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Application of Blockchain for Supply Chain Financing: Explaining the Drivers Using SEM

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Abstract: Owing to the lack of research in emerging Asian nations, this research aimed to unearth the determinants of blockchain acceptance for supply chain financing by a Bangladeshi financing company called IPDC. Centred on a technology acceptance framework called UTAUT (unified theory of acceptance and use of technology) and open innovation research, an expanded model with a mediating variable is developed for this study. This research work employs the deductive inference method in conjunction with the positivism paradigm. A structural questionnaire was used to gather data, which were then processed through Smart-PLS (partial least square) for SEM (structural equation modeling). The survey includes all the people who are directly or indirectly involved in the supply chain financing platform of IPDC. The study consists of seven direct hypotheses and one mediating hypothesis. The results show that all the direct hypotheses except the impact of social influence on the behavioural intention to use (BINTU) blockchain are significant. The mediating hypothesis indicating the role of BINTU in the relationship between facilitating conditions (FCON) and the actual use of blockchain is also supported. FCON and BINTU together explain 88.7% variation in blockchain use behaviour for supply chain financing. The research advances past findings by employing an expanded UTAUT framework and validating observations with the other relevant studies throughout the world.

Keywords: blockchain use behaviour; expanded UTAUT; IPDC; supply chain financing

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1. Introduction

The money market of Bangladeshi is presently confronting numerous issues, scams and transparency problems [1]. The sudden internet finance boom has likewise prompted various difficulties in the conventional monetary framework [2]. In the last few years, the rapid development of data and corresponding advancements of information and communication technology (ICT) has caused disturbances in all business models [3]. Thus, the rapid growth in technology-based business and digital supply chain management is leveraging new relationship models through the entire supply chain network to redesign its service platform [4]. As a result, financial institutions must focus on emerging techniques to drive service innovations, allowing them to respond to changing consumer demands and market pressures [2]. The emergence of a new encrypted and secured technology called blockchain has given a ray of light for ensuring transparency in business transactions, creating a demand for smooth, collateral-free and distance free financial services [5]. New technologies like blockchain technologies (BT) are gradually catching people's attention while the environment keeps up with rising technical advancements in monetary operations [6]. Since blockchain is basically a global archive of documents or a public ledger of all transactions or digital events that have been performed and exchanged by

relevant groups, everyone can know the details of the activities within the chain [7]. It also has the benefit of ensuring improved perceptibility and transparency of transactions [8].

The financial sector in Bangladesh is highly competitive, and because of that, customers in this sector are in a strong bargaining position [9]. Thus, to meet the customers' demand for transparency and collateral-free financing, financial institutions need to embrace technology. BT is such a technology that offers numerous benefits comprising transparency, guilt and deception deterrence [10].

Blockchain integrated supply chain (SC) financing is a priority issue right now. Conventional SC relies on traditional banks for relevant financing operations. With the introduction of blockchain technology (BT), an increasing number of organizations in many sectors have contemplated adopting it to assist supply chain financing globally [11]. Consequently, blockchain for financing has been successfully implemented in different countries. For example, in their research, Chod et al. showed how the application of blockchain increased supply chain financing efficiency and reduced cost. Choi in his research claimed that the blockchain-based supply chain is exposed to less risky financing than conventional systems.

Furthermore, it can ensure better profitability with minimum risks, as evident from the research findings [11,12]. Similarly, Shibuya and Babich compared blockchain-led financing for the supply chain with conventional financing systems. They argued that blockchain's transparency and decentralized systems could provide better solutions that made it an attractive option to prefer than traditional supply chain financing [13]. Lahkani et al., in their study, showed that the application of blockchain for supply chain financing could improvise the performance by ensuring 74% more efficient use of logistics and 75% higher productivity in digital documentation [14]. However, there is no study in Bangladesh on the successful implementation of blockchain in financing. Still, the studies on the success stories of such applications worldwide are the motivations to evaluate blockchain users' behavioural intention for supply chain financing in Bangladesh as introduced by IPDC Finance.

As blockchain applied to supply chain financing platforms is still in its infancy in Bangladesh, most organizations are yet to go beyond analyses leading to the adoption phase. However, the adoption of blockchain technology for supply chain financing platform is a unique endeavour of a Bangladeshi financial institution called IPDC Finance. Keeping the benefits of adopting blockchain technology in mind, it is a matter of interest that IPDC Finance Limited has successfully implemented ORJON, Bangladesh's and South East Asia's first blockchain-based digital supply chain finance platform. Against this backdrop, it is essential to explore the drivers leading to adopting blockchain technology for all of its stakeholders. This study, thus, is an attempt to explain the drivers by using a unified theory of acceptance and use of technology (UTAUT). UTAUT is a suitable approach to gain an understanding of how technology like blockchain implementation for supply chain financing is intended and adopted [15]. Hence, our research is expected to contribute to blockchain-related studies to extend its application to a larger extent.

2. Literature Review and Theoretical Background

2.1. Literature on Blockchain Technology

Recent technological advancement has allowed the issues of inconsistency and the absence of transparent and efficient financial management to be resolved [1]. BT is increasingly gaining the interest of financial service providers and clients of this sector [6]. Blockchain is a general-purpose platform that can be utilized in the banking and financing industry for transparency and trust among the stakeholders. BT is based on the internet and, therefore, depends on its basic framework. It is referred to as the "Security Protocol" that emphasizes ensuring security [16]. Hence, BT is a new means of storing and sharing information that provides encryption and increases confidence.

The blockchain network is a collaborative way to store records of all previous transactions. It runs on a predefined specification that determines the course of executing

and validating transactions, as well as its participants' functionality [17]. Many value-added functions, such as capturing, monitoring, and exchanging information, can be accelerated, and scalability can be accomplished without delay, thanks to blockchain. Its implementation will aid in increasing capabilities of trailing and tracking the system [18]. In a blockchain network, transactions groups are combined into blocks of transactions linked in the network applying the hash of the earlier block's history. As a result, the fundamental security function of a blockchain network is applied as a property of immutability. If anyone wants to adjust some of the codes, the specific ledger will no longer be viable as its hash code within the following block will be entirely different [17].

BT's rising growth and optimism about it across the global economy is a glimpse of change that ensures the challenges of accountability and openness in the financial sector be assured [19]. Tapscott [20] claimed that "Satoshi Nakamoto" introduced a new "peer-to-peer digital currency network" scheme using a crypto exchange "bitcoin" based on BT at the time of worldwide financial distress. BT is currently used extensively in managing financial transactions and non-financial institutions for activities like supply chain management [7].

2.2. Literature on the Use of Blockchain Technology in Financial Sector and Supply Chain Management

BT is a fundamental, enabling infrastructure with promising applications in the financial industry. On the one side, Bangladesh's financial sector is dealing with the effects of interest rate liberalization and profit declines triggered by a shrinking spread gap. Moreover, global transformation, digital creation, and financial developments all have an effect [2]. Blockchain has the potential to become one of the most effective transformative technologies. BT technology can find use in record keeping, state asset management, financial institution ledger execution, and financial asset clearing and settlements [21]. Companies can increase a real-time distributed registry of purchases and interactions for all partners of their supply chain network by implementing a blockchain-enabled supply chain. As a result, BT's primary goal in supply chain finance is to increase supply chain financing accountability and clarity through record-keeping functions [22]. It may serve as a single data source and aid in the integration of all roles in the chain. Because of its capacity to generate activity logs, BT assists companies in making reliable demand predictions, successfully managing capital, and lowering product carrying costs; simultaneously, it provides a transparent view to the financing companies about their investment for that financing. This, in essence, can assist stakeholders in risk reduction at cheaper prices as compared to the conventional method, which requires excess capability and third-party backups [22].

Although the application of BT is a new phenomenon in Bangladesh and South East Asia, six companies in Bangladesh partnered with IPDC Finance for their supply chain financing to create a tenable, translucent, dependable marketplace to connect all the dots essential for effective and sustainable financial development. The companies involved in supply chain financing of IPDC include British American Tobacco (BAT) Bangladesh Limited, BSRM Group, Bangladesh Lamps, ACI Godrej Agrovet Pvt. Limited, IMAGES Group and Sajeeb Group. Thus, it is necessary to explain the factors influencing the stakeholders' intention of adopting blockchain for supply chain financing for its wider acceptance for ensuring transparency and timeliness.

2.3. Open Innovation Dynamics and Blockchain as an Open Innovation

Corporations are constantly relying on external information as well as other technology in addition to their technology. The open innovation (OI) phenomena of such innovation and knowledge sharing are fast expanding across various sectors, across countries, and worldwide to fit with the dynamic business environment [23]. According to OI studies, firms have benefited differently from OI initiatives. Because the necessary information is broadly disseminated beyond the firm's boundaries, the corporation may participate in a "network-based innovation approach", such as blockchain, by interacting and sustaining a network of connections with numerous strategic alliances [24]. Thus, a corporation is

motivated to join a bigger technology infrastructure that includes persons, groups, and different firms [25].

Romero et al. [26] tagged the present business environment as a complex and dynamic ecosystem. They claimed that open innovation could play a significant role in this complex system with different models. The intensity of competition among different organizations in a multidimensional structure demonstrates the complexity of such a structure [27,28]. Complexity emerges if the interdependence of the components becomes significant. Again, interdependent ecosystems are made up of interconnected, conscious actors such as corporations, clients, or financial institutions [29]. Dynamic capabilities often seek an optimal solution and have several layers of accumulation and integration [30] and include innovative approaches [31].

Firms with the finest goods may not always prevail because unforeseeable occurrences may create a "lock-in" of inferior technologies [32]. The transition of major architectural constructions is the outcome of OI based newly developed technologies [23]. Hence, it is significant to examine how OI may interlink with BT. One of the most intriguing things is its ability to revolutionize technological innovations [33]. BT is a technology that would revolutionize the connections between many players in society, including people, businesses, and governments, through its OI character [34]. Blockchain, which was created to fuel bitcoin, is increasingly demonstrating its usefulness in various applications. The latest interpretations of OI refer to it as an 'across boundaries' approach that is significant for decentralized dependable solutions. BT has a complicated web of antiquated procedures and intra and inter-organizational network inside the value stream of a business sector that is comprehensively designed to resemble OI. Furthermore, the decentralized feature of OI intersects with the decentralized character of BT [35].

BT is one of the latest institutional technologies. The majority of the advancements of the distributed network of a consensus mechanism in blockchain may be ported to the OI funnels [36]. The key issue is that BT appears to be inextricably related to dispersed OI systems and digital collaborative invention. The advantages of using BT to improve OI platforms are enormous, and most of those are in their infancy. Thus, the integration of BT with different OI platforms can create a successful business solution [35]. Hence, our effort to demonstrate the use of blockchain for supply chain financing and its acceptance can help materialize the objective of integrating BT for business success in the context of OI for dynamic and complex business models.

2.4. Research Gap

This segment of the study explores the existing literature on the subject matter to identify the research gap. Although many studies are undertaken to explain blockchain adoption behaviour in different countries of the world, the number of studies highlighting the use of blockchain is very limited in Bangladesh [5].

We have conducted a keyword search in the Scopus database to see the current research progress and identify the gap in the field of blockchain application in finance by following the studies of Alone et al. [36] and Munim et al. [37]. First, we used the keywords: "blockchain application" OR "blockchain adoption" OR "blockchain adaptation" AND "finance". We searched on 10 June 2021. After limiting these to English language and Article type, we obtained 121 articles in this field globally. Among the articles showing blockchain implementations for financing operations, a few successful ones are highlighted here.

Choi [11] created simulation solutions for both conventional and blockchain-based SC networks in his research. Using Nash bargaining between producer and merchant, he determined the best contract and volume decisions for every SC. The study demonstrated scientifically why a network-sharing agreement might synchronize all sorts of SC. Lastly, the researchers compared the ideal network performance of traditional and blockchain-based SC. Choi in his study demonstrated that a blockchain-based SC had reduced risk exposure than a conventional SC. Furthermore, if conventional banks' service charges are

significantly high, implementing BT is a less-risk dominant strategy that results in a larger predicted return and a reduced risk [11].

Chod et al. [12] investigated how business operating parameters like operational costs, competitive landscape, and residual stock values affect efficiency. Next, they focused on how verifiability could be accomplished in business and asserted that BT could facilitate it with greater efficiency than conventional measures.

Shibuya and Babich [13] used a multi-layer supply chain framework to compare a BT-based "Supply Chain Financing" platform with a traditional "Bank-based Supply Chain Financing" system. The primary benefit of a BT-based approach is the capacity to generate assertions to pledged properties at higher supply chain levels. In contrast, a conventional system only provides for claims to the proximate purchaser's collateral property. They suggested that the BT-based solution for the financing supply chain is highly appealing and should be favoured.

Lahkani et al. [14] explained the benefits of applying blockchain for the supply chain for sustainable e-commerce financing. They stated that the usage of blockchain enhanced the productivity of logistics by 74% and electronic documentation by 75%. According to their findings, the primary benefit of adopting blockchain is that it generates a reliable decentralized network. Furthermore, it improves transaction efficiency as well as the dependability and openness of data transmission.

However, our research is focused on behavioural intention to adopt blockchain for financing operations in Bangladesh. Hence, to identify the research gap further, we again conducted a literature search in Scopus by using the keywords "blockchain application" OR "blockchain adoption" OR "blockchain adaptation" AND "Bangladesh" and found only four articles. Finally, when we added "Finance" and searched the same again from Bangladesh perspective, we found no specific research on the use of blockchain for financing. Hence, from the search mentioned above, it is evident that there is a dearth of literature in the research cluster in blockchain and finance, especially in Bangladesh, which is still unexplored. IPDC Finance Limited is the first company to adopt blockchain for supply chain financing in Bangladesh. Hence, there is an explicit research gap to explain the factors affecting the adoption of blockchain for supply chain financing.

2.5. The Unified Theory of Acceptance and Use of Technology (UTAUT)

Traces of facts and connections have clarified the introduction and application of technologies from various theoretical models [5]. Previous research has shown significant reservation when applying multiple scattered theoretical models. Many reviewers have shown unfavorable consequences for such incoherent models, which have struggled to present a coherent picture of human actions during implementation and the real application of technologies [38]. Several models describe the introduction and application of technologies, avoiding comprehensive explanation from all aspects in a tightly guarded invention. In comparison, there is less benefit of using various theories in isolation to explain technology adoption [39,40]. In an innovation context, Venkatesh et al. (2003) [15] and Venkatesh et al. (2012) [41] advocate a holistic theoretical model combining the key issues of eight models applied earlier. It is a better option to apply the combined model called UTAUT in explaining behavioural intention and adoption of technologies in business operations [20,22]. Table 1 depicts the detail of the preceding theories upon which UTAUT is built.

Table 1. Base theories of the unified theory of acceptance and use of technology (UTAUT) model.

Theory	Explanation of the Theory	Source Author	Year
Theory of Reasoned Action (TRA)	Individual response is projected based on prior intent and behaviour.	[42]	1980
Social Cognitive Theory (SCT)	Environmental effect like societal force and specific personal aspects like personality are similarly imperative to forecast behaviour.	[43]	1986
Technology Acceptance Model (TAM)	Perceived usefulness and perceived ease of use can explain the end users' technology acceptance tendency.	[44]	1989
Theory of Planned Behaviour (TPB)	Psychological drivers influencing technology adoption have been explained in this model for the first time.	[45]	1991
PC Utilization Model	It is a model of combined TRA and TPB to explain use behavior instead of intention to use.	[46]	1991
Motivational Model (MM)	Extrinsic and intrinsic stimulus for the usages of technology have been described in this model.	[47]	1992
Combined TAM-TPB Theory	Subjective norm and perceived behavioural control have been added with the TAM to ensure a comprehensive explanation of technology acceptance.	[48]	1995
Diffusion of Innovation Theory (DIT)	Drive from intention to pervasive use has been explained in this model.	[49]	1995

All of the above eight theories have been used many times separately to explain the acceptance of technology [15]. In most of the earlier research, it is worth mentioning that by using an individual model separately, the users' behavioural intention is explained by between 17% and 53%. In this regard, the UTAUT model outperformed the said unique models [50]. The superiority of using UTAUT rests on its ability to analyze multi-layer phenomena [51]. Alam et al. [52] claimed that multi-dimensional constructs need to be recognized for an appropriate explanation of innovation and technology acceptance. UTAUT, built on a rigorous analysis and interpretation of eight theories, can serve the purpose of multi-level study [15,53].

3. Research Framework and Hypotheses

The UTAUT model represents four drivers having an influence on the intention and application of technology. Performance expectancy (PEXP), effort expectancy (EEXP), social influence (SIN) and facilitating conditions (FCON) are the main factors of the original UTAUT model explaining use intention and actual use of technology. Here PEXP and EEXP are personal-level variables, SIN is social-indicator variable, and FCON is organization-level variable [15,41]. Though there were moderators called age, experience, gender and voluntariness of applications in the original UTAUT model, those were found to be insignificant and were not used in the later research where the initial fundamental factors were recognized to be reliable factors in explaining the acceptance of technology [40]. However, Queiroz and Wamba [4] argued that trust in blockchain and its stakeholders is a significant driver in explaining the use of blockchain in the supply chain. Thus the research framework is designed in Figure 1 as follows.

3.1. Direct Hypotheses

Based on the relevant literature, we developed seven direct hypotheses for blockchain adoption in supply chain financing as follows.

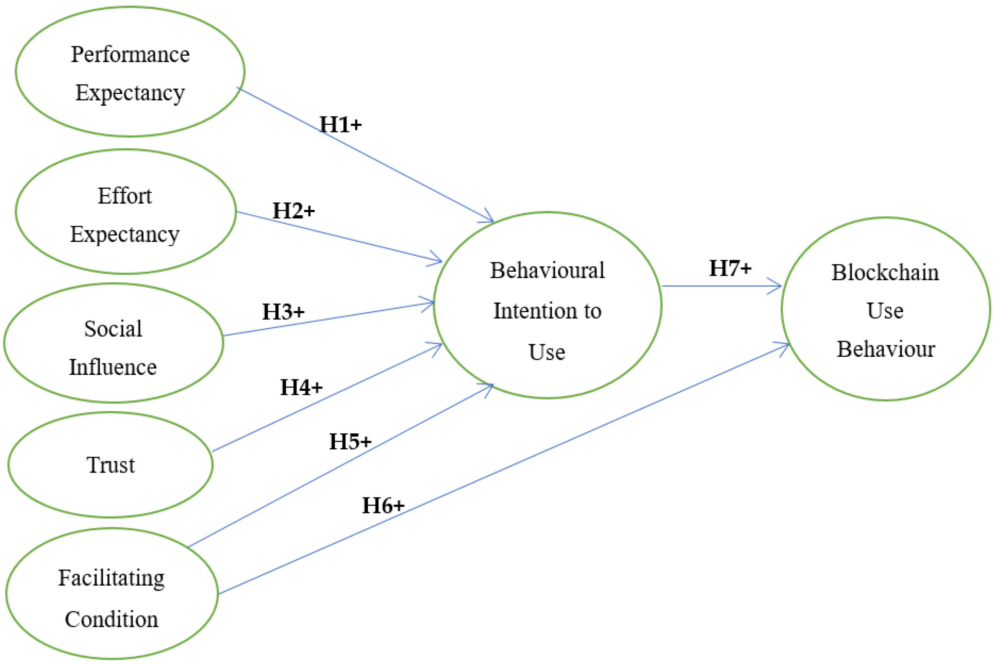

Figure 1. Research framework explaining blockchain adoption drivers for supply chain financing.

3.1.1. Performance Expectancy (PEXP) Hypothesis

PEXP is described as "the extent to which a person assumes that applying the technology will assist him or her in achieving improvements in work performances" [15]. In this research, PEXP refers to the degree to which the supply chain financing stakeholders perceive that using blockchain technology can improve their productivity and performance. An individual's intention to accept and use a brand new technology like blockchain is related to his/her perception of the advantages of the technology in his or her job [15,44]. Thus, blockchain applications should generate expectations regarding enhancements of job performance in the supply chain and relevant financing activities [54]. In addition, blockchain will leverage its redistributed standing to ensure smooth operations amid uncertainty [55]. Previous literature reported that the intention of people to use and adopt a technology depends considerably on PEXP [15,41,56–58]. The successful applications of blockchain for supply chain financing in different countries also show support in favour of our claim. For example, Chod et al. (2020) and Lahkani et al. (2020) in their study showed that the implementation of blockchain for financing operations can increase efficiency and productivity [12,13]. Thus, we formulated the hypothesis below to test.

Hypothesis 1 (H1). *PEXP positively influences the intention to adopt blockchain.*

3.1.2. Effort Expectancy (EEXP) Hypothesis

EEXP tests the simplicity of using technologies [59]. As per the UTAUT applicant, this argues that consumers are likely to implement technologies if they subsequently meet the purposes [59]. In line with the PEXP results, experiments have found that EEXP is a strong indicator of using new technologies [15,40,41,60]. If BT users believe that the platform is simple to use, they are willing to apply it [61]. It is claimed that EEXP influences the decision to apply technologies from a developing country perspective [53,62]. Related observations are also found in research in multiple circumstances, like online education [63], mobile finance [64,65], storytelling [66] and taxation [5]. Choi et al. (2001) [27] and Surana et al. (2005) [28] claimed that the business dynamics and complexities in the present business context demand a system that can ensure better performance with ease, and the application of blockchain can ensure that. Forthwith, if a user assumes that the effort

expectancy of using technology is not available, consumers would not use it [67]. Thus, we test the hypothesis below.

Hypothesis 2 (H2). *EEXP has a positive impact on the intention to adopt blockchain for supply chain financing.*

3.1.3. Social Influence (SIN) Hypothesis

SIN is defined as "the degree to which an individual perceives that other important people believe he or she should use a new system" [15]. When deciding on societal phenomena, an individual assesses important ones in determining self-behaviour [60]. Thus, the societal impact could be defined as the degree to which a person assumes how important others want him to employ the latest technology [15]. Observations include that individuals are impacted by colleagues, family, partners, and significant others [68]. Scholars demonstrated in each of UTAUT and updated UTAUT that an individual's motive is influenced by the expectation of important people (family, employers, co-workers, peers and neighbours) [15]. Recent research has proven how vital SIN is in technology adoption. For instance, SIN performs a key position in adopting Internet-based banking [69,70]. Earlier studies found that when blockchain is applied in the supply chain, SIN can impact BT stakeholders' intention because both are highly interrelated [71,72]. Based on the above discussions, the following hypothesis is considered.

Hypothesis 3 (H3). *SIN positively explains the intention to adopt blockchain for supply chain financing.*

3.1.4. Trust Hypothesis

The trust variable suggests that the "trust" element is closely linked to a person's desire to use BT [5]. Blockchain is a decentralized network that establishes trust within the structure for storing and validating transactions. Pavlou et al. [73] concluded that trust and security are critical considerations for the implementation of emerging technologies. The assumption is that security control is integrated into the planned framework that supports trust. According to Tseng and Fogg [74], "similar to many aspects in human culture, technology-based networks seem to be grappling with a legitimacy problem. People's attitudes toward technology are influenced by its reputation, which determines their decision to use it. For instance, once consumers discover that BT is no longer trustworthy, they will be hesitant to use or will no longer use it. Thatcher et al. [75] argued that a lack of belief in technology could lead customers to end its use due to the absence of trust about reliability or performance; that might be a critical issue to influence users' intentions to use BT. Recent research findings also show the impact of trust and transparency on the intention to accept the application of blockchain. Choi in his research showed how successfully blockchain application for financing can reduce risk and increase trust of the users [11]. Similarly, Shibuya and Babich claimed that the transparency and decentralized systems of blockchain can make it an attractive option to prefer than the traditional supply chain financing by ensuring higher trust [13].

Hypothesis 4 (H4). *Trust positively predicts the intention to adopt blockchain for supply chain financing.*

3.1.5. Facilitating Conditions (FCON) Hypothesis

Venkatesh et al. [15] described FCON as the extent stakeholders think a firm's technical infrastructure helps device usage. FCON is defined as "the degree to which a user believes that an organizational and technical infrastructure exists to assist the use of the system" [15]. In our study, FCON will refer to users' appreciation of the sources that are handy to help blockchain. In a BT context, the transactions supported with the aid of blockchain are saved in the cloud. This represents a vast non-barrier adoption in relation

to infrastructure costs. Additionally, the blockchain infrastructure enables the traceability of the transactions to assist blockchain participants in an effortless way [76,77]. There are preconditions for every system to function in the operational and technological architecture for implementing emerging technologies. Researchers have described mixed outcome on the effect of FCON. Although research has shown that FCON affects the use of technologies [40,53,65], a few studies have reported no substantial impact of it [38,39,78]. However, In line with most of the prior literature, FCON is found to affect the adoption and use of technology [15,41,67,79,80]. Evidently, from the UTAUT model, we argue that the existence of FCON influences the intention to use technologies [53]. Criteria like desired functionality and technological assistance must also be facilitated through the application of innovative technologies [15]. Prior to taking steps to launch a new system, users search for the accessibility of technological requirements and infrastructural aids according to the presumption of UTAUT as the lack of such supports triggers uncertainty and incompetence for any potential difficulties [41,81]. Pertinently, an enterprise without resources, expertise and strategic commitment are likely to delay technological application [53]. In the earlier instances of open innovation like blockchain use cases, it is claimed that complexity arises when many parties are involved in a process [29–31]. For business successes in the dynamic context it is essential to make sure the technological infrastructure is ensured by the organization to support blockchain adoption [35]. Demonstrated assistance from the top management for the approval of essential resources and expertise increases the likelihood of technological acceptance and application [66]. The hypotheses established in accordance with the interpretation of UTAUT and existing studies are as follows.

Hypothesis 5 (H5). *FCON positively influences the intention to adopt blockchain for supply chain financing.*

Hypothesis 6 (H6). *FCON positively explains the blockchain use behaviour.*

3.1.6. Behavioural Intention and Blockchain Adoption

Yu [82] argued that human psychology for using technology is possible to predict. Consequently, the influence of human behavioural intent on practical use is extensively investigated in social sciences and technology studies [41]. Social psychologists have generally explored behavioural intentions and users' conscientious intent to predict their future behaviour. Several of the models built into UTAUT explain the relationship between behavioural intention and use [83]. Behavioural intention (BINTU) is described as the degree to which an individual is convinced to use something new [84]. In this study, behavioural intention refers to the stakeholders' desire to implement BT for supply chain financing activities offered by IPDC Finance Ltd. Previous literature confirmed that BINTU directly impacts the use of technology in the applied sciences [15,45,58,85,86]. In this regard, Venkatesh et al. [86] argued that "the motivational power to adopt an innovation stems from an individual's inner contrast of the behaviour". Thus, behavioural intention is related to one's inner evaluation. Consequently, behavioural intention precedes behavioural expectations. Thus, behavioural intention directly influences technological know-how utilization [85,86]. Hence, a documented review of the current research leads to the following hypothesis.

Hypothesis 7 (H7). *BINTU positively influences blockchain use behaviour.*

3.2. Mediating Hypothesis

Almost no controversy is available in the recent study on the effect of facilitating conditions (FCON) of intent to adopt and real adoption of technologies. Along with the UTAUT assertion, FCON can be referred to, directly and indirectly, influencing indicator of technology adoption [41]. Nevertheless, it is also clear that FCON is a direct indicator of real use [20,40]. We postulate that FCON forecasts the intention of using technology

through literature support theoretically and empirically [41,62,81]. We further argue that the intention to use technology (BINTU) has a major effect on the actual blockchain use behaviour (BUB). Our argument is supported by previous studies [53,62]. According to the earlier research results, we should proceed theoretically and empirically given that the adoption of blockchain for supply chain financing is influenced by FCON and mediated by the intention to use it [40,53,65]. Based on the above arguments, the hypothesis below is established.

Hypothesis 8 (H8). *BINTU mediates the relationship between FCON and BUB.*

4. Research Methodology

Quantitative analysis approach is applied to investigate the variables affecting BT acceptance for supply chain financing. This research followed the empirical deductive reasoning of "establishing a hypothesis considering relevant literature and then employing a test procedure to affirm the reliability of the designed hypothesis" [87]. This study's analysis segment contains two parts. Firstly, the measurement model (MM) is assessed. The MM section guarantees the research's consistency, credibility and appropriateness. Then, a structural equation model (SEM) is proposed to describe the effect of exogenous constructs on BT's intention and actual use for supply chain financing. Partial least square SEM (PLS-SEM) is used for validating a model for this research.

The research consists of a proper flow. First, the strength of the developed framework is assured through model fit criteria. The normed fit index (NFI), comparative fit index (CFI), Tucker–Lewis index (TLI) are examined for this research. Standardized root mean square residual (SRMR), root mean square approximation error (RMSEA), and chi-square tests are also undertaken for ensuring a robust model [88–90]. Second, the reliability and convergent validity are examined with factor loadings, composite reliability (CRI), Dijkstra–Henseler's rho (rA) and average variance extracted (AVE). Third, the discriminant validity is assessed through cross-loadings, the Fornell–Larcker criterion, and heterotrait–monotrait (HTMT) ratio. The exclusion of multicollinearity is also tested by applying the variance inflation factor (VIF) indicator. Finally, with the coefficient of determination (R^2) and effect size (f^2), the SEM is validated [91]. The hypotheses are examined at a 95% confidence level.

4.1. Reasons for Using Partial Least Square Structural Equation Model (PLS-SEM)

The integration of latent constructs and structural interactions has been termed structural equation modelling (SEM) [92]. It is a fairly generic powerful statistical methodology that is mostly linear and cross-sectional. SEM aims to enable the testing of assumptions regarding the impact of a range of parameters on others [93]. Thus, SEM allows for examining latent constructs and their linkages, allowing for the examination of cognitive construct relationships that ensure no measurement error [94]. Special instances of SEM include factor analysis, route analysis, and regressions. SEM is primarily a confirmatory method instead of an exploring one [95]. An investigator is more willing to employ SEM to evaluate if a particular model is valid instead of "discovering" a good model—although SEM investigations sometimes include an exploratory component. As a result, SEM is employed to estimate complicated cause–effect relation models with latent variables as the suitable research methodologies in a wide range of fields, especially behavioural investigations. Thus, SEM is a widely utilized analytical methodology in academia, and it is frequently used to assess models in many social and behavioural sciences [93]. In the case of empirical studies, scholars use SEM and other models like intuitionistic fuzzy. For example, Goswami et al., in their industry survey-based empirical research, applied SEM mentioning its suitability to examine the relationship between latent variables [95]. On the other hand, Choudhary et al. (2019), in their mixed method, used intuitionistic fuzzy to assess manufacturing supply chain sustainability [96]. Similar to our study, the research of Tommasetti et al., by using the extended theory of planned behaviour (TPB), explored the customers' perception of restaurants' sustainability where they claimed that SEM allows

the main limitation of regression models of simultaneously verifying the causality among several variables to overcome [97]. Considering the advantages and applicability of SEM for behavioural studies, we developed our research framework based on it.

To construct SEM, scholars have two major methods, such as covariance-based SEM (CB-SEM) and partial least square SEM (PLS-SEM) [98]. However, it is difficult to identify the right model to apply [5]. The method that fits particular research must be chosen, and the simulations are based on various assumptions [99]. Powerful forecasting ability [100], capacity to work with non-normal dataset [101], a small number of samples and sophisticated processing are the reasons to apply PLS-SEM [102,103]. Unexplained heterogeneity (UH) identification is an extra benefit to the use of PLS-SEM [104,105]. Hair et al. [99] claimed that, when properly applied, PLS-SEM path analysis is a "silver bullet" for cause and effect evaluation. While applying CB-SEM, few parameters are omitted to achieve a fair 'goodness of fit compared to PLS-SEM. When using PLS-SEM, consistency, reliability, and validity are typically more resilient. Moreover, PLS-SEM is marginally superior to CB-SEM for evaluating the variance explained in the regression model [98].

CB-SEM provides good results specifically to confirm proven hypotheses. On the contrary, PLS-SEM is a quantitative technique used for exploratory research and confirmatory study [106]. Researchers need to recognize that PLS-SEM ensures greater robustness than CB-SEM while deciding whether to apply CB-SEM or PLS-SEM. Higher robustness alludes to the notion that a particular association is much more significant by using PLS-SEM when it is pervasive in the population. The robustness makes it highly useful for PLS-SEM to configure a path model [107] as required in this study.

Finally, according to Ramayah et al. [108], PLS-SEM may be considered both for formative and reflective modelling techniques. It is suitable even when the dataset is small, whereas CB-SEM is mainly suitable for a reflective model and large sample size. Therefore, the PLS-SEM is deemed to develop the required structure model for this study, taking the supporting literature into account.

4.2. Sample Size

The participating members of IPDC Finance and the partner companies are surveyed for this research. The survey includes all the people who are directly or indirectly involved in the supply chain financing platform of IPDC Finance Ltd. Considering the small size of the population, the sample size is determined as a "minimum five observations per parameter" [69]. Thus, the sample size for the study is 67, which fulfill the minimum sample size requirements in this regard.

4.3. Research Data and Collection Method

Required data of the study are primary data obtained from the IPDC supply chain financing platform (Arjon) stakeholders. First-hand data are most appropriate for such analysis when the subject matter is quite new, and second-hand data are unavailable to analyze the study problem. Since the adoption of the BT-based supply chain financing is a recent phenomenon in Bangladesh, the evaluation of the factors influencing the intention of its stakeholders to use it is an interesting area to explore with primary data. Thus, data were collected through a survey. The survey questionnaire was sent through the internet, allowing it to obey the health and safety requirements required by the coronavirus disease 2019 (COVID-19) epidemic and carry out the process properly. The questionnaire was digitally recorded in Google Forms and distributed over peer-to-peer digital networks, social media platforms, and traditional postal methods.

The ethical research process is strictly followed when conducting the survey. We assured that the respondents gave their informed permission and had the right to secrecy. We indicated the aim, advantages, and limitations of our research on the cover page of the questionnaire. We also asked the responders to freely select the answer alternatives because there is no right or incorrect answer. Furthermore, we advised not to write the participants' names or any other identification mark to protect anonymity.

4.4. Instrument Development

The research instrument will methodically cover the constructs to ensure efficiency. All items in a particular construct need to be matched with each other, whereas in a good instrument, a certain object of one construct does not align with objects of other constructs [109,110]. Hence, the structured questionnaire is founded on solid literature and employs a '5-point Likert Scale' on an interval scale varying from 'strongly disagree' to 'strongly agree.' However, a pilot survey is conducted with the relevant people for the necessary amendments before sending the final questionnaire to the respondents. Apart from the completion of the questionnaire, the respondents in the pilot survey were requested to explain the consistency, the questionnaire's structure and style, terminology and respondents' acceptance. Based on the reviews, the survey instrument was updated. Furthermore, reliability testing revealed that the measured elements have strong internal accuracy, having suggested $\geq$0.7 Cronbach value [111]. The measurement items for the instrument are described in Table 2.

Table 2. Measurement items.

Construct	Measurement Items	Sources Used
Performance Expectancy (PEXP)	PEXP1 Blockchain technology makes the recording for supply chain financing smooth and easy. PEXP2 Blockchain technology helps to accomplish tasks quickly. PEXP3 Blockchain technology increases supply chain financing efficiency.	[41,56,58,85,112]
Effort Expectancy (EEXP)	EEXP1 Blockchain technology requires less effort for the transaction than the traditional system. EEXP2 Blockchain technology skills can be learned easily. EEXP3 Blockchain enables smooth financial transactions with less effort. EEXP4 Blockchain-enabled supply chain financing helps easy tracking with less effort.	[15,55]
Social Influence (SIN)	SIN1 I should use blockchain-based financing for the supply chain because my behaviour is influenced by other people who intend to use blockchain. SIN2 I should use blockchain-based financing for the supply chain for the people/organizations important to me. SIN3 In general, the use of blockchain should be supported by financing company and the supply chain community as a whole.	[41,58,85,112,113]
Facilitating Conditions(FCON)	FCON1 I think the necessary resources to use blockchain technologies is available with IPDC Finance. FCON2 I think IPDC Finance ensures the necessary knowledge to use blockchain technologies. FCON3 IPDC Finance ensures the availability of a specific person (or group) to assist with blockchain-related difficulties.	[41,67,79,85,112]
Trust	Trust1 I believe the blockchain-based financial service of IPDC Finance is transparent, and the service is trustworthy. Trust2 I trust that the blockchain transactions can be carried out successfully by all stakeholders. Trust3 I think I can trust blockchain-based supply chain financing stakeholders. Trust4 I believe blockchain supply chain financing service stakeholders will always keep my best interests in mind. Trust5 Blockchain enabled-supply chain financing service applications provide me with the necessary feedback that makes me confident to deal.	[54,114–120]
Behavioural Intention to Use Blockchain (BINTU)	BINTU1 I intend to use blockchain technologies for supply chain financing. BINTU2 I think I would use blockchain technologies for other financing transactions if offered. BINTU3 I believe I should use blockchain technologies with other organizations to offer such a platform in a trustworthy manner. BINTU4 I want to continue using blockchain-based supply chain management offered by IPDC Finance.	[41,58,85,86,112]
Blockchain Use Behaviour (BUB)	BUB1 I use blockchain-based financing for the supply chain happily. BUB2 I use IPDC supply chain financing because they adopted blockchain for it. BUB3 I prefer to use blockchain-based financing transactions for supply chain financing than the conventional supply chain financing management.	[41,85]

5. Results and Discussion

5.1. Demographic and Descriptive Statistics

Sixty-seven (67) completed questionnaires were available for the study. There were 89.56% men and 10.44% women respondents, showing a clear male dominance in open innovation platforms. The age range of 30 to 35 years had the largest number of respondents, accounting for 51% of all respondents; 25% belonged to the age group of 35 to 40 years,

and the remaining 24% consisted of other age groups. Hence most of the respondents were between 30 to 40 years, showing a midlevel of age. Around 75% of the respondents had 6 to 10 years of experiences in the financing industry. Almost 100% of the respondents had obtained some orientation and informal training in blockchain-based financing operations, while only around 25% of them had formal training in this regard. Hence, it can be assumed that the respondents had sound knowledge of the subject matter.

5.2. Model Fitness

To verify the fitness of every model, we need an appropriate estimate. This research first calculated SRMR (standardized root mean square residual) for assessing fitness. An SRMR value of less than 0.08 may be found to ensure model fitness [89]. In addition to SRMR, separate fitness requirements were applied by the researchers to assess a study model. NFI (normed fit index), CFI (comparative fit index), TLI (Tucker–Lewis index), and RMSEA (root mean square approximation error) are among the widely used fit indicators [88]. To confirm the methodological robustness of the model, chi-square and its significance need to be examined [90]. NFI, CFI, and TLI scores must be higher than 0.90 as per Bollen [88], while the RMSEA score should be smaller than 0.08. Finally, the chi-square p-value needs to be smaller than 0.05 [88]. Table 3 below represents acceptable fitness scores of 0.944, 0.956, and 0.962 for NFI, CFI, and TLI. Likewise, the SRMR and RMSEA scores of 0.078 and 0.066 refer to the fitness of the model having a χ^2 equal to 1989.331 ($p < 0.05$).

Table 3. Model fitness report.

Model Fit Criteria	Fitness Value of the Study	Acceptance Criteria	Reference	Fitness Ensured
SRMR	0.078	<0.08	[89]	Yes
RMSEA	0.066	<0.08	[88]	Yes
NFI	0.944	>0.90	[88]	Yes
CFI	0.956	>0.90	[88]	Yes
TLI	0.962	>0.90	[88]	Yes
χ^2	1989.331			
χ^2 Significance	0.000	<0.05	[90]	Yes

5.3. Measurement Model

We assessed confirmatory factor analysis to ensure the reliability and validity of the proposed model [121]. The composite reliability (CRI) measure and Dijkstra–Henseler's rho (trA) are measured to confirm the reliability of all constructs. All constructs of this research have a higher than 0.7 CRI confirming the applicability of the parameters [122]. Likewise, each case's internal consistency and reliability are confirmed with a Cronbach score and rA higher than 0.7 [123]. Three estimates are used in this study for measuring convergent validity. We assessed the size of the loading, average variance extracted (AVE), and the significance of loadings. Based on the cutoff point recommended by Hair et al. [122] and Vinzi et al. [124], all outer loadings should be 0.5 or more, provided that the AVE is higher than 0.5. Each outer loading in Table 4 is greater than 0.50. AVE in each case is also higher than 0.50. Thus, the required conditions of fitness are ensured in all the cases [97,99]. AVE higher than 0.5 for all parameters indicates that the variation is explained for greater than 50% variability of indicators [99,122,125]. In this analysis, the CRI for all constructs are greater than 0.70 and higher than the AVE (see Table 4). Finally, a bootstrap re-sampling procedure was used to determine the significance of the loadings [122]. At a 5% significance, all of the study results are statistically significant. As a result, the model's convergent validity is proved [126–128].

Table 4. Validity and reliability scores.

Construct/Indicator	Loadings	Significance	Cronbach's Alpha	Dijkstra–Henseler's Rho(r_A)	CRI	AVE
BINTU1	0.729	0.000	0.907	0.909	0.935	0.781
BINTU2	0.785	0.000				
BINTU3	0.832	0.000				
BINTU4	0.768	0.000				
BUB1	0.827	0.000	0.813	0.843	0.889	0.729
BUB2	0.816	0.000				
BUB3	0.866	0.000				
EEXP1	0.745	0.000	0.813	0.848	0.876	0.639
EEXP2	0.718	0.000				
EEXP3	0.737	0.000				
EEXP4	0.744	0.000				
FCON1	0.580	0.000	0.833	0.878	0.898	0.748
FCON2	0.673	0.000				
FCON3	0.783	0.000				
PEXP1	0.772	0.000	0.973	0.991	0.982	0.949
PEXP2	0.718	0.000				
PEXP3	0.749	0.000				
SIN1	0.914	0.000	0.908	0.711	0.913	0.778
SIN2	0.934	0.000				
SIN3	0.792	0.000				
Trust1	0.618	0.000	0.876	0.922	0.912	0.681
Trust2	0.904	0.000				
Trust3	0.908	0.000				
Trust4	0.824	0.000				
Trust5	0.904	0.000				

For solid measurement models, discriminant validity (DV) is essential to confirm. It describes the degree to which, by scientific criteria, one construct is distinctly different from other constructs. Two commonly applied tests of DV are typically considered in this regard. Evaluating cross-loading is the first technique. The external loadings of a variable on the corresponding construct should have a higher score than all of the cross-loads on other constructs, to be precise [122]. Table 5 guarantees compliance with the requirements for cross-loading.

Table 5. Cross loadings.

Factors → Indicators ↓	BINTU	BUB	EEXP	FCON	PEXP	SIN	Trust
BINTU1	0.880	0.618	0.571	0.464	0.390	0.400	0.579
BINTU2	0.882	0.635	0.545	0.534	0.418	0.542	0.474
BINTU3	0.889	0.677	0.506	0.580	0.441	0.033	0.337
BINTU4	0.884	0.626	0.572	0.498	0.416	0.047	0.488
BUB1	0.548	0.748	0.289	0.716	0.265	0.230	0.288
BUB2	0.689	0.877	0.506	0.580	0.441	0.033	0.337
BUB3	0.684	0.926	0.572	0.498	0.416	0.047	0.488
EEXP1	0.644	0.577	0.843	0.399	0.362	0.133	0.354
EEXP2	0.412	0.333	0.791	0.238	0.296	0.183	0.301
EEXP3	0.400	0.365	0.828	0.350	0.280	0.146	0.170
EEXP4	0.456	0.412	0.826	0.208	0.408	0.275	0.094
FCON1	0.331	0.437	0.203	0.779	0.162	0.208	0.051
FCON2	0.535	0.631	0.236	0.874	0.177	0.171	0.191
FCON3	0.606	0.659	0.391	0.934	0.283	0.214	0.300

Table 5. *Cont.*

Factors → Indicators ↓	BINTU	BUB	EEXP	FCON	PEXP	SIN	Trust
PEXP1	0.514	0.480	0.396	0.282	0.972	0.148	0.240
PEXP2	0.457	0.439	0.400	0.243	0.989	0.195	0.224
PEXP3	0.392	0.378	0.457	0.180	0.962	0.127	0.249
SIN1	0.128	0.108	0.101	0.260	0.151	0.914	0.123
SIN2	0.123	0.081	0.259	0.163	0.029	0.934	0.127
SIN3	0.109	0.079	0.105	0.221	0.145	0.792	0.178
Trust1	0.190	0.111	0.081	0.020	0.283	0.075	0.818
Trust2	0.454	0.391	0.288	0.205	0.198	0.100	0.904
Trust3	0.501	0.385	0.315	0.209	0.185	0.104	0.908
Trust4	0.434	0.332	0.249	0.111	0.165	0.114	0.824
Trust5	0.512	0.488	0.244	0.325	0.247	0.099	0.904

The 2nd DV test is the condition of Fornell–Larcker [122]. The research results show an appropriate degree of DV (Table 6). In the resolution, Henseler et al. [89] introduced a HTMT ratio having a cut off value of 0.90 to assess DV. This assessment is a thorough and precise measurement [122,129–131]. The examined scores in this study, therefore, ensure the requisite validation (Table 6).

Table 6. Fornell–Larcker criterion and heterotrait–monotrait (HTMT) ratio.

Assessment		BINTU	BUB	EEXP	FCON	PEXP	SIN	Trust
Fornell–Larcker Criterion	BINTU	0.884						
	BUB	0.626	0.854					
	EEXP	0.620	0.549	0.799				
	FCON	0.588	0.681	0.331	0.865			
	PEXP	0.472	0.448	0.426	0.246	0.874		
	SIN	0.035	0.105	0.198	0.225	0.089	0.882	
	Trust	0.529	0.440	0.301	0.229	0.244	0.119	0.825
Heterotrait–Monotrait (HTMT)	BINTU							
	BUB	0.850						
	EEXP	0.696	0.632					
	FCON	0.652	0.837	0.381				
	PEXP	0.495	0.488	0.477	0.261			
	SIN	0.037	0.143	0.200	0.272	0.126		
	Trust	0.576	0.489	0.334	0.262	0.286	0.170	

5.4. Structural Model

The SEM was tested after checking the confirming reliability and validity. An examination was undertaken to test the multicollinearity [122]. To confirm no correlations among the items, we checked the collinearity of the measures by using VIF (variance inflation factor) and weight significance. To assert that there is no collinearity, VIF needs to be smaller than 3.3 [89]. Weight scores were then evaluated via a bootstrapping process with 5000 samples. All *p*-values imply significance for weights (see Table 7). The non-existence of multicollinearity is guaranteed because a lack of association between the variables and *p*-value is significant.

5.4.1. Coefficient of Determination (R^2)

The coefficient of determination (R^2) is a calculation that shows the model's predictive ability. R^2 expresses the cumulative impact of the exogenous constructs on the endogenous construct. Cohen [132] and Chin [125] have proposed different ranges of R^2 values called poor (0.02 to 0.13), moderate (0.13 to 0.26) and substantial (0.26 and above), respectively. In this analysis, the R^2 scores for BUB and BINTU were found to be substantial (Table 8).

Table 7. Non-collinearity variance inflation factor (VIF) test.

Statistic	Loadings	T	*p*-Value	VIF
BINTU1←BINTU	0.729	23.197	0.000	2.855
BINTU2←BINTU	0.785	18.176	0.000	2.849
BINTU3←BINTU	0.832	18.864	0.000	2.801
BINTU4←BINTU	0.768	21.709	0.000	2.633
BUB1←BUB	0.827	7.709	0.000	1.575
BUB2←BUB	0.816	12.367	0.000	2.190
BUB3←BUB	0.866	14.276	0.000	2.801
EEXP1←EEXP	0.745	7.743	0.000	1.629
EEXP2←EEXP	0.718	5.096	0.000	1.358
EEXP3←EEXP	0.737	5.864	0.000	2.246
EEXP4←EEXP	0.744	7.294	0.000	2.162
FCON1←FCON	0.580	3.128	0.001	1.804
FCON2←FCON	0.673	7.179	0.000	2.065
FCON3←FCON	0.783	8.389	0.000	2.846
PEXP1←PEXP	0.772	11.888	0.000	3.151
PEXP2←PEXP	0.718	26.882	0.000	2.030
PEXP3←PEXP	0.749	8.961	0.000	2.982
SIN1<- SIN	0.914	2.014	0.022	2.936
SIN2←SIN	0.934	11.353	0.000	2.130
SIN3←SIN	0.792	10.691	0.000	3.218
Trust1←Trust	0.618	11.678	0.000	1.409
Trust2←Trust	0.904	7.093	0.000	3.109
Trust3←Trust	0.908	9.632	0.000	3.262
Trust4←Trust	0.824	5.974	0.000	2.507
Trust5←Trust	0.904	9.284	0.000	3.239

Table 8. Structural equation modelling (SEM) results.

	Beta Values	T Statistics	*p* Values	Hypothesis Decision	R^2	f^2
BINTU→BUB	0.804	14.553	0.000	Supported	0.887	0.731
FCON→BUB	0.308	3.225	0.000	Supported		0.250
EEXP→BINTU	0.338	3.829	0.000	Supported	0.663	0.229
FCON→BINTU	0.367	3.828	0.000	Supported		0.363
PEXP→BINTU	0.163	1.831	0.034	Supported		0.163
SIN→BINTU	0.002	0.021	0.491	Not Supported		0.010
Trust→BINTU	0.304	3.548	0.000	Supported		0.234

The significance of the projected structural coefficients was assessed by the bootstrapping method. The model's predictive capacity is measured by applying the R^2 test, representing the observed variation in the endogenous construct. In Table 8, the R^2 score shows that PEXP, EEXP, SIN, Trust and FCON can describe 66.3% changes in BINTU. Finally, FCON and BINTU combined explain 88.7% variation in blockchain usage behaviour (BUP) for supply chain financing.

5.4.2. Effect Size (f^2) of the Main Effect Model

Effect size assesses the shift in R^2 due to eliminating a specific exogenous construct from the fitted regression. This illustrates if the factor excluded does have a major impact on the endogenous construct [122]. The f^2 scores are categorized as large, medium and small based on the score of 0.350, 0.150 and 0.020, respectively [132]. Chin et al. [91] suggested that it is reasonable to acknowledge a small f^2 if the other parameters are strong.

According to Cohen's [132] categorization, FCON has a large effect on BINTU, whereas; EEXP, Trust and PEXP have a medium effect on BINTU. SIN has no significant effect on the intention to adopt blockchain. Again, BINTU has a large effect, whereas FCON has a medium impact on BUB.

5.4.3. Results of Direct Hypothesis

Six out of seven direct hypotheses were accepted at a 5% level of significance (see Table 8). Both of the individual-level hypotheses are accepted though one called EEXP (Beta = 0.338 & $p < 0.05$) has a stronger positive influence on BINTU than the positive influence of PEXP (Beta = 0.163 and $p < 0.05$). However, both of the variables are statistically significant, confirming Hypotheses 1 and 2. In contrast, the only social-level hypothesis, Hypothesis 3, is not accepted, referring to no significant influence of SIN on BINTU. The added variable with the origin UTAUT called "Trust" has a positive influence on BINTU with statistical significance at a 5% level (Beta = 0.304 and $p < 0.05$), confirming the support for Hypothesis 4. The organization-level factor called FCON has a positive and statistically significant impact both on BINTU (Beta = 0.367 and $p < 0.05$) and BUB (Beta = 0.308 and $p < 0.05$) at 95% confidence level, ensuring the acceptance of Hypotheses 5 and 6. Finally, the intention to use blockchain for supply chain financing (BINTU) is found to have a strong and positive impact on the adoption of the blockchain (BUB) (Beta = 0.804 and $p < 0.05$). Hence, Hypothesis 7 is also supported.

5.4.4. Result of Mediating Hypothesis

Bootstrapping technique in PLS-SEM is applied to demonstrate mediating power. Hair et al. [122] claimed that 'Bootstrapping' is advantageous because it can work even with a smaller dataset. It is also appropriate to employ Preacher and Hayes's [133–136] protocol when analyzing mediation results. The mediating effects exist when indirect effects are significant. Two different modes of mediation, total and partial, are covered in the current mediation studies. For which direct impact is not substantial while the indirect impact is substantial, complete mediation is inferred. From the other side, where both the direct and indirect impacts are significant, partial mediation is assured [137].

It is evident from Table 9 that intention to use blockchain for supply chain financing (BINTU) mediates the relationship between facilitating conditions (FCON) and blockchain use behaviour confirming the support for hypothesis 8. There is partial mediation (PM), because the direct impact (FCON -> BUB) as well as the indirect impact (FCON -> BINTU -> BUB) is significant. Again, the two subgroups of PM are complementary mediation and competitive mediation. There is a complementary partial mediation (CPM) where both the primary and indirect impacts suggest the same (positive or negative) direction. The mediating impact is competitive, where the direct and indirect impacts are in the reverse directions [138]. The observations in Table 9, as per the statement of Carrión et al. [137] and Baron and Kenny [138], demonstrate that BINTU has a complementary partial mediating impact on the relations between FCON and BUB.

Table 9. Results of indirect hypothesis.

	Beta Values	**T Statistics**	***p* Values**	**Hypotheses Decision**
FCON→BINTU→BUB	0.295	4.277	0.000	Supported
FCON→BUB	0.308	3.225	0.000	Supported

5.4.5. Predictive Relevance (Q2)

The Q2 scores of Stone–Geisser should be assessed as a predictive accuracy parameter, including assessing the intensity of R^2 [133,134]. To measure the Q2 of cross-validated redundancy and cross-validated communality, the blindfolding technique has been applied. Q2 score of more than zero for a particular construct in SEM suggests the explanatory power of that variable [122]. Osborne et al. [139] propose that the communality over 0.4 is sufficient. On the contrary, Child [140] suggests that communality values below 0.2 should be excluded.

The Q2 values in Tables 10 and 11 were calculated applying a blindfolding technique, and as per Child [140] and Hair et al. [122], every Q2 score met the necessary criterion.

Table 10. Construct cross-validated communality.

	SSO	SSE	Q^2 (=1-SSE/SSO)
BINTU	268.000	103.838	0.613
BUB	201.000	110.092	0.452
EEXP	268.000	162.537	0.394
FCON	201.000	103.369	0.486
PEXP	201.000	34.808	0.827
SIN	201.000	146.167	0.225

Table 11. Construct cross-validated redundancy.

	SSO	SSE	Q^2 (=1-SSE/SSO)
BINTU	268.000	138.070	0.485
BUB	201.000	79.736	0.603
EEXP	268.000	268.000	
FCON	201.000	201.000	
PEXP	201.000	201.000	
SIN	201.000	201.000	

5.5. Assessment of Model Robustness

Linearity and unobserved heterogeneity are evaluated to examine whether the fitted model is robust [141]. First, we tested if any non-linearity existed. Studies frequently conclude that the relationship between the variables is linear when analyzing a path model [141]. When a linear relationship typically mimics a real-life relation, it is not the reality in every situation [142]. The quadratic effects of all the exogenous constructs on the endogenous construct were tested to explore potential non-linearity. The non-linearity (quadratic) test was conducted in Smart-PLS.

We assessed the regressions of BINTU on PEXP, EEXP, SIN, Trust and FCON along with the regression of BUB on BINTU and FCON at 95% confidence level. The bootstrapping process for 5000 iteration claims that any of the relations is not showing quadratic effects (See Table 12).

Table 12. The absence of non-linearity (quadratic effect) test.

	Original Sample	Sample Mean	Standard Deviation	T Statistics	*p* Values
BINTU→BUB	0.686	0.691	0.082	8.368	0.000
EEXP→BINTU	0.341	0.325	0.093	3.643	0.000
FCON→BINTU	0.420	0.424	0.099	4.257	0.000
FCON→BUB	0.328	0.318	0.092	3.573	0.000
PEXP→BINTU	0.116	0.117	0.051	2.271	0.012
SIN→BINTU	0.074	0.121	0.105	0.705	0.241
TRUST→BINTU	0.312	0.296	0.075	4.153	0.000
Quadratic Effect BINTU→BUB	0.062	0.051	0.103	0.600	0.548
Quadratic Effect EEXP→BINTU	0.041	0.045	0.099	0.418	0.338
Quadratic Effect FCON→BINTU	0.102	0.050	0.108	0.944	0.345
Quadratic Effect FCON→BUB	0.046	0.027	0.100	0.462	0.322
Quadratic Effect PEXP→BINTU	0.107	0.130	0.066	1.631	0.052
Quadratic Effect SIN→BINTU	0.019	−0.032	0.072	0.261	0.397
Quadratic Effect Trust→BINTU	0.039	0.041	0.052	0.756	0.450

The unobserved heterogeneity (UH) is examined next. UH happens where there are subsets of data that need significantly distinct estimations for models. Therefore, when UH appears, determining the model referring to the entire data set could produce misleading findings [143]. In such instances, FIMIX-PLS (Finite Mixture-Partial Least Square) is particularly effective in developing parameters for model assessment that impact the decision on the number of segments to be contained for the analysis [104,122]. Sarstedt et al. [103] proposed that investigators should jointly accept the modified Akaike information criteria (AIC) and AIC3 [144] or CAIC [145].

The section size is overestimated by AIC, although MDL5 tends to underestimate it. The suitable section size ought to be within MDL5 and AIC. It is possible to find the appropriate segment number where AIC3 and CAIC belong to the same segment [141]. Each minimum values other than AIC belongs to section one in this analysis, meaning that there should be one segment. Since a single-segment solution with divergent results is implied by the parameters shown in Table 13, we may assume that UH has no substantial effect [146].

Table 13. Unobserved heterogeneity (UH) test.

Parameters	Seg-1	Seg-2	Seg-3	Seg-4	Seg-5	Minimum
AIC (Akaike's Information Criterion)	26.06	14.572	179.652	43.999	69.737	14.572
AIC3 (Modified AIC with Factor 3)	12.94	33.572	188.652	14.999	20.737	12.94
AIC4 (Modified AIC with Factor 4)	31.94	52.572	197.652	34.001	38.263	31.94
BIC (Bayesian Information Criteria)	37.876	56.461	199.495	41.984	38.293	37.876
CAIC (Consistent AIC)	66.876	75.461	208.495	80.984	87.293	66.876
MDL5 (Minimum Description Length with Factor 5)	10.761	31.147	187.504	19.976	26.989	10.761

6. Discussion

It is impossible to succeed in the age of technological advancement and the knowledge-based world without embracing modern technology [147,148]. By linking multitudes of corporate operating domains with externals (e.g., the company needing supply chain financing) and internals (e.g., BT executors and management), digital innovations bring a remarkable change [149,150]. Supporting the digital innovations and digital transformation in an enterprise, like accepting BT, allows a radical change as it creates skills and expertise to have competitive advantages. A computational theoretical framework is developed for this analysis, integrating the UTAUT model with the trust factor, aiming to uncover the determinants of BT acceptance intention and its adoption.

We reviewed the literature in accordance with the proposed conceptual framework of this study to explore the ways of participating and enhancing knowledge in open technology adoption research. We performed a questionnaire survey on the real users of blockchain-based supply chain financing offered for the first time in Bangladesh and the South East Asian region by a Bangladesh financing company called IPDC Finance Limited. This research would undoubtedly lead to advancing the UTAUT model's literature for validating previous studies in different perspectives. Generally, policymakers, government officials, researchers and business experts are expected to generate essential awareness and expertise of the BT adoption process and its practical application in the banking and financing industry for different investment activities, including supply chain financing.

The study results show that the conceptual framework evaluated for this study is acceptable. Five determinants named PEXP, EEXP, SIN, Trust, and FCON were examined for this research. Among the variables, PEXP and EEXP refer to the individual-level factors influencing BINTU. SIN is a social level variable with no significant impact on the regression models. FCON is an organization level variable that shows the essence

of organizational readiness and support for influencing people's intention to use new technology like blockchain. Finally, the trust variable mainly predicts the users' behavioural response to BT adoption based on its trust. The value of the coefficient of determination (R^2) for the BT application intention was 66.3%, and blockchain use behaviour was 88.7%. Both of the R^2 scores can be regarded as substantial as per Cohen [132].

The study's findings indicate that FCON is the most potent predictor with a beta of 0.367, explaining BINTU for supply chain financing. EEXP is also a strong predictive variable with a coefficient of 0.338. The predicting capacity of FCON and EEXP predicts that the financial institutions and their clients possess a positive mindset to adopt modern technology like BT for their supply chain financing activities if the organizational supports are available from the service provider and if smooth operations with ease are ensured. Similarly, PEXP positively influences the users' intention to adopt blockchain as they believe BT can enhance their performance. Thus, banking and financing policymakers are recommended to ensure institutional supports by providing training to executors and developing the infrastructural framework for the BT platform. Proper training and structural soundness are expected to have a strong impact on the stakeholders with greater confidence of accomplishing the relevant tasks efficiently with less time and efforts. With a beta of 0.304, trust is another indicator of BINTU. This demonstrates how a higher level of trust influences users' perceptions of emerging technologies such as BT. The delicate nature of financial transactions may be the explanation for the relation between trust and technology acceptance. Trust has been checked and confirmed in previous technology acceptance research as well [5,56,57,121,151,152].

In addition, we evaluated the direct and indirect effect of FCON for the real usage of BT. UTAUT's conceptual model is taken as the base to explain the intention to accept BT and its adoption. Much of the previous research neglected to examine whether there is any mediating impact of intention to accept BT on the proposed relation between FCON and real use behaviour [60,75,153]. Some of the earlier research naively performed experiments ceaselessly believing complete mediation occurs [154]. Recognising the cynicism of such earlier studies and with the desire to fill the literature gap, we initiated this study and observed that there is complementary partial mediation. The result for the mediating role of BINTU on the relation between FCON and actual use behaviour is different from the study of Uddin et al. [155], who found a complete mediation.

Francisco and Swanson [76] have identified similar results that support the influence of PEXP, EEXP, FCON and Trust on blockchain adoption behaviour. However, the proposition of their study indicates a positive influence of SIN, which is not found in this research. Bartlett et al. [71] and Swink and Schoenherr [156] demonstrated that increased transparency results in greater performance because participants could plan better due to greater visibility which is similar to the findings of this study, indicating the influence of PEXP on BINTU. The findings of Oliveira et al. [67], Venkatesh et al. [15,41], Weerakkody et al. [58] also provide a strong support for the argument of the influence of PEXP on BINTU. Like this study, the research of Småros et al. [157] found that a BT-based framework enables the use of "smart contracts". Based on user-defined rules requiring little to no human intervention, EEXP ensures the required effectiveness. We found no significant effect of SI on BINTU and BUB. However, Markus [158] and Granovetter [153] claimed that if there is increased normative pressure and a "critical mass" of users, the situation could lead to higher intentions to use BT. However, Queiroz and Wamba [4] claimed in their comparative study between the USA and India that SIN has no impact on BINTU in the USA, which is similar to our findings although it has a positive effect on BINTU in India. FCON refers to the extent the users believe a company's technical infrastructure is supportive for the use of that technology. According to the findings of this research, the highly networked nature of blockchain applications necessitates technical resources to enable its use as supported by Lee [159]. The technology acceptance study of Venkatesh et al. [15] also provides similar results in this regard.

The study results indicate that a lack of trust in BT may lead users to cease using such a modern technology due to a lack of confidence in reliability or performance. Such beliefs make trust a vital factor in understanding end users' intentions. This argument is strongly supported by Thatcher et al. [75] and Francisco and Swanson [76]. Interestingly, Queiroz and Wamba [4] indicate that trust has no impact on blockchain acceptance intention in the USA. At the same time, there is a positive relation between BINTU and trust in India, a neighbour of Bangladesh. Finally, similar to many other technology and blockchain studies based on UTAUT [4,42,44,49,76,85], this research found a strong impact of BINTU on the blockchain use behaviour (BUB).

The non-linearity and unexplained heterogeneity measures have ensured the robustness of the analysis. According to the research findings, the insignificance of quadratic effect assured a linear relationship between the dependent and independent variables. Finally, FIMIX-PLS is applied to assess the probable sets of segment(s), and it has been noticed that just a single segment is suitable. Therefore, we checked and ensured that the SEM results are robust [160].

7. Research Implications

7.1. Theoretical Implications

The incorporation of emerging inventions may not ensure that they will be applied and gain success. A conceptual perspective is needed to help discover the fundamental motivating factors and obstacles that can drive or prevent businesses from implementing blockchain technology to track supply chains. Earlier studies have demonstrated the significance of behavioural purpose and its context in shaping the adoption of technologies. This study proposes UTAUT to extend the understanding of adopting end-user technologies for blockchain-based supply chain financing. This research gives a rigid logical structure to clarify the interactions and to promote the creation of blockchain resources. This study incorporates behavioural modelling as a prism for interpreting the acceptance of BT for financing supply chain activities. A theoretical model is technically developed as a possible paradigm for analyzing the use behaviour of blockchain.

The study used the parameters PEXP, EEXP, SIN, Trust and FCON as the predictors to describe BINTU for BT adoption. The results described PEXP, EEXP, Trust and FCON as the influential variables in the interpretation of users' intent to accept BT. This result is close to earlier BT-related studies [58,60,67,75,153]. However, SIN is not statistically significant in this regard which is similar to the findings of Queiroz and Wamba [4] in the Indian context. This paper extended UTAUT by including the "Trust" variable. Akturan and Tezcan [151], Alalwan et al. [37,127], Chong [121], Kabir [5], Kabir et al. [161,162] have found the positive impact of trust on BINTU which is similar to the findings of this study. In short, this research extends new insights on the conceptual perspective to address the variables that affect BT-based supply chain financing. Thus, with the latest theoretical paradigm, this study reconciled the current disparity in the literature.

7.2. Practical Implications

A need for accountability in supply chain financing will proceed to evolve. Blockchain allows companies to analyze and minimize both the supply chain and its financing risk by offering a transparent way of monitoring and tracking the sources, procedures and purchases of goods. This is even more critical than before, as clients are deeply interested in the integrity of their supply chain. Likewise, the lending institutions need to realize the condition of their fund, which helps to produce the highest return in time. The prospects of blockchain for professionals are extensive and influential, involving tracking, privacy authentication, safe transfers, and high efficiency by smart contracts. All of the fields offer companies the ability to achieve strategic advantage. Therefore, it creates an incentive for potential competitors to highlight the qualities of their transactions. It can become a major benefit over non-flexible, bigger and more experienced rivals. Major benefits may be gained from providing reliable evidence by backing up transaction statements.

This analysis showed that PEXM and EEXP have an impact on the intention to implement BT. Designers of BT-based supply chain financing platforms should focus on designing a client-centric interface by realizing the value of seamless and effective functionality and timely flow of information to ensure efficiency and usability [15,41,67,157,163,164]. With the aid of the theoretical framework provided in this study, the financial institutions and supply chain financers can better clarify clients' aspirations. Trust is a key aspect that influences the desire to implement BT where the integrity and reliability of financing is a significant issue. Since BT is a technological innovation, trust in technology and among stakeholders is crucial. To boost the trust of stakeholders, financial institutions must reduce their uncertainty by providing good cybersecurity tools that will allow raising the confidence of each company in the chain. The BT mechanisms must create organizational safeguards to prevent any possible cheating and breach of confidence in the transaction tracking [165]. Initial confidence among stakeholders would raise the acceptance of BT. This is recommended that data protection frameworks be communicated with participants to improve trust levels between clients [166,167]. Most notably, FCON is the key success component of BT in supply chain financing. Thus, the BT-based supply chain financing requires organizational support in terms of infrastructure and technical know-how from the offering institutions [4,76,159]. The findings of this study can help banking and financing policymakers to formulate strategies for bringing a significant percentage of the companies into joining a BT-based supply chain financing network for a better financing platform for both the institutions and their clients.

8. Conclusions and Scope for Future Research

We are in the era of empowered consumers who are calling for more transparency about the transactions they are conducting, particularly the accountability of supply chain financing. The demand for visibility in the funding of the supply chain will continue to rise in the years ahead, whilst consumer appetite for data will intensify [76]. The funding of supply chain operations would also entail the identification and alleviation of supply chain risks by maintaining a stable track and trace and monitoring method. Responding to this specification seems to be very difficult at times, not cost-effective, or even unattainable, provided the conventional system of the supply chain prevails; even so, BT proposes the potential of resolving this issue. BT offers a degree of accountability in the supply chain financing that helps supply chain managers and the funding firms to access the data needed to meet the demand for traceability. The prospects of BT are varied and significant, comprising aspects like tracking, authentication, secure trading, and rapid dispensing of transactions [4].

Unfortunately, Bangladesh's banking sector is faced with various scandals and corruption problems that call for accountability and the restoration of citizens' trust [161]. Again, the funding of the supply chain is one of the most critical activities for financial institutions when it relates to transparency and smooth financial operations. Application of blockchain in ensuring transparent and efficient financing as found from the blockchain-based financing studies of Chen and Bellavitis [168], Gomber et al. [169], Min [170], O'Dair and Owen [171], Shrier et al. [172], Qi and Xia [173] and Witzig and Salomon [174] have been motivated to evaluate its implementation and acceptance behaviour in supply chain financing by a Bangladesh financing company and its stakeholders for the first time in the South East Asian region. Hence, this research tried to propose a structural model (SEM) to describe the necessity of blockchain adoption in ensuring better financial tracking for supply chain financing. The study hypotheses were confirmed and reviewed using SEM. The findings of the fundamental SEM assessment, as well as the non-linearity and unobserved heterogeneity measures, confirmed the robustness of the model. This paper presented and tested the study model in accordance with UTAUT tenets [41,175]. The findings revealed that, with the exception of social influence, all direct predictors forecast their dependent variable. Similar findings were observed in the other part of the world, especially with BT acceptance and implementation, in earlier technology acceptance re-

search [4,72,76,121,157,167,176–180]. The study supported the hypotheses and indicates that when PEXP, EEXP, trust, and FCON of BT prevail, users' passion and inclination toward the use of blockchain for supply chain financing increase, and vice versa [4,57].

The study's findings offer critical insights into how BT can improve accountability, performance, and effectiveness for financing by the financial institutions, considering the importance of its performance efficiency with less effort, organizational technical and non-technical facilities, and trust among the stakeholders.

This study has a limited scope that provided space for potential studies. First, this study is based on UTAUT with a few shortcomings. There have been drawbacks to the conceptual UTAUT model which need to be considered. UTAUT presumes that the utility of the applications is the key motivating force of technology acceptance. It is reinforced by prior technology adoption models for the implementation of BT. Stanciu [181] recognized the cognitive aspect included in users' decision-making on technology acceptance, which has become very influential and impossible to overlook, particularly for technologies that have historically been functional in design. UTAUT deviates from various psychosocial assumptions, such as protection, risk and safety appraisal mechanisms for apps, the demand for connectivity, and presumed correlation between user groups and others concerning the implementation of BT. In addition, while UTAUT is a framework for predictions, it fails to guide measures to promote user acceptance [112] (Brown et al., 2010). Second, our approach describes a few constructs only to describe the acceptance of BT for supply chain financing. Researchers are recommended to expand our model by combining the variables from the advantages of information technology for entities [182,183] and the Sun and Teng paradigm [184]. Third, our analysis did not involve the moderating effects of UTAUT. Future research is anticipated to mitigate those deficiencies. Fourth, we studied BT adoption factors only in Bangladesh, which may not provide us with sufficient support for the generalization of our findings globally. It also sets up a research path that will require the use of a comparative blockchain acceptance model in other settings and regions. Fifth, as pointed out in the earlier sections, it was discovered that SIN had no effect on BINTU. This requires to be further explored in different cross-countries research. Finally, the technical aspects of the deployment procedure and the technical problems that need to be addressed to incorporate such technology are not the focus of this research. Hence, it is recommended for future researchers to study the technical aspects of blockchain so that it can be applied in different areas of open innovation. Even integration of BT with other techniques to propose better solutions will be interesting to analyze. For example, the study of Alkahtani et al. [185] used a data-mining technique to provide improved design in order to detect manufacturing faults with warranty data. Similarly, Ray et al. [186] tried to explore the best buyback strategies based on game theory. Again Goswami et al. [187] proposed a model for new product development amid supply chain uncertainty. The techniques presented in the above research can be embedded with blockchain to ensure better solutions for which further technical studies are essential.

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Informed Consent Statement: The research ethical process is strictly followed when conducting the survey. We assured that the survey participants gave their informed permission and had the right to secrecy. We indicated the aim, advantages, and limits of our research survey on the cover page of the survey questionnaire. We also asked the responders to freely select the answer alternatives because there is no right or incorrect answer. To protect anonymity, we also advised not writing the responders' names or any other sort of identification mark.

Data Availability Statement: The research is based on primary data collected through questionnaire survey. The survey data can be retrieved from https://drive.google.com/drive/folders/0ANTF-LnvHucUUk9PVA.

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