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# FACTORS INFLUENCING THE ADOPTION OF SMART CONTRACTS IN THE CONSTRUCTION INDUSTRY IN KLANG VALLEY, MALAYSIA

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**ABSTRACT**

This study aims to examine the factors influencing the adoption of smart contracts within the construction industry in the Klang Valley area of Malaysia and provide implications for the construction industry to encourage the adoption of smart contracts to solve existing problems and increase technological advancements. A sample of 60 employees working in the construction industry was collected in an online survey. The SPSS software provided the descriptive analysis for each variable and the reliability test. Pearson's Correlation Coefficient is applied to observe the correlation between the dependent variable and each of the independent variables. The regression model used is the Multiple Linear Regression model to test the relationship between the variables. The study found that time management is one factor that influences the adoption of smart contracts in the construction industry near Klang Valley. The other variables, including late payment, administration cost, and dispute, were found not to influence the adoption of the blockchain-based application but could be tested further by other researchers. The study results provide implications for the employees in the construction industry in adopting smart contracts based on an understanding of their perceptions of intelligent contracts.

**Keywords:** Smart Contract; Blockchain; Construction Industry; Time Management

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## 1. INTRODUCTION

The prosperity of a country is correlated with economic growth in which all sectors, including primary, secondary, tertiary, and quaternary sectors, cooperate to maintain economic stability (Alaloul et al., 2021). Thus, the construction sector is significant in Malaysia as its importance indicates the country's wealth, standard of living, and health. Globally, the construction industry generates USD 1.7 trillion, contributing 5-7 % of GDP in most nations. The necessity for development in the construction sector is critical because it makes a sizeable contribution to the country's GDP (Alaloul et al., 2021). The construction industry is the most important element of a country’s economy, especially Malaysia’s. In other words, the growth of Malaysia’s economy depends on the construction sector. The Department of Statistics Malaysia (2022) reported that the overall construction work that was completed by the first quarter of 2022 experienced a continuous rise at a year-over-year rate of -6.1%, which is equivalent to RM 29.5 billion from the previous Q4 in 2021 at -12.9% that amounted to RM27.6 billion. Selangor, Wilayah Persekutuan, and Sabah are the states that contributed the most to the increase in the year-over-year rate, with a total accumulation of RM 16 billion, which is a little more than 50% of the construction work done in Q1 of 2022.

Klang Valley was chosen for this study as this destination is an urban metropolis within Malaysia that comprises (no.) cities. As mentioned previously, Wilayah Persekutuan is one of the main contributors to the construction work in Q1 of 2022, and Kuala Lumpur is one of the Federal Territories in Malaysia, which also happens to be a part of Klang Valley. Klang, Petaling Jaya, Kuala Lumpur, Hulu Langat, and Gombak make up Klang Valley. Klang Valley, one of Malaysia's most developed regions, is situated roughly in the middle of Peninsular Malaysia's West Coast and has a total size of around 2,832 square kilometres (Mohd Fadzil, 2017).

The traditional contract construction-wise outlines the parties' obligations to one another and the relationship between them, and it also specifies the business terms and the guidelines of the project in general; the contracts and the rights of the parties in the contracts are also protected by the Contracts Act 1950 in Malaysia (Bolhassan et al., 2022). Before the advent of the Internet, contracts were typically signed in person by both parties and on paper. Traditional contracting provides paper delivery instead of electronically stored in a contract management system (Bolhassan et al., 2022). Due to the increase in people's faith in the Internet, the creation of entering into a contract electronically or digitally has pushed Malaysia to enforce the Electronic Commerce Act 2006, which specifies that the legality, enforceability, and validity of information in the form of electronic shall not be disputes (Bolhassan et al., 2022). Ahmadisheykhsarmast and Sonmez (2018) explained that procurement is one of the labour-intensive stages of a construction project's execution. Several contracts occur within a supply chain, starting with the supplier and moving down via the subcontractors and primary contractors in a construction environment. The authors reiterate that when two parties enter a contract and utilize facilities like a Letter of Credit (LC) document, third parties like banks establish confidence between the parties, and ultimately, this trust is typically valid for purposes like project management, financial transactions, and others. Hence, the creation and use of standard contract conditions is a crucial component since the nature of a construction contract, which has always been a partnership between a large or small group of participants, requires that the risks of these parties be allocated (Bolhassan et al., 2022).

The conventional method of construction is one of the contributing factors that interrupt the performance of the construction sector in Malaysia. The poor performance of the Malaysian Construction Sector (MCS) has been greatly impacted by the absence of a fair bidding process, transparency in tendering, and timely money release (Alaloul et al., 2021). Other issues faced in the construction industry that can hinder the completion of the project or even trigger bankruptcy include late payment, time management issues, administrative costs, disputes, and many more. Hasmori et al. (2018) revealed that financial problems, late delivery of materials, communication and coordination issues between the clients and consultants, and planning are a few of the top 10 factors of project delays in the Klang Valley.

Smart contracts operated on blockchain technology have contributed a significant number of benefits to various industries since its discovery and implementation. Blockchain technology is essentially a distributed ledger that keeps the data of every transaction made available to the public and can be accessed by the parties on the platform (Ahmadisheykhsarmast & Sonmez, 2018). Simply put, blockchain provides parties in the system with a secure network that provides many lists of transactions synchronized across all the computers. The distributed data ensures the security of the blockchain by removing every single possibility of failure such that the main technology of blockchain makes sure that every transaction made in the network cannot be altered or erased and the nodes within the network hold on to

those transaction data simultaneously (Ahmadisheykhsarmast & Sonmez, 2020). The smart contract is one of the applications built on the blockchain network, and the possibilities to utilize this technology are endless. That said, smart contracts execute the terms and agreements automatically without the need for an intermediary using blockchain technology and a computer (Khan et al., 2021). In other words, the smart contracts are self-enforced as the instructions, clauses, terms, and conditions are coded into the program. They will self-execute by releasing the autonomous movement of electronic transactions of information like payment to be transferred to the other party when the contractual criteria specified in the program are satisfied (Ahmadisheykhsarmast & Sonmez, 2018; Crosby et al., 2016). Because of their binary logic, which ensures that inputs equal the outputs and that the fulfilment of contract terms depends on coding, smart contracts are decisive (Ahmadisheykhsarmast & Sonmez, 2018). Thus, this ensures the transparency of the transaction between the parties involved, as both parties cannot meddle with the money before the terms and the due date are met. There are many parties involved in the construction and development process. With many parties, problems may arise as there are many opinions and advice to consider. However, what if there is a possibility of decreasing the number of parties involved in the process? Using smart contracts that are based on blockchain technology can potentially achieve this idea. Knowing that Malaysia is approaching every technological step of the economy, using smart contracts based on blockchain technology can boost technology adoption in this important sector.

Written by The Edge Markets (2021), Public Invest Research noticed that a five-year plan covering the years 2021 – 2025 has beneficiaries that are traditional brick-and-mortar like the construction sector, is not going to experience any excitement during the years as the plan includes the country's intention to transition to an infrastructure based on digital technologies as an instrument of the country's future growth. This suggests that the construction industry is clearly behind the other industries in terms of technological advancements. Furthermore, the International Labour Organization (2022) released a statement on how the employability of skilled workers among women and youths can increase the construction industry's productivity thanks to the use of technology and contemporary construction techniques. This further solidifies the importance of implementing technology to boost the employability rate within the sector and the health of the economy.

Haron and Arazmi (2020) studied the construction industry in Malaysia and consider payment delays to subcontractors by the primary contractor and customer to be a serious cause for worry as it causes the subcontractor(s) to face severe cash flow issues. This circumstance may have a disastrous effect on the contractual payment chain. The authors continued by stating that construction companies experience financial difficulties due to payment delays or withholding, and in certain cases, these effects are so severe that some businesses are forced to cease operations. Participants in a smart contract can automatically make payments by

the terms of the contract to the parties concerned when a predefined condition is satisfied (Crosby et al., 2016). Applying blockchain-based smart contracts can provide authorities with the means to pursue past-due payments by applicable legislation. It could assist in resolving the perennial problem of late payments and cash flow issues (Penzes, 2019).

One of the most frequent causes of significant negative impact on a project and the parties involved is a delay and setback in the construction activity (Hasmori et al., 2018). According to Hasmori et al. (2018), the ten leading factors causing construction delays in Klang Valley include financial troubles, late delivery of materials, improper planning and scheduling, poor communication and coordination among the parties, and many more. In other words, timely delivery of materials, improvements in communication, and efficient financial flow are needed to meet the construction dates. That said, due to the structure and environment of the construction sector, it is indeed challenging for several parties to cooperate using traditional data systems; nevertheless, blockchain-based applications have shown that they can manage these intricate, network, and interlinked – structured interactions and provide stability, trust, and security (Nanayakkara et al., 2021). Cost and schedule overruns are frequently encountered during the project's procurement phase's payment process; therefore, smart contracts are legally required to reduce the cost and time associated with schematizing specific parts of building project performance (Zaky & Nassar, 2021).

Administrating a contract is a crucial step in any construction project. Due to this, the administration's operation may result in a considerable amount of time and cost overruns (Ibrahim et al., 2022). This is because the effect of administrating the contract is seen in the monetary transaction; therefore, an inadequate process of financial administration results in the loss of time and administrative costs. Furthermore, stakeholder involvement is always emphasized in a traditional contract, and construction contracts are frequently based on a multifaceted party. Therefore, the stakeholders must manually administrate the contracts and interpret them by their respective specialities (Bolhassan et al., 2022). Consequently, ineffective contract management and administration procedures might be a factor as these services involve heavy costs. Thus, blockchain-based smart contracts can assume the contract’s administration and terms. The smart contract model acts as a third party that the contractual parties can trust to facilitate monetary transactions (Ibrahim et al., 2022). Construction disputes appear unavoidable and have been a pervasive issue in the Malaysian construction business as construction continues through various projects listed under the Malaysian Economic Transformation Program (ETP) (Hussin et al., 2013). Construction disputes are an unavoidable part of the industry. They must be resolved quickly to avoid non-compensable damages like delays that could harm the performance or outcome of a well-planned project (Hussin et al., 2013). Contractual disputes can result from a refusal to make a supposed payment, passing the payment due date, and the inability to guarantee payment (S Ahmadisheykhsarmast & Sonmez, 2018). That said, there is a need for a method of conflict resolution that provides a straightforward, quick, and

affordable mechanism for resolving disagreements within the parties of a construction contract. Automation of payments by smart contracts lessens the likelihood of party disagreements, which is known to be a contributing factor in construction conflicts (Bolhassan et al., 2022). This study will provide the possible issues faced in the construction industry in Klang Valley that can be solved using a blockchain-based application, smart contracts. This research will be accomplished by applying independent variables (late payment, time management, administration cost, and disputes) and the dependent variables (smart contracts).

## 2. LITERATURE REVIEW

According to Feenberg (1991), the critical theory of technology addresses the danger to human agency imposed by the pretensions of the technocratic system that rules modern society. The researcher also explained that "democratic interventions" are the citizen's actions linked to technological disputes. At the same time, the creative appropriation of technology is the second type of intervention that includes users hacking or reinventing equipment to satisfy unforeseen demands. The last intervention is known as "a priori" due to the involvement of previous activities in the announcement of technologies. The researcher found that while agreeing with Science and Technology Studies (STS) that technology is neither universal nor value neutral, the critical technology theory proposes an explicit framework of interventions in technology democratically.

### 2.1 Smart Contracts

A study done on smart contracts based on the construction sector in Thailand by Chaveesuk et al. (2020) suggests that the use of smart contracts in the construction industry would assist in reducing the lengthy, pricey, and brittle transactions that are linked to integrity and transparency problems because of possible record manipulation with traditional contracts. The study also revealed that adopting smart contracts in Thailand's construction industry would eliminate inherent difficulties during the pre-integration stages, such as delays, not paying as stated in the contract, and other actions viewed as contract breaches that could result in litigation. Proposing an extended version of the Technology Acceptance Model framework showed the prominence of perceived ease of use, usefulness, trust, readiness, and resources in encouraging the welcome and behavioral purpose for using smart contracts. It is also stated that a dynamic shift in perception, construction, formulation, and contractual administration guidelines and philosophies is required to adopt and allow the movement toward smart contracts in the construction industry in Thailand.

Altay and Motawa (2020) investigated the pertinence of smart contracts in the construction sector as the applicability of blockchain technology is controversial, and many views are being exchanged among experts. Due to the

unique traits of the construction business that make it more sophisticated and delicate, adopting this technology is generally limited and gradual compared to other industries like banking. Hence, this study investigates how well smart contracts work in the construction business and their drawbacks and potential advantages. Smart contracts provide potential benefits in various industries, most notably the resolution of payment issues and high security, even though they have significant limits for this industry, such as the difficulty of modifying transactions and being legally binding. However, the authors argue that because this technology is so new, it needs to be improved to overcome the challenges of changing transactions, to be compatible with all payment terms of conventional contracts (such as punctuality of payment and deduction of payment), to enhance security system, and to formalize legal responsibility and binding in the project.

On the contrary, Gurgun and Koc (2022) studied the challenges in adopting smart contracts in construction projects on the administrative side, as smart contracts could be an effective solution. However, the construction sector is not known for adapting to fast technological advancements. A literature survey was conducted to ensure the framework is appropriate for the research question. The results demonstrate that the top 5 risks preventing the adoption of smart contracts in this construction setting are the regulation changes, lack of prime motivator, works not considered in planning, flaws in the current legal structure, and the shortcomings of solutions for dispute mechanisms. The study also included strategies for risk reduction based on FGD, revealing that improvements in drafting semi-automated smart contracts are thought to be more workable than complete automation.

Similarly, Li et al. (2019), in their study, suggest a great deal of potential for distributed ledger technology to help digitalization in the construction sector and answer many of its problems. To determine what adjustments must be made before successful implementation, more research must be done on the industry's readiness and the state of its organizations and procedures. Since smart contracts must be appropriately designed because they will remain permanently stored in a public ledger, their adoption and acceptance by the public may be hampered or delayed due to the complexity of smart contract coding. Besides that, the difficulty will be creating a regulatory environment that encourages service integration, overcoming interoperability issues, and offering a controllable system without stifling innovation. Other difficulties with smart contracts include their limited storage capacity, interoperability, data reliability, and information confidentiality.

## 2.2 Late Payment

The paper of Haron and Arazmi (2020) on the issues surrounding late payments among subcontractors in the construction industry in Malaysia suggests that one of the key elements that can influence a project's success is the practice of prompt and efficient payment in construction projects. A questionnaire survey analysis using thirty-seven respondents from chosen principal contractors and subcontractors in Gombak, Selangor, served as the research technique. Analyses of

interviews were used to collect the data and information. According to the research's findings, the client's payment withholding is one factor contributing to late payment from the client. This results in subcontractors suffering from extreme cash flow problems, which may have a disastrous effect on the contractual payment chain. This is because construction businesses experience financial difficulties because of late payments or not releasing payments on time, which can force some businesses to cease operation or suffer bankruptcy.

An article by Nanayakkara et al. (2021) examines how blockchain and smart contract technology can address payment-related problems in the construction sector. The article revealed that the most significant qualities that make up smart contracts are self-execution, integrity, non-tangible, fraud resistance, and the ability to connect all parties without an intermediary directly. These features give smart contracts greater functionality, consistency, effectiveness, responsibility, auditability, and precision than conventional software solutions. The method of collecting primary data in this article used a forum of experts who are stakeholders in the construction industry through a standardized questionnaire. The paper's main conclusion is that solutions based on blockchain technology and smart contracts can significantly reduce financial payment-related issues in the construction sector, such as incomplete payments, non-payments, cost of financing, lengthy payment cycles, retention, and payment security. The paper concluded that although the construction industry's culture towards payment cannot be modified by blockchain, it is expected to speed up any transfer of payments due to the enhancement in transparency and the utmost need for accountability. A study by Ahmadisheykhsarmast and Sonmez (2020) examined the causes and effects of the payment problem, but only a few studies suggested solutions. To eliminate or significantly reduce payment-related problems in the construction industry, SMTSEC, a unique smart contract payment security system, is introduced in this study. This paper's major goal is to introduce a smart contract system that will enhance the progress payment procedure in the construction industry by offering a reliable technique for the safe, prompt, and transparent payment of construction projects. The proposed method of delaying payments for the construction of works for the upcoming progress payment period forces the employer to plan and coordinate payments in advance. It ensures prompt payment of progress payments to the principal contractor, subcontractors, and suppliers. Hamledari and Fischer (2021) argue otherwise in their paper that due to blockchain-based applications' reliance on centralized control mechanisms and lack of guaranteed execution, the current payment applications, even when computerized, cannot allow the dependable automation of progress payments. It is also reasoned that contractual agreements and their terms are not always carried out as agreed by the parties, which may lead to defaults and late or missed payments. The form of conventional contract documents used by practitioners and the dependence on centralized parties (such as a court of law) to enforce the terms of contracts only when one party defaults on the agreements are two factors that contribute to this. Furthermore, the

authors listed the risks that come with the implementation of smart contracts. It is argued that a defective code may endanger the integrity of project data or result in financial loss because computation results are not reversible in the blockchain ledger. Secondly, applying computer language to act as the terms of the contracts will be difficult and impossible in various situations; the complexity and intricacy of agreements cannot be read accurately by a machine; therefore, it is necessary for the existence of a hybrid mode where there is inclusivity of human's interpretation of the terms of agreement and the autonomous implementation of the contractual relationship. Based on past research, the researchers attempt to unravel the relationship between late payment and smart contracts. Hence, hypothesis $H_{A1}$ will be studied in this research.

$H_{A1}$: Late payment and the influence of smart contract adoption in the Klang Valley construction industry are related.

### 2.3 Time Management

In their paper, Björklund and Vincze (2019) discuss smart contracts, a component of blockchain technology, to completely restructure how networks are organized in the future. Low levels of digitization, low productivity, and ineffective procedures are all connected with the construction sector. The fundamental cause is that the industry still manages its supply chain operations on paper. Companies find it challenging to evaluate data, access prior data when disagreements arise, manage contract risk and administer manual paper-based operations promptly due to a lack of digital processes and flow. The construction sector may benefit from technological innovation in the form of better tracking of commodities, real-time planning, less administration, increased efficiency along the supply chain, and improved cash flows. It is concluded that blockchain smart contracts can potentially improve supply chain management and finance efficiency. On the contrary, Björklund and Vincze (2019) conducted a semi-structured interview with 5 established Swedish construction businesses and distributed a questionnaire. The findings indicate that the construction industry has little understanding of emerging technology. According to the experts, one may argue that the legal industry will need considerable time to build legislation surrounding smart contracts. However, alternative technical solutions may help achieve similar efficiency gains. Furthermore, using and providing the blockchain smart contract with sufficient data is challenging due to the low degree of digital maturity and the continued use of paper-based operations. All supply networks for physical items must also overcome the difficulty of securing the input data. Singh and Prasath Kumar (2022) mentioned in their article that their study aims to investigate the possibilities of blockchain technology in the context of supply chain management and smart contracts applications in the construction industry. That said, traditional third-party trust and openness have become more difficult; information is unreliable and usually gets expensive and time-consuming. Quality management is now an essential component of material management because the specifications for purchasing construction materials vary, and large orders are frequently placed.

Supply chain management's purchasing and delivery aspects can be streamlined with blockchain if adherence to the delivery schedule, quality, and needed specifications are adhered to. The researchers attempt to unravel the relationship between time management and smart contracts based on past research. Hence, hypothesis $H_{B1}$ will be studied in this research.

$H_{B1}$: There is a relationship between time management and its influence in adopting smart contracts in the construction industry in Klang Valley.

## 2.4 Administration Cost

Through the expertise of specialists in the field, Zaky and Nassar (2021) seek to assess the possible benefits of implementing smart contracts in the construction sector in their study. A questionnaire was created to gauge professional opinions on when and how to apply such technologies in the construction industry. After additional in-depth analysis, the recommendations leaned toward implementing smart contracts in the future. The structure of the smart contract system does not require an intermediary, resulting in significantly reduced overhead and transaction costs. Additionally, there is a decrease in the notary and administrative fees associated with the pursuit of payment. As was previously mentioned, smart contracts are self-executing and have relatively low processing costs. After receiving payments, there are no additional administrative fees to move the money farther down the supply chain. Likewise, Singh and Prasath Kumar (2022) shared similar views, stating that overhead costs, project management, and administration can be decreased and made more efficient. However, the authors also shared some limitations to implementing smart contracts where immutability is a benefit of smart contracts and blockchain technology. This immutability sets security standards, but it has its limitations. Even minor programming flaws could become costly and time-consuming to fix when the smart contract is made available for usage since they are almost impossible to update or change. In their paper, San et al. (2019) suggested that by enhancing time and cost efficiency as well as data quality, blockchain applications in the construction sector have a significant positive impact on the sector (accuracy in design and work documentation). As modifications are visible and transparent, this also makes it easier for the quantity surveyor to prepare the cost plan, bills of quantities, and tender addenda (if any). With the use of blockchain in the construction sector, clients can avoid middlemen and related transaction expenses. The authors added that this is possible by using a smart contract to create a direct contract between the project client and the design consultants, suppliers, and direct contractors. Utilizing smart contracts in construction contracts will also assist in lowering the cost of maintaining contract documents. The researchers attempt to unravel the relationship between time management and smart contracts based on past research. Hence, hypothesis $H_{C1}$ will be studied in this research.

$H_{C1}$: There is a relationship between administration costs and their influence on adopting smart contracts in the construction industry in Klang Valley.

### 2.5 Disputes

Similarly, Penzes (2019) shared that smart contracts can significantly improve the effectiveness of any dispute resolution because all transactions, payments, and approvals are immutably recorded across all parties on the blockchain. Besides, Zaky and Nassar (2021) shared similar opinions that disputes concerning payments in the construction industry, especially, can be reduced through extracting the benefits of smart contracts. Ahmadisheykhsarmast and Sonmez (2018) also agreed in their study by noting that since the smart contract is created in the blockchain, a distributed ledger, all relevant data, including transaction amount, payment justification, and payment date, are recorded in a blockchain node, disputes, any obscurities, and ambiguities can be reduced. Singh and Prasath Kumar (2022) expressed a similar opinion that the frequency of claims and disputes relating to the time component can be reduced if contractual terms and conditions are properly registered on a smart contract. This will strengthen stakeholder relationships. San et al. (2019) articulated that disputes arising from payment are a problem in the construction business and are frequently expensively resolved in court. Construction disputes can be resolved for less money by employing blockchain technology in contracts since smart contracts ensure that issues with late or non-payment never arise. The blockchain application saves time and money because all the procedures are automated and impartial. Ye et al. (2022) also shared that such disputes between clients and contractors can be minimized because the smart contract carries out the contractual and payment clauses based on automated protocol, leaving no chance for the parties to disobey, reinterpret, or alter the agreed conditions. Thus, the need for costly and time-consuming arbitration for dispute resolution for contractual and payment issues can be reduced. However, the authors concluded that future empirical studies are needed to solidify the framework of this idea before adopting it into the industry. Based on past research, the researchers attempt to unravel the relationship between disputes and smart contracts. Hence, hypothesis $H_{D1}$ will be studied in this research.

$H_{D1}$: There is a relationship between the disputes and their influence in adopting smart contracts in the construction industry in Klang Valley.

## 3 DATA AND METHODOLOGY

This research will use primary data to assist in focusing on the research questions. The primary data collection method will be done by distributing questionnaires via the Internet to reach out to more respondents. The target respondents or population for this research will be workers in the construction industry in Klang Valley, Malaysia, who are the most relevant respondents to this research study. 60 questionnaires were designed with the Google Form platform and distributed to the construction employees in Klang Valley. The data will be analyzed using software like SPSS to determine the impact of the independent variables on the dependent variables.

### 3.1 Descriptive Statistics

Regarding skewness and kurtosis, it effectively measures the distribution's symmetry while the latter dictates how heavy the tails of the distributions are (Gawali, 2022). That said, if either of the values for them is not more than ±1.0, then the distribution does not exceed the normal range; thus, it can be regarded as normal. On the flip side, when the distribution for skewness and kurtosis is out of the normal range, it cannot be considered normal if the values exceed ±1.0 (Texas AandM University, n.d.). As seen from Table 1, the results of the skewness and kurtosis of the dependent variable revealed that the values of skewness and kurtosis are -0.049 and -1.072, respectively, which suggests that the distribution is acceptable since it is within the ranges of -1.0 and 1.0. Furthermore, the distribution is left-skewed and platykurtic. On the other hand, independent variables show some extreme numbers. Since the skewness and kurtosis of most of the independent variables exceed - 1.0 or are not within the ranges of -1.0 and 1.0, they are not acceptable. The first independent variable, late payment, has a skewness value of -1.190 and a kurtosis value of 4.209, which suggests that the distribution is skewed to the left and leptokurtic. The time management variable has a skewness value of 0.175 and a kurtosis value of 0.413 w, indicating the right-skewed distribution and platykurtic. The administration cost variable has a skewness value of -1.663 and a kurtosis value of 3.032, which dictates the distribution to be left skewed and leptokurtic. The last independent variable, dispute, has a skewness value of -1.543 and a kurtosis value of 2.582, implying that the distribution is skewed to the left and leptokurtic. Overall, it can be concluded that only the time management variable is acceptable according to the acceptable range of skewness and kurtosis. In contrast, the rest of the independent variables are not acceptable.

***Table 1:*** Descriptive Analysis

| Variables | Min | Max | Mean | Std Deviation | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Statistic | Std.Error | Statistic | Std. Error |
| Smart Contract | 1.86 | 4.86 | 3.3952 | .77463 | -.049 | .309 | -1.072 | .608 |
| Late Payment | 2.00 | 5.00 | 4.1028 | .51264 | -1.190 | .309 | 4.209 | .608 |
| Time | 2.83 | 5.00 | 3.9111 | .44938 | .175 | .309 | .413 | .608 |
| Management | 2.33 | 5.00 | 4.2528 | .56706 | -1.663 | .309 | 3.032 | .608 |
| Admin Cost | 2.83 | 5.00 | 4.3806 | .48430 | -1.543 | .309 | 2.582 | .608 |
| Dispute | | | | | | | | |
| Valid N=60 | | | | | | | | |

### 3.2 Reliability Test

Test results can be reliable if they are sufficiently consistent and free of mensuration mistakes to be of value (Amirrudin et al., 2020; Aslam et al., 2018, 2022). The table below shows the result of the reliability test that was achieved using Cronbach's Alpha to estimate the level of consistency of the independent and dependent variables. The interpretation of Cronbach's Alpha to measure reliability

relies on the coefficient range from 0 to 1.0. The greater the coefficient between the variables, the more it suggests that they share the covariance and likely assess similar root notions (Goforth, 2015). In another sense, an increased value of Cronbach Alpha indicates a more reliable scale, and it is commonly regarded as having an acceptable level of not less than 0.70 (Howard, 2021). The method applied to this research depicted in Table 2 revealed that the value of Cronbach's Alpha for smart contract, late payment, time management, administrative cost, and dispute were calculated to achieve 0.93, 0.73, 0.596, 0.739, and 0.644, respectively. The alpha of the respondents' knowledge of smart contracts (dependent variable) exceeds the acceptable range of more than 0.70. Hence, this value is acceptable. On the other hand, the independent variable's alpha values lie below and slightly above the acceptable range. That being said, the independent variables, late payment and administrative cost, are barely acceptable as the values barely exceed the benchmark of 0.7. In contrast, the independent variables' time management and dispute fall below the acceptable limit of 0.7. Hence, the result is unfavourable to Cronbach's Alpha. Finally, the overall Cronbach's Alpha figure for every variable achieved a value of 0.778, which is within the acceptable range.

***Table 2:*** Reliability Test

| Variable | No. of Items | Cronbach's Alpha |
|---|---|---|
| Smart Contract | 7 | 0.930 |
| Late Payment | 6 | 0.730 |
| Time Management | 6 | 0.596 |
| Administrative Cost | 6 | 0.739 |
| Dispute | 6 | 0.644 |
| Overall Cronbach's Alpha | | 0.778 |

### 3.3 Pearson's Correlation Coefficient

Table 3 depicts the numerical findings of the correlation between the dependent variable, smart contract, and all independent variables. The findings show that late payments and smart contracts are positively correlated since the value is 0.257, between 0 and 1. Besides that, the positive correlation between smart contracts and late payment is weak since 0.257 is less than 0.5. The correlation suggests that the late payment variable can explain 25.7% of the influence in adopting smart. In other words, it demonstrates how late payment has a 25.7% influence on the adoption of smart contracts. The significance value, p, is 0.048, implying that the correlation is significant since the value is less than 0.05. Therefore, H0 is rejected, and H1 is accepted. The correlation value of 0.324 indicates a positive correlation between time management and smart contracts, and the relationship is weak since the R-value is less than 0.5. In other words, the correlation between the influence of the adoption of smart contracts and time management is weakly positive. This also demonstrates that 32.4% of influence in adopting smart contracts comes from time management within the construction industry. Moreover, the p-value suggests that the statistical significance is

significant since the value is less than 0.05. Hence, according to the circumstance, Ha is accepted while H0 is rejected. The outcome of the test shows that the value -0.062 is a negative correlation between smart contracts and administration costs. Additionally, the correlation is very weak since the value is not above -0.05. Therefore, it can be interpreted that only 6.2% of administration costs can influence the adoption of smart contracts in the construction industry. On the other hand, the p-value shows a significance of 0.637, which stipulates that it is insignificant since the p-value very much exceeds the p-value limit of 0.05. Consequently, the alternative hypothesis, H1, will not be accepted, but the null hypothesis, H0, will be accepted instead. The correlation coefficient between the dispute variable and smart contracts indicates 0.07. This suggests that the variables are very weakly and positively correlated. It also demonstrates that disputes in the construction industry merely exhibit 7% towards the influence of smart contract adoption. The significance value, p, is 0.596, which signifies that it is not statistically significant as it is much greater than 0.05. Consequently, the null hypothesis is accepted, while the alternative hypothesis is rejected.

***Table 3*:** Pearson's Correlation Analyses

| | | DV | IV1 | IV2 | IV3 | IV4 |
|---|---|---|---|---|---|---|
| DV | Pearson Correlation | 1 | .257* | .324* | -.062 | .070 |
| | Sig. (2-tailed) | | .048 | .012 | .637 | .596 |
| | N | 60 | 60 | 60 | 60 | 60 |

*. Correlation is significant at the 0.11 level (2-tailed).

DV = dependent variable (smart contract)
IV1= first independent variable (late payment)
IV2 = second independent variable (time management)
IV3 = third independent variable (administration cost)
IV4 = fourth independent variable (dispute)

### 3.4 Multiple Linear Regression

The model summary table below consists of a few determinants that can assist in explaining the relationship between the variables. Frost (2022) states that R-squared is the metric of the goodness-of-fit for regression models that is linear and provides a straightforward scale of 0-100% to quantify the weakness and strength of the association between the model and the dependent variable. Additionally, 0% indicates that the model around its mean cannot explain the variation within the variable's response. In comparison, 100% denotes that the model does explain every variation in the variable's response surrounding its mean (Frost, 2022). That said, the table displays that the value of R is 0.39, indicating a positive relationship between the variables. At the same time, R-squared is represented by the value of 0.15, which means that 15% of the dependent variable can be explained by the 4 independent variables in this research. That said, the values can also be interpreted as the other 85% of the influence in adopting smart contracts can be explained by other factors. Furthermore, the values can help to depict the significant correlation between the influence in the adoption of smart

contracts and the 4 independent variables, late payment, time management, administration cost, and dispute, which is a positive one.

***Table 4:*** Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .390[a] | .150 | .088 | .73969 |

Predictors: (Constant), Dispute, Time Management, Late Payment, Administration Cost

ANOVA can determine if the means of not less than 2 groups vary considerably from one another by comparing the means of a variety of samples to examine the influence of one or other factors (Singh, 2018). The significance value or p-value is 0.059. This value indicates that the variables are statistically significant with each other since the value does not exceed the significance level of 0.10. The value can also explain that the type of relationship between the dependent variable, the factors influencing the adoption of smart contracts in the construction industry, and the independent variables, late payment, time management, administration cast, and dispute, is a positive relationship.

***Table 5:*** ANOVA Analysis

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 5.310 | 4 | 1.328 | 2.43 | .059[b] |
| | Residual | 30.093 | 55 | .547 | | |
| | Total | 35.403 | 59 | | | |

Predictors: (Constant), Dispute, Time Management, Late Payment, Administration Cost
Dependent Variable: Smart Contract

***Table 6****:* Regression Coefficient Analysis

| Model | Unstandardized B | Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|
| **(Constant)** | 1.384 | 1.102 | | 1.255 | .215 |
| Late Payment | .202 | .228 | .134 | .887 | .379 |
| Time Management | .527 | .252 | .306 | 2.094 | .041 |
| Administration Cost | -.288 | .216 | -.211 | -1.334 | .188 |
| Dispute | .080 | .266 | .050 | .299 | .766 |
| Dependent Variable: Smart Contract | | | | | |

The coefficients of the research are displayed in Table 6. According to the table, the significance value for the following factors is as follows: the late payment factor is 0.379, the time management factor is 0.041, the administration cost factor is 0.188, and the dispute factor is 0.766. Most of the variables' significance value suggests that they are not regarded as statistically significant since most are more than the significance values of 0.05 and 0.10. Hence, the null hypothesis, H0, is accepted, while the alternative hypothesis is rejected. The values also indicate that the variables, namely, late payment, administration cost, and dispute, do not

influence the adoption of smart contracts. However, the time management variable with the acceptable significance level of 0.041 suggests that it influences the adoption of smart contracts since it is less than 0.05. Therefore, it can be concluded that time management is one of the factors that influences the adoption of smart contracts.

## 4 RESULTS AND DISCUSSION

Smart contracts are blockchain-based applications that are quickly gaining public attention because of the properties they carry with them. Many elements enable the construction industry to benefit from smart contracts, such as late payment, time management, administration costs, and disputes. While other industries are further developing technologically and digitalizing their operations, the construction industry in the Klang Valley, Malaysia, is still behind as there are not many technological implementations and advancements within the industry. Therefore, examining the factors influencing the adoption of smart contracts in the construction industry in Klang Valley is significant as it can potentially assist the industry in introducing more technology like smart contracts. Several researchers conducted studies and produced findings suggesting significant relationships between the factors and smart contracts. While carrying out the research, several perspectives were acquired to understand better the factors that can affect the adoption of smart contracts. The purpose of adopting smart contracts is to increase security and improve the efficiency of construction operations' different types of processes and procedures. Subsequently, the chosen factors in this research are considered when adopting smart contracts. As a result, the identified factors that influence the adoption of smart contracts are crucial to enhancing the traditional method of operating within the construction industry. The four important factors influencing the adoption of smart contracts within the construction industry in Klang Valley are applied and tested in this research. This study focused on four main elements, namely, late payment, time management, administration cost, and disputes that potentially influence the adoption of smart contracts. After deducing the results, the study has concluded that three out of four variables have no significant effects on adopting smart contracts that is significant. However, the remaining variable does have a significant effect on adopting smart contracts. The three variables in this research are found not to affect the adoption of smart contracts, specifically, the late payment, administration cost, and dispute variables. However, only the time management variable is found to affect the adoption of smart contracts. The study by Badi et al. (2021) reveals a strong relationship between late payments and smart contracts since half of their respondents agree that the dependent variable does safeguard parties of the contract from late payments. Although the findings from the previous study suggest so, this study’s findings reveal no relationship between smart contracts and late payment variables. In other words, late payment is not a factor that influences the adoption of smart

contracts. According to McNamara and Sepasgozar (2021), automation, like smart contracts within the construction procedures, reduces time, and the study suggests a strong positive relationship between time management and smart contracts. Similarly, the results of the findings correspond to the authors' findings, implying a relationship between smart contracts and time management variables. Despite a previous study that Hoxha and Sadiku (2019) conducted, in which the authors suggested a strong link between cost reduction and blockchain technology, there is no relationship between administration cost and smart contracts, according to the findings. This insinuates that the administration cost variable does not influence the adoption of smart contracts. Bolhassan et al. (2022) study reveals a relationship between disputes and smart contracts since it is found that smart contracts help reduce disputes in the process of payment domain in the construction industry. Despite the positive outlook of their study, the findings suggest otherwise. There is no relationship between the two variables, implying that dispute is not a factor in the influence to adopt smart contracts.

## 5 CONCLUSION

For the past few years, COVID-19 has been known to be the deadliest virus, but there is a silver lining to the unfortunate phenomenon, which is the rapid development and discovery of new technology like blockchain technology. Blockchain technology became popular due to its beneficial characteristics and properties, which are now known to solve various problems in various industries. The properties that make up blockchain technology include scalability, security, immutability, and transparency. Smart contracts, a blockchain-based technology, therefore, also have those advantages. Besides that, the construction industry faces several issues that the smart contract can assist in solving. However, due to its embryonic phase, the smart contract is yet to be implemented due to concerns about practicality, regulatory, and security issues. This, in its entirety, affects the influence of the adoption of smart contracts within the construction industry. Ultimately, the research is about the factors influencing the adoption of smart contracts in the construction industry in Klang Valley - late payment, time management, administration cost, and dispute. A smart contract is determined as the dependent variable while the four factors are the independent variable. Despite the efforts, the independent variables in this research are deemed inadequate for the factors influencing the adoption of smart contracts to be examined, except for the time management factor. Therefore, additional informational resources and thorough studies are required to improve the quality and outcomes of future research. A recommendation to increase the influence of adopting smart contracts within the construction industry is to provide education. For instance, universities can incorporate blockchain technology courses of their own or infuse the basics of the subject into student's courses. This will expose students and, eventually, the public to blockchain technology's characteristics, advantages, and disadvantages. This will also increase public awareness, leading to increased literacy of blockchain technology. The construction industry in Malaysia is an essential industry

responsible for developing the country's infrastructure, but the industry is not advancing technologically compared to other industries. Thus, educating and increasing public awareness of the attributes of blockchain technology can increase the adoption of smart contracts in the relative industry as the understanding of the technology among the public increases.

Besides that, a recommendation can also involve government interception by providing financial incentives. Blockchain technology is new and requires devices that are compatible with the system, and most of the time, the devices that are compatible with heavy systems are very up-to date. Since the construction industry in Malaysia is technologically lacking, construction companies, especially small-sized companies, might find it expensive to integrate the smart contract system into their existing operating system and procedures. Therefore, the government could provide financial assistance or incentives in the form of monetary aid to those companies so that they can bring in advanced technologies like smart contracts. Doing this will not only benefit the companies in growth and expansion but also contribute to better procedures to handle projects efficiently and strengthen relationships with clients. Hence, this will encourage the adoption of smart contracts within the construction industry. Finally, regulators collaborating with other countries could also be recommended. As with the use of any technology, risks can be detrimental to the parties involved. Therefore, regulators must look into the regulations that can provide security to smart contract users in other countries. Other countries that are more experienced and knowledgeable about blockchain technology can inspire and partner with Malaysian regulators to ensure that the users of the application and technology are protected from any danger. This will improve the alliance with other countries and create a sense of confidence, comfort, and trust to continue using the smart contract application. Hence, the increase in confidence and trust in the technology will influence the adoption of smart contracts within the construction industry.

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