Blockchain-Based Smart Contracts Affect the Speed of Arbitration in Resolving Disputes and the Role of the Mediator in the Arbitration Process Especially in Supply and Logistics Contracts

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Abstract

This research examines the impact of blockchain intelligent contracts on the arbitration rate and the mediator's function of settling disputes in supply and logistics contracts. The quantitative approach for the study and the involvement of 202 legal professionals acquainted with blockchain, the investigation explores the relationships of using smart contracts, trust, and speed of the arbitration process. The research results show that using smart contracts based on blockchain technology significantly improves the arbitration process's speed, efficiency, and transparency and strengthens the parties' trust. They can benefit policy-makers, lawyers, arbitration players, and enthusiasts by helping them grasp the potential of smart contracts in the arbitration system.

Keywords: Blockchain-based, Smart Contracts, Arbitration Speed, supply and logistics contracts.

In the modern world, the fast-moving adoption of blockchain and subsequent innovations have stimulated the creation of smart contracts in supply/logistics—automated contracts where the terms are directly coded into the system. Such smart contracts are expected to revolutionize various sectors, such as arbitration, by providing better approaches, efficiency, and security in solving disputes. This research emphasizes analyzing the impact of smart contracts built based on blockchains on the speed of arbitration, with trust in the arbitration process being outlined as the mediator.

Arbitration is one of the most popular forms of ADR because of its appropriateness, flexibility, and comparison with trial-type procedures. However, arbitration is usually time-consuming and cumbersome, particularly where it involves cross-border disputes and legal matters. Smart contracts based on blockchain can positively affect all arbitration components and improve the arbitration process.

Both established and emerging theoretical frameworks identify trust as a critical element in any structure for managing conflict since it defines the willingness of subjects to engage in a conflict and accept the decision made. Blockchain technology leads to a change in the trust levels in the system when smart contracts are employed in arbitration since it has higher security and precise visibility of data. Thus, the present research intends to extend the

investigation of the relationship between blockchain-based intelligent contracts and arbitration time with trust as a moderator.

This research concentrates on how smart contracts can effectively enhance the procedures limiting the arbitration processes and describes the role of trust in enhancing this acceleration. Also, this study seeks to provide critical insights into the opportunities and challenges of smart contracts in arbitration concerning the blockchain to inform policymakers and other actors on what strategies they must adopt to ensure the successful deployment of the concept.

Literature Review and Theoretical Framework

2.1. Smart Contracts Powered by Blockchain

Blockchain, commonly called distributed ledger, is a decentralized and secure record that will implement and manage the exchange of digital assets independently of central authorities. A smart contract, a programmed agreement, is placed in the digital environment of the blockchain and gets activated if certain conditions are fulfilled. These contracts facilitate private, public, and effective means of presenting the offers by the parties as agreements without the intervention of the intermediaries and the costly transactions, as acknowledged by R. Silva, H. Inácio, and R. P. Marques (2021).

In the environment of arbitration linked to smart contracts at blockchain, several methods, including the processing of evidence in support of the claims, charges, and counter-charges, and evaluation of the awards as well as the necessary distribution will be facilitated by these contracts (M. Andoni et al., 2018). Also, due to blockchain's objective characteristics, the integrity of the arbitration procedure is maintained, the data cannot be altered, and trust among the participants may improve (H. M. Alzoubi et al., 2022).

2.2. Speed of Arbitration

Arbitration speed means the degree of efficiency and time between the beginning of the arbitration process and the decision. This factor is essential in arbitration because most parties seek a speedy and efficient means to solve their disputes to cut expenses and prolong the waiting time for a decision (P. Ortolani, 2019). Several factors may cause arbitration delays, including the dispute's intricacy, arbitrator availability, the arbitration process's regulations, and the parties' collaborative behavior (T. Ghazal, M. Alshurideh, and H. Alzoubi, 2021).

The application of intelligent contracts based on blockchains could have a beneficial effect on the pace of arbitration by automating particular processes and making it quicker; moreover, it could help accelerate administrative work, as well as enhance the safety of information exchange (P. S. Ghosh, S., & Aithal, 2022; N. E. Radwan, et al., 2022). Still, the literature review has revealed that research on the subject of the effect of smart contracts on the rate of arbitration has been limited in elaboration (D. B. Ferreira et al., 2022).

2.3. Confidence in the Arbitration Process

The issue of trust plays a significant role in any dispute resolution mechanism since it fosters or derails the parties' willingness to engage in the process or accept the outcome(s) (H. Alzoubi et al., 2021). As for trust in arbitration, they add that it depends on the competence and impartiality of arbitrators, the favorable nature of the arbitration rules, and the honesty and safety of the arbitration process itself (D. Vlahna et al., 2020). Blockchain is suggested to improve trust in many sectors, including dispute resolution, due to its features such as decentralization, transparency, and non-tampering (M. Chevalier, 2021). Implementing smart contracts into arbitration could increase people's trust as the smart contract guarantees that the arbitration will produce the intended result of the agreement with no signs of human bias or interference (H. Alzoubi et al., 2021).

2.4 Effect of Blockchain-Powered Smart Contracts on the Speed of Arbitration

Smart contracts are the future advancement expected to revolutionize arbitration by increasing speed and efficiency (H. M. Alzoubi

et al., 2021). As recorded by Swan (2015), there are several areas in arbitration that intelligent contracts may adopt to include enforcement, execution and settlement of disputes, which may take less time and resources (L. W. Cong and Z. He, 2019; John Kasem and Anwar Al-Gasaymeh, 2022). Furthermore, intelligent contracts update and organize records pertinent to a case or claim to provide easier access and reference by arbitrators. In sum, based on the literature, intelligent contracts based on blockchain could facilitate arbitration procedures and make them faster (M. Alharby, A. van Moorsel, 2017).

2.5 Impact of Blockchain-based Smart Contracts on Arbitration Trust

The parties' confidence in arbitration is critical, directly impacting their interactions and acceptance of the process. This includes using promising technologies based on the distributed register: intelligent contracts can improve trust within the arbitration framework because they contain the principles of decentralization, transparency, inviolability and security. They guarantee that the records of transactions cannot be altered, enhancing the reliability of arbitration and, therefore, parties' trust (A. Lakhan et al, 2021; E. Anaam et al, 2023). Therefore, when using smart contracts and blockchain technologies, there is a positive association with the trust placed in the arbitration process, according to the published literature (A. Cruz, 2021).

2.6 Effect of Trust on the Speed of Arbitration

Trust accounts for much of the speed and efficiency of the arbitration dealings. Sceptical parties are less likely to cooperate and participate helpfully because when they trust the process, they will participate, advancing the solutions of the dispute(s). Also, high trust may reduce the requirement for elaborate procedural protection measures, which is helpful in further enhancing the arbitration process. The literature supports the notion that trust in the arbitration method makes it possible to increase work speed.

2.7 Indirect Effect of Blockchain-Powered Smart Contracts on Arbitration Speed through the Mediation of Arbitration Trust, Particularly in Supply and Logistics Contracts.

As reviewed in the sections above, the literature shows that smart contracts based on the blockchain may significantly impact the speed and trust degree in arbitration processes and trust, which may affect the effectiveness of arbitration (Edward Probir Mondol, 2022). This implies an indirect relationship exists between the use of smart contracts based on blockchain and the tempo of arbitration, magnetized by the trust. Although this rather indirect relationship has yet to be the subject of prior research, the existing information suggests that such a dynamic is possible. Thus, by increasing the level of trust within the arbitration framework, smart contracts based on blockchain technology could indirectly contribute to accelerating the dispute resolution process (B. K. Mohanta et al., 2018; S. Guergov and N. Radwan, 2021).

Altogether, the literature highlights the capability of smart contracts in the blockchain context to enhance arbitration in terms of speed and trust (B. E. Howell and P. H. Potgieter, 2021; H. M. Alzoubi et al., 2022). It also posits that trust is an intermediary of how smart contracts affect the speed of arbitration, pointing to the fact that the best fascinating insights require more empirical research (C. Udokwu et al., 2018).

The theoretical foundation of this research is anchored on the notion that blockchain smart contracts can favorably influence the tempo of arbitration by moderating trust in the arbitration process. This framework derives from the equally vast literature on smart contracts, arbitration speed, and trust, not forgetting the advantages of blockchain in all aspects of life (J. D. M. Lew, 2008).

External practitioners or interested parties may want to recommend using intelligent discovery software as one of the cost-efficient ways to accelerate the document review process. Such programs employ some form of algorithm that is geared to identify the documents that are

relevant and responsive to other samples deemed to be relevant. While such tools may be handy in most or even all other types of litigation, they are less helpful in supply chain litigation, given the dynamic and multifaceted conduct of such cases. However, wherever possible, authors prefer the method known as targeted human review, which is considered more effective (SARAH K. RATHKE, 2015).

The proposed model asserts that intelligent contracts can directly increase the efficiency of arbitration (H1) and trust within it (H2). Thus, there is an expectation that increased trust will, in turn, also expedite the arbitration process (H3). Fourthly, the proposed model claims a mediation relationship exists between smart contracts' adoption and arbitration speed through trust (H4).

Problem Statement and Identified Research Gap

While there is a growing body of literature on the roles of smart contracts based on blockchain technology in different industries, an arch that focuses on the impacts of smart contracts on arbitration needs to be included. Most prior work investigates smart contracts mainly regarding their characteristics and effects on the arbitration process. However, a more intricate analysis of the association between a) smart contracts, b) the speed of arbitration, and c) trust in the context of arbitration is needed.

The purpose of this study, formulated in the problem statement 'The impact of blockchain-based smart contracts on the speed of arbitration and the mediator's role,' highlights a notable research gap in the literature applicable to both the direct and indirect effects of blockchain-based smart contracts on arbitration speed, with special attention to the trust mediation effect.

This is worrisome, as recognizing the relationship between smart contracts, arbitration speed, and trust can help policymakers, legal professionals, and everybody interested in arbitration in their work. These are essential in developing guidelines for implementing intelligent contracts within arbitration processes to increase effectiveness and reliability.

To bridge this research gap, the study will explore the following questions:

- How does the application of a smart contract designed to rely on the blockchain system influence the duration of the arbitration?
- Can the influence of smart contracts on the arbitration rate be intensified or weakened by the level of trust in the arbitration process?

Thus, while answering these questions, the research will contribute to the development of the current knowledge regarding blockchain-based smart contracts and arbitration and, more specifically, to the validation of the opportunities brought by this technology to improve the results of the mentioned processes.

3.1. Research Hypotheses

1. The application of blockchain technology and brilliant contracts enhances the efficiency of arbitration.
2. Applying blockchain smart contracts reduces uncertainty about the arbitration procedures.
3. Due to the enhanced trust in the arbitration procedure, the time factor is beneficial.
4. The mediation of the impact of smart contract usage on the speed of arbitration is the trust in the arbitration process.

3.2. Research Model

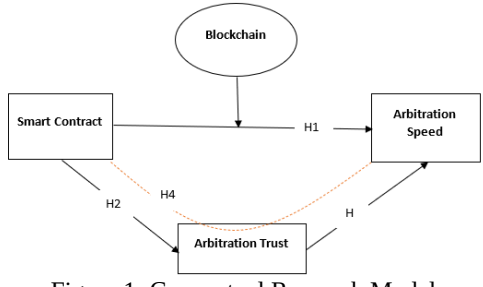

Figure 1: Conceptual Research Model

Methodology & Research Design

Therefore, this research employs the quantitative method to objectively analyze the

cause-and-effect relationship between the variables, particularly how smart contracts based on blockchain technology impact the speed of arbitration and the level of trust. Thus, using descriptive and analytical approaches, the study would examine complex relationships between the identified variables and explore their dynamics in the arbitration context. This study's utilization of an empirical approach guarantees the acquisition and analysis of measurable data to support the results. Most of the relationships established by the study employ the deductive approach of the research that investigates relations that stem from theories developed from prior studies. Due to the combination of the post-positivist epistemology, the deductive approach to research, and the methodical design of the research study, the highly explicated understanding of the role played by trust intermediaries between smart contracts based on the blockchain and the arbitration speed is allowed.

4.1. Sample and Population

The study focuses on the population, including arbitrators, lawyers, and other participants engaged in arbitration-related cases incorporating blockchain smart contracts. To gather data about firsthand experience, a purposive sampling procedure was used to identify participants with firsthand experience in these scenarios. From this, 202 respondents were screened and used to establish the study's sample of 800 participants to ensure sufficient power to support the analysis.

4.2. Collecting Data

A cross-sectional survey was used to collect information from the participants using an online platform. This survey was more oriented to obtain more detailed information regarding the respondent's essential characteristics, direct experience with smart contracts developed based on blockchain, the speed of arbitration observed in the cases they have participated in, and The attitude of the respondents towards trust in the arbitration process.

4.3. Variables and Measurement

The measurement of the study's variables formed the basis for developing a structured questionnaire, which was adopted based on the research questions formulated for the study and used a five-point Likert scale. The construct of arbitration speed about the relative comparison was established from 8 items where the participants were asked about the smart contracts used in their case. Seven items were directed at establishing the pace at which the arbitration was implemented by asking the respondent the time it took from the case's inception to its close. In this particular study, six items were employed to quantify the level of participants' trust in the arbitration process, where participants were expected to rate issues related to their trust.

Data Analysis

Since it was necessary to analyze the stated hypotheses and the data gathered for the study, Structural Equation Modeling (SEM) was used. Since SEM facilitates examining various variables, measurement error and other disturbing factors were considered in this research.

5.1 Assessment of the Measurement Model

To assess and confirm the reliability and validity of the measurement model, the cross-loadings were checked with AVE, Cronbach's alpha, and the CR composite reliability indices. This assessment supported the internal consistency, the convergent validity and the discriminant validity of the constructs in the current study, with most of them exceeding the recommended cut-off values, which have been noted in the literature review (M. R. Ab Hamid et al., 2017). Regarding the validated factors, reflective indicators were used, and Partial Least Squares (PLS) were used to evaluate the structural equation model. This evaluation also examined the convergent and discriminant validity model in relation to the given theory. (Table 2)

5.2. Convergent Validity

The indicators were evaluated with Average Variance extraction (AVE), Composite Reliability (CR), and Cronbach Alpha for convergent validity. With these metrics, it was possible to assess the criticalities of the indicators and the purpose of the validity of the research model, which is associated with internal consistency. As exemplified in Table 1, the evaluation revealed that convergent validity was obtained with values exceeding the accepted cutoff of >0. 50 and >0. 60, respectively (Fornell, C. And Larcker, D. F, 1981). In detail, the initial measurement results confirmed all hypothesized relationships with p-values of less than 0. 05, which stresses the measurement model's validity and reliability of the established constructs. These indicators were generally approved since they established a significant factor loading of more than 0. 70 in the analysis performed on each of them that affected the overall results.

Table 1: Composite Reliability, Average Variance Extracted, Cronbach's Alpha

Variables	CR (rho c)	AVE	Cronbach's Alpha
Blockchain Based Smart Contracts	0.964	0.718	0.955
Arbitration Speed	0.939	0.793	0.912
Arbitration Trust	0.944	0.772	0.925

5.3. Distinct Validity

Hence, the outcomes from the Fornell-Larcker and Heterotrait-Monotrait (HTMT) approach, as stated in Table 2, reveal the interrelations of the variables. The outcomes were obtained by estimating the square root of AVE. They were usually presented in bold font at off-oscillation diagonal cells, according to inter-construct correlations that outperformed the correlations between the constructs. Therefore, the measure model pointed to high discriminant validity. Also, discriminant validity was tested in this research using another significant analytical tool, the HTMT ratio. Table 2 disclosed the following: These findings suggested that the HTMT ratios were intact and complied with the recommended total of ≤ 0. 90, confirming that the HTMT criterion for discriminant validity is acceptable, at a cutoff of 0. 90 is satisfactory.

Table 2: Discriminant Validity

	HTMT			
	Construct	1	2	3
1	Blockchain Based Smart Contracts			
2	Arbitration Speed	0.754		
3	Arbitration Trust	0.635	0.602	
	Fornell-Lacker Criterion			
		1	2	3
1	Blockchain Based Smart Contracts	**0.847**		
2	Arbitration Speed	0.624	**0.890**	
3	Arbitration Trust	0.587	0.687	**0.878**

The application of the PLS Algorithm was used to perform the path coefficients. At the same time, the PLS bootstrapping process of 5000 resamples was used to test the significance of path coefficients at 0. 05. The chi-square value {R^2} was used to confirm the extent of the influence of the exogenous variable on the endogenous variable, and consequently, the model explained 82. 5% of the explainable

portion of the arbitration trust is $39,751 + $18,739 = $58,490—7% in arbitration speed.

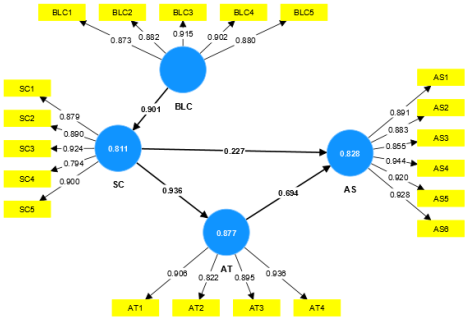

Figure 2: Structured Measurement Model (PLS-SEM)

Table 3 shows a significant correlation between blockchain-based smart contracts and arbitration speed and supports the first hypothesis as suggested by the statistical readouts, concluding BBSC>AS = 0. 694, t = 2. 65, p = 0. 008. The findings also reveal that blockchain-based smart contracts increase the level of trust in the arbitration process, thus confirming Hypothesis 2 (BBSC>AT = 0. 901, t = 21. 82, p = 0. 000). Moreover, the correlation between arbitration trust and the speed of arbitration was also found to be statistically significant (AT>AS = 0. 936, t=2. 81, p= 0. 000) thus hypothesis 3 was also valid. The study also aimed to investigate the moderating effect of arbitration trust on the link between smart contracts on blockchain and arbitration speed. Based on this inference of the indirect effects (a + b), there was moderation, which showed that both the direct and indirect impact of blockchain-based smart contracts on arbitration speed regulating through arbitration trust were statistically significant (BBSC>AT>AS = 0. 585, t = 2. 70, p = 0. 007). The results reflected in this partial mediation (complementary mediation) support Hypothesis 4, which posited that arbitration trust acted as a mediator in the relationship between blockchain implementation and arbitration speed enhancement.

Table 3: Hypothesis Testing

		Direct Effect				Indirect Effect					
	Hypothesis Paths	Beta	R^2	t-value	p-value	Beta	t-value	p-value	Percentile bootstrap 97.5% confidence interval		Decision
									Lower 2.5%	Upper 97.5%	
H1	BBSC→AS	0.694	0.828	2.65	0.008						Supported
H2	BBSC→AT	0.901	0.877	21.82	0.000						Supported
H3	AT→AS	0.936	0.811	2.81	0.000						Supported
H4	BBSC→AT→AS	0.627		30.28	0.000	0.585	2.70	0.007	-0.212	0.930	Partial Med

Analysis of Results

This research exemplifies why blockchain-based smart contracts are set to disrupt the speed of arbitrage in support of the initial hypothesis of this study. These smart contracts are based on blockchain systems that enable the automatic performance of contract provisions and the application of consequences without parties' intervention. This automation immensely increases the speed and efficiency of the proceedings of the disputes. The discovered post-contractual relationship in this regard shows that such automation makes information readily available to all the contracting parties, thus reducing the chances of conflict arising from misunderstandings of the contract terms. Also, the nature of the blockchain structure increases the speed of the solutions concerning the disputes since the parties can quickly and

effectively receive and check the specifics of the concluded contracts.

The findings of our study are highly conclusive in showing that the application of smart contracts in the blockchain system dramatically enhances the rate of arbitration by doing away with intermediaries through the use of computer code written into the contracts to automate the process of the execution of contractual disputes and also the creation of self-executing contractual records. However, such potential issues are the potential sophistication of certain contained agreements and the reliability of the base code of intelligent contracts that must be considered. Regarding another element of the blockchain-based smart contract, its ability to fasten the arbitration process depends on the general conditions of the dispute and the quality of the software solution used.

In contrast to the prior research, the presence of smart contracts based on blockchain technology proves that by removing the intermediation layer and facilitating the arbitration process, the speed of arbitration can be revolutionized. Being autonomous programs, smart contracts only allow for the execution of the conditions of agreements, which makes them incredibly useful for solving business disputes without appeal to traditional legal procedures and their high costs and time consumption. These metamorphic characteristics hint at a future where blockchain may prove critical in improving the effectiveness and efficiency of arbitrational procedures.

Conclusion

The conclusion of this study will advance our knowledge of the usability of smart contracts in arbitration processes based on blockchain and define the importance of trust within such processes. This research's findings would benefit policymakers, legal scholars, and practitioners who engage in arbitration, possibly shedding light on using smart contracts in arbitration procedures. In addition, it is essential to notice the potential of using smart contracts based on the blockchain to improve the rate and effectiveness of arbitration proceedings. By reducing the number of intermediary personnel who convey information and intentions, the decentralized system helps to save time and means compared to traditional arbitration techniques. Moreover, the levels of trust in arbitration significantly determine the acceptance of smart contracts developed on blockchain technology since it guarantees parties fairness and neutrality during the process. Given the current increased acceptance of blockchain technology, the usage of blockchain is expected to increase in arbitration, thus making it a gradually preferred means in the field.

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