complexity	
1	Learning Blockchain is complex
2	Learning Blockchain will require much effort
3	Blockchain tools are easy to use
4	Blockchain is easy to integrate with existing processes in my organization
Cost	
1	Blockchain can lower transaction costs and reduce paperwork
2	Blockchain can eliminate service charges for the financial intermediaries
3	Blockchain cost is clear and easily understandable
4	Adopting Blockchain will not decrease hardware and facility cost
Innovativeness	
1	Blockchain adoption will excite me
2	I am usually among the first to try blockchain technology
3	Other people give me suggestion to adopt blockchain in the company
4	Blockchain adoption will make the company data accessed by me without any help
Facilitating Conditions	
1	I have the knowledge necessary to adopt blockchain in the company
2	The company has the resources necessary to adopt blockchain in the company
3	The company will specify person (or group) to assist in case of blockchain adoption related difficulties
4	The Company top management has expressed interest in blockchain adoption
Market Dynamics	
1	Blockchain customers' preferences are always changing in the industry
2	Blockchain will increase the sensitivity to changes in the marketplace
3	Blockchain changes in the industry are difficult to predict
4	Blockchain customers' requirements in the industry are challenging
Regulatory support	
1	Government legislation supports the adoption of blockchain
2	The laws and regulations that exist nowadays are sufficient to protect the use of Blockchain
3	The company will receive financial support from the government or relevant authorities to adopt blockchain
4	The company's decision to adopt Blockchain would depend on industry standards in place
Partner Readiness	
1	The company's partners are enthusiastic about blockchain adoption
2	The company's partners are willing to change their processes and practices for blockchain adoption
3	The company's partners recommend blockchain adoption
4	The company's partners provide blockchain applications, influence the company's decision to adopt blockchain
Attitude towards Blockchain	
1	I think blockchain adoption is necessary for as it will improve the software development process

2	Blockchain adoption is highly advisable because of its attractiveness
3	Blockchain adoption will help to increase the transparency in the company
4	I will accept any changes resulting from blockchain adoption and will actively participate in the adoption of blockchain
Intention to Use Blockchain	
1	I intend to use the blockchain technology
2	I will recommend using blockchain technology to others
3	My company intends to adopt blockchain technology soon
4	It is expected ICT sector in Malaysia will take advantages from the blockchain technology in software development process and service operations
Trust	
1	I can trust Blockchain technology
2	Blockchain decentralization makes it a safe system
3	Blockchain will increase the confidentiality with its transparency
4	Blockchain service providers will not keep my best interests in mind

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