Evaluation of Existing Payment Systems Towards Adoption of Smart Contract for Construction Projects

Ekweani, Chioma P. Ogunlolu, Alice T. & Ibrahim, Mubarak R.
[1,2] Department of Quantity Surveying, Baze University Abuja
[3]Department of Building, Baze University Abuja

Corresponding Author:
chioma.ekweani@bazeuniversity.edu.ng
+234 806 018 8330

Abstract
The aim of the paper is to evaluate issues with the existing payment system for construction projects with a view to recommend smart contract payment system (an effective alternative) for construction projects. A qualitative systematic review was conducted to identify the challenges of the existing payment system followed by a focus group interviews session with construction payment stakeholders. The findings reveal that the issues with the existing payment system can be grossly minimized if there is a better interpretation and understanding of contract conditions/terms at the outset by the project participants. Additionally, the paper disclosed that the adoption of smart contract payment system has a better advantage of eliminating mistrust, delayed payment, mal payment and non-payment for construction projects. The paper concludes that smart contract payment system can significantly abate payment related-issues through the provision of an enabling trusted environment, transparent and traceable transaction, prompt automation of payment terms without a central authorization and elimination of disputes among contracting parties. Because Smart contract payment system is technology-based, it is more suitable for adoption in a technologically-enabled environment.

Introduction
Construction projects rely on efficient payment systems for better performance and survival (Tariq & Gardezi, 2022). A construction project may succeed or fail depending on the efficiency of the payment system employed in the contract (Bolhassan, et al 2021; Ramachandra & Rotimi, 2020). The existing payment system relies on certification of works done by the contractor for interim (progress) payment (JCT, 2016). The process for interim payment requires: a physical assessment of works on site, evaluation of materials onsite and offsite, thorough review of the contractor's payment application, valuation of all variations and claims. These activities are time-consuming, require intensive human efforts and contribute to over 40% of the causes of delayed payment for construction projects (Ekweani, 2022).

The cumbersome nature of the existing payment system is accountable for its inefficiency. Project participants are saddled with contractual obligations, tasks and roles which are sometimes difficult to satisfy due to the complexity of the system (Bissoon & Outridge, 2020; Hamledari & Fischer, 2020). Similarly, Bolhassan et al., (2021) posits that the human involvement in administration of payment for construction projects is equally attributable to the failure of the system because there is the tendency of project participants to misinterpret the conditions of contract based on their understanding of the conditions which may be limited or compromised.

Article published on boldscholar.com. Verify this document by clicking here

Additionally, existing literature reveals that the factors responsible for delayed payment of construction projects are mostly process-related issues as seen in: delays in approval and certification of work done, contractor's delays in submission of claims and invoices, errors in submission of claims and valuation, disputes over claims and inadequate supporting documents, administrative errors, improper supervision and financial control and underpayment of certified amount (Odenigbo, et al., 2021; Ramachandra & Rotimi, 2020). Consequently, the existing payment system is challenged with poor project performance, project abandonment and mistrust, untimely breakdown of business relationships, frequent disputes and business failures. This creates a need to explore an alternative payment system for efficient payment of construction projects.

Literature Review

The existing payment processes

Payment processes are chains of events, activities and decisions that are performed within the payment system for payment to happen. Processes by their nature have requirements and these requirements are properties of a desired treatment that must be met to lead to one or several outcomes (Wieringa, 2014). Once the payment requirements are not satisfied, the system is likely to fail and one way to mitigate this is by modeling the existing payment process to spell out the causes for possible solution to be proffered (Ekweani, 2022).

Three (3) main processes are required for payment to be disbursed. They are: payment application, payment certification and payment documentation. These processes are made of chains of activities and sub-processes.

Payment application: Payment application shows value of works done and amount deemed as due for works completed. Usually, the contract will require that the contractor submits his payment application to the Quantity Surveyor not later than the interim valuation date or as agreed in the contract conditions (JCT, 2016). The application will also show the means by which the sum was arrived. For most construction projects, payment precedes work done. Typically, the contractor is expected to assess the value of works completed and the amount he considers due to him at a given payment period (JCT, 2016).

Payment certification: This is the approval and confirmation for payment usually signed by the contract administrator or the Architect. A Certificate for payment is a document that attests or confirms that works are completed and payment is due to the contractor as applied or notified (JCT, 2016). Prior to the issuance of payment certificate, a valuation is carried out by the Quantity Surveyor to ascertain amount due for payment. Valuation is a detailed breakdown for work undertaken for the purpose of payment. It involves visiting the site and checking that the works have been carried out either by measurement or by visual inspection. A valuation build up will usually comprise the following:

i. Work packages: that is work executed by the contractor that is in full accordance with the contract specifications.
ii. Preliminaries: this consists of the set-up costs, running costs, staff and management costs, overheads and profits which are not factored into the contract bill.
iii. Variation: this captures all cost implied modifications on the project design.
iv. Offsite goods and materials: these are large items of manufacture prior to site installations which are considered for payment. The JCT specifies conditions for inclusion of these items.

Article published on boldscholar.com. Verify this document by clicking here

v. Claims: all delays that are solely caused by the client or his representatives or risks that fall to the client where the contractor is liable.
vi. Provisional sums: these are substitutions of agreed costs for items in the contract which were subject to negotiation.

Payment documentation: all payment supporting files are documented after payment is disbursed for traceability, reference and record keeping purposes.



Figure 1: Existing Payment Process

Challenges of the existing payment system

Challenges of the existing payment system identified from the review of literature were categorized into three as: delayed payment, mal-payment and non-payment. Factors responsible for delayed payment are: disagreement on due amounts for works done, error in claims, unrealistic cash flows, employer's poor management of cash-flow, failure to implement good governance in business, payers' attitude/local culture and use of pay-if-paid clauses, insolvency and bankruptcy (Ramachandra & Rotimi, 2020; Peters et al., 2019; Hansen et al., 2017).

Existing literature reveals that about 40% of the causes of delayed payment were attributable to the payment processes often occurring during interim payment period as seen in: delays in valuation of variations and final account, delays in certification of due amounts, improper supervision and financial control, delays in submitting/responding to claims, delays in approval of claims and delay in releasing retention monies to contractor (Ekweani, 2022; Abdul-Rahman et al., 2014, Emenike, 2010). Non-payment and mal payment are traceable to employer's behavioral patterns/attitude such as: withholding payments unnecessarily and making arbitrary deductions from certified due amount, failure to comply with payment provisions, underpayment of certified amount, disagreement on valuation of works done, poor communication between parties, pending variation orders approval, poor quality of works, dispute with debtors/creditors, internal conflicts and claims (Olusola, 2019; Mohammed, Suman, Harun & Hashim, 2018; Ye & Rahman, 2010).

Factors responsible for the challenges of the existing payment system are revealed as: employer's financial problems, delay in work approval, inadequate supporting documents, major accidents, inaccurate bill of quantities, disputes over claims and responses, administrative errors and substandard workmanship (Okereke, 2020; Olusola, 2019; Swai & Arewa 2018).
Table 1 below shows the list of challenges of the existing payment system and their sources.

Article published on boldscholar.com. Verify this document by clicking here

Table 1: Challenges of the Existing Payment System

Payment Issues	Sources
Delayed payment: Delays in certification of works, Delays in submission and approval of claims, Employer's poor financial management, Lengthy process, Third party involvement	Tariq & Gardezi, 2022; Bolhassan, Changsaar, Khoso, Siawchuing, Bamgbade & Hing 2021; Odenigbo, Odusami, Okolie & Okafor 2021; Ramachandra & Rotimi, 2020; Akinola & Awolesi 2019; Abdul-Rahman, Kho & Wang, 2014, Emenike, 2010.
Mal-payment: Misinterpretation of contract conditions, Underpayment of certified amount, Disputes, Administrative costs, Poor record keeping, and misinterpretation of contract documents	Bissoon & Outridge, 2020; Thanuya & Olabode 2020; Li, Greenwood & Kassen 2019; Peters, Subar & Martin 2019; Mohammed, Suman, Harum & Hasim 2018; Hansen, Rostiyanti & Purnomo 2017; Niazi & Painting, 2017.
Non-payment: Local culture/attitude of employers, Mistrust and Corruption.	Alawi, 2021; Ahmadisheykhsarmast & Sonmez, 2020; Olusola, 2019; Ibrahim Wuni & Agyei-wumi 2017; Borvorn, 2012; Sahab & Ismail 2011; Mbachu, 2011; Ye & Rahman, 2010.

Delayed payment

Delayed payment is a common phenomenon in most construction projects causing financial hardship for the contractor, cash-flow problems, abandonment of projects, disputes between parties in the contract, bankruptcy, negative social impact and delays in completing project (Tariq & Gardezi, 2022; Akinola & Awolesi 2019; Niazi & Painting, 2017). Ibrahim Wuni & Agyei-wumi (2017) enlisted additional effects of delayed payments in construction projects to include: cost overrun, time overrun, poor quality of work, idleness of equipment and negative impact on contractor's reputation. Furthermore, Bissoon & Outridge (2020) mentioned: reduction of business profitability, increase in late payment to suppliers, difficulty in procuring materials and services and increase in construction cost as impacts of delayed payment on contractor's cash-flow.

Mal payment

Mal payment often manifesting in underpayment is a common experience in the construction industry which results to problems such as reduced project performance, destruction of trust among project parties, disputes and eventual abandonment of project (Ahmadisheykhsarmast & Sonmez, 2020; Ramachandra & Rotimi, 2020; Wang, Wang, & Wang, 2018). Mal payment arises from inability to set off certified due amount, and associated problems of getting paid even with certificates in hand. Existing research depicts that the construction industry has loss of income of 1.6% with payment made 56.51 days after certificates for payment has been made (Experian 2003). 80.3% of Construction Industry Development Bank (CIBD) members in Malaysia had encountered underpayment in public and private sectors (Emenike, 2010).

Non-payment

The main factor causing non-payment are attributable to employer's defaults in (the "cannot pay") and (the will not pay") attitudes which snowballs into poor quality of work, disputes with debtors and creditors and eventual business failure (Ramachandra & Rotimi, 2015). Emenike,

Article published on boldscholar.com. Verify this document by clicking here

(2008) opined that because payment is made after work done rather than payment on execution of works, the non-payment issues may persist in the construction industry. The outcome of non-payment is largely seen in cash-flow problems, stress on constructors, project abandonment and bankruptcy.

The smart contract payment system

The adoption of smart contract payment system was advocated to improve existing payment challenges by decreasing the length of interim payment cycle (Ahmadisheykhsarmast & Sonmez, 2020). Smart contract payment system is based on planned payment schedule/cash-flow system. A payment schedule is a list of dates showing when payments should be made and agreed by the parties in the contract. It can be linked to the completion of certain pre-agreed activities, at which interim payments must be made. By including a payment schedule in a contract, setting out who needs to do what and by when, the likelihood of parties getting dates wrong can be reduced, and so disputes are less likely (Hamledari, & Fischer, 2021; Hesam & Martin, 2020; Ahmadisheykhsarmast & Sonmez, 2020). A payment schedule will usually include the following details:

i) The start date of the contract.
ii) The amount to be paid as an initial payment.
iii) The interval of other payments after the initial payment.
iv) The timeframe within which the project will be completed.
v) The estimated total contract amount.

The automation of payment is the most viable application of smart contract payment system in the construction industry (Li et al. 2019; Mason 2017). Smart contract (SC) is simply a program that lives in a block-chain block and governs how data is added to the block-chain (Bolhassan et al., 2021). They are digital contracts stored on a blockchain that are automatically executed when predetermined terms and conditions are met (Nakamoto, 2008). SC works by following simple "if/when…then" commands that are written into code on a blockchain. A network of computers executes the actions when predetermined conditions have been met and verified. These actions could include releasing funds to a party in the contract or simply sending a notification. The blockchain is then updated when a transaction is completed (Andreas & Wood, 2019). To establish the terms of the contract in a SC, parties to the contract must determine how transactions on the contract would run and agree on the "if/when….then" clauses that governs those transactions, explore all possible exceptions, and define a framework for resolving disputes (Wiley, 2017).

Smart contract has received increasing attention in the past few years due to the technology's key features: elimination of third-party intermediaries and automation of payment processes (Perera et al. 2020; Salleh et al. 2020). Other features such as traceability and increased transparency of transaction features increase the drive towards the adoption of smart contract payment system for construction projects (Bolhassan et al., 2021; Penzes et al. 2018).

The smart contract payment system autonomously translates the progress at job sites to construction progress payments without reliance on centralized, intermediated, and resource-intensive workflows such as invoice collection and application/certification for payments (Hamledari, & Fischer, 2021). Unlike the existing payment system which requires physical assessment of works done for payment purposes, in smart contract payment system, work progress and site conditions are captured using reality capture technologies (Ahmadisheykhsarmast & Sonmez, 2020; Hesam & Martin, 2020). The progress data is stored

Article published on boldscholar.com. Verify this document by clicking here

off-chain and shared in a distributed manner among the private Peer-to-Peer (P2P) network of project stakeholders. The remote procedure call is then used to communicate the off-chain as-built information to the project's smart contract. The smart contract memorializes the contractual agreements, and it is deployed on the Ethereum virtual machine (EVM). With each update to the product flow status (i.e., progression of work at job site), the EVM determines the resulting transactions, accounts payable, and accounts receivable by having all its nodes, and not just one, execute the project's smart contract script (Hamledari, & Fischer, 2021; Hesam & Martin, 2020).

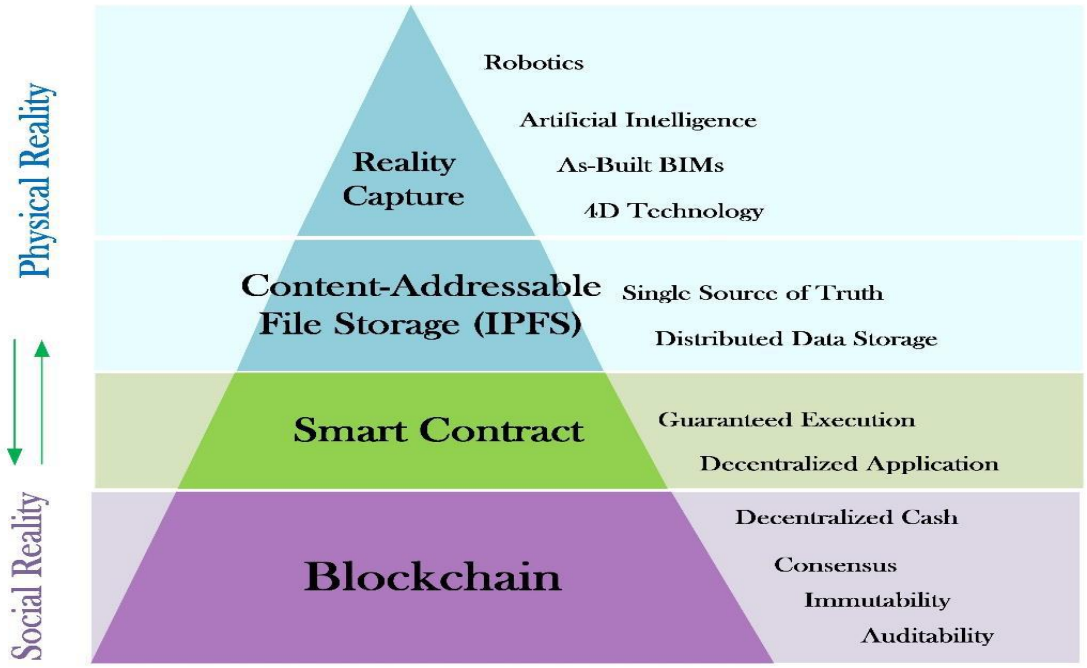


Figure 2: Four pillars of smart contract payment system. Source: (Hamledari, & Fischer, 2021)

Need for smart contract payment system

The need for a more reliable and efficient means of payment has become increasingly evident and highly demanding in the construction industry. Payment autonomy calls for a move away from today's manual and heavily intermediated workflows around payments including the preparation, review, approval, and execution of payment applications. The smart contract payment system is proposed as the most effective means of overcoming the shortcomings of the existing payment system through its key features: self-executing and automated. ARCADIS (2019) reported that failure to properly understand and administer contracts was the major reason most construction projects failed. The key feature of smart contract is in its ability to simplify and digitalize contract conditions/agreements so that parties can transact directly within a trusted environment without intermediaries and the possible occurrence of human errors (Hamledari, & Fischer, 2021; Tharaka, Mika, & Madhusanka, 2020).

A smart contract payment security system (SMTSEC) developed by Ahmadisheykhsarmast & Sonmez, (2020) was adopted in a live construction project and resulted to an efficient and timely payment for the project. The SMTSEC which was used to make direct payment to contractors and subcontractors also improved the contractor's cash flow and reduced payment problems. Other features of smart contract payment system are seen in: security of payment, accuracy and promptness of payments, reduction of misinterpretation of contract conditions and shortened payment processes. Additionally, the system provides for excellent record keeping and

Article published on boldscholar.com. Verify this document by clicking here

automatic status update once pre-defined conditions are met, hence alleviating delayed, mal-payment and non-payment.

Table 2: Existing payment system vs Smart contract payment system

Section	Existing Payment System	Smart Contract Payment System
Contract Conditions	Interpreted based on project participants understanding.	Digitalized and coded in the contract.
Contractual transactions	Often involve third-parties/intermediaries.	Done between the parties directly.
Contract Execution	Progresses slowly.	Automatic.
Payment	Delayed, inaccurate and uncertain.	Prompt, accurate and secured
Platform	Paper based	Peer-to-peer network

Benefits and features of smart contract payment system

In recent years since the inclusion of technology in the construction industry, researchers have projected that the full adoption of smart contract technology can advance the industry immensely in light of future trends. Smart contract ensures trust which has been a fundamental issue between parties in construction projects. In the procurement phase of a construction project, smart contract can code the condition/agreement as clauses in the contract. This enables transparency and promotes trust between the parties. Also, because smart contracts are self-executing, the need for intermediaries are eliminated and problems concerning the slow processing and verification of payment are minimized (Bolhassan et al., 2021; Cardeira, 2015). Payments are guaranteed and automatically executed with smart contract payment system; hence, the issues of delayed payment and non-payment are nullified (Ahmadisheykhsarmast & Sonmez, 2020).

The following features make smart contract payment system a more suitable system:

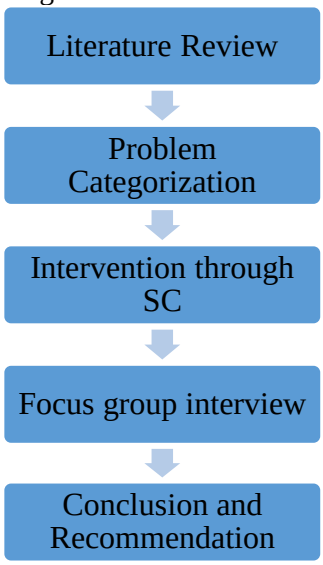
i) Provision of a trusted environment that ensures integrity across all nodes
ii) Absence of intermediaries which makes transactions faster with low service fee
iii) Promotes transparency and traceability of transactions because transactions are recorded and stored as they occur.
iv) Ensures an impeccable record keeping of transactions
v) Operates a peer-to-peer system with no central authority.
vi) Minimises disputes among contracting parties
vii) Automation and guaranteed execution of contract

Challenges of the smart contract payment system

The major challenge of smart contract payment system as identified in literature is its immutability, cyber-security and mining concerns (Bolhassan et al., 2021; Hamledari & Fischer, 2020). Smart contracts may not be suitable for use in long duration contracts that are prone to variation. Another major limitation is that smart contracts require a considerable amount of data and expertise in execution which is significantly lacking in the construction industry (Bolhassan et al., 2021; Ahmadisheykhsarmast & Sonmez, 2020; Hamledari & Fischer, 2020). Construction industry stakeholders are not still reluctant to fully incorporate upcoming technologies in their practice and this poses a challenge to the adoption of smart contract technology.

Article published on boldscholar.com. Verify this document by clicking here

Figure 3: Research Method



Methodology

A qualitative research approach using semi-structured interviews for a closed group interaction was used to gather data for this paper. Existing researches on smart contract adopted similar method as well (Bolhassan et al., 2021; Mason, 2019)

Explorative focus group interview session

A closed group interaction with employers, contractors and consultants involved in public construction projects in Abuja were carried out to obtain relevant and detailed information about the payment issues been evaluated. The respondents were selected by purposive sampling technique.

Content analysis was conducted to evaluate the phenomenon under review. It was carried out through: literature review on payment related articles with a selection criterion from 2010-2022; thematizing insights developed from the review for discussion; and analysing the outcome from the interview sessions.

Results and Discussion

Closed Group Discussion

The findings from closed group interactions reveal that parties in a construction project often are unable to meet up to their contractual roles/obligations due to misinterpretation and non-adherence to the contract conditions. Furthermore, it was gathered that the actions/ inactions of both the employer and contractor are mostly responsible for the payment challenges encountered in project execution. Once either of the party to the contract fails to satisfy the payment requirement (for example, if the contractor fails to satisfy the quality of works stipulated) the payment terms will become problematic. When asked about incorporating the JCT conditions of contract in smart contract payment system, one interviewee opined that in meeting up with the current advancement in technology, the JCT (2016) conditions of contract is becoming obsolete and may have contributed to the inadequacies of the system.

In evaluating the causes of the payment challenges, it was gathered that in most cases, parties in a contract rarely read the contract condition nor abide by it. A concern was expressed by some of the respondents who believe that contracting parties often misinterpret the contract conditions due to a limited understanding of the conditions and failure to ask for clarifications

Article published on boldscholar.com. Verify this document by clicking here

on their roles and obligations on the contract. One respondent ascertained that third parties (such as financial bodies) involvement in payment processes have caused much delays on payment for construction projects and cited examples where the bank refused to pay the contractor even after certification of works done.

Another issue which received much mention particularly with public projects payment is the issue of corruption. The respondents attested that in order to get approval for payment for most public sector projects, contractors must be "highly connected" to top government officials or affiliated to one of them. The situation is worsened when the administration tenure elapsed and a new administration takes over. Oftentimes, when payment is finally disbursed, the government officials take larger chunks of the money leaving the contractor to work at a loss and eventually projects end up abandoned or in dispute. It was also discovered that budgetary allocations and policies contribute to the challenges of the existing payment system particularly during planning and allocation for construction projects. A respondent categorically stated that even after budgets are released, they are been slashed to unimaginable amounts during project award and disbursement; not to mention that none of the construction professionals are consulted during budget planning and allocation.

A number of measures were recommended for overcoming the existing payment challenges. They are: Adopting a clearly-defined contractual conditions and negotiation of payment terms with employers at the outset of projects, provisions for speedy dispute resolution, Incorporating efficient communication mechanisms between parties in a contract, Implementation of construction industry payment and adjudication Act, Implementation of financial management to improve employer's cash-flow, Right of contractors to suspend works when payment for works done is delayed or not disbursed, Submission of timely and accurate invoices with complete documentation of payment records, Imposing interest penalty on late payer and adopting new innovative payment systems. Of all the recommended measures, a move towards the adoption of smart contract technology received more recommendation from the respondents who are optimistic about its ability to curb existing challenges of the payment system. These support the finding of the following authors: Tariq & Gardezi, 2022; Bolhassan, et al., 2021; Alawi, 2021; Ahmadisheykhsarmast & Sonmez, 2020; Ramachandra & Rotimi, 2020; Olusola, 2019; Cardeira, 2015.

Conclusion and Recommendation

Payment is what keeps project running. An efficient payment system is paramount to achieving project survival and success. Existing payment system is challenged with mistrust and business failures caused by delayed payment, mal-payment and non-payment. A number of factors are responsible such as: utility of obsolete contract conditions, misinterpretation of contract agreement, unfavorable budgetary allocations, inconsistent government policies and corruption. Among the measures recommended for addressing these challenges, the adoption of smart contract payment system was mostly opted for based on its distinctive features. However, smart contract system is still at its embryonic stage and suitable for adoption in a more technologically-enabled environment.

The study recommends the further research in identifying the requirements and frameworks for implementing payment for construction projects based on smart contract technology.

Article published on boldscholar.com. Verify this document by clicking here

References

Abdul-Rahman, H., Kho, M., & Wang, C., (2014): Late payment and non-payment encountered by contracting firms in a fast-developing economy, *J. Prof. Issues Eng. Educ. Pract*. 140 (2) (2014) 04013013, https://doi.org/10.1061/(ASCE)EI.1943-5541.0000189.

Ahmadisheykhsarmast S., & Sonmez R., (2020): A smart contract system for security of payment of construction contracts, Automation in Construction, Volume 120, 2020, 103401, ISSN 0926-5805,https://doi.org/10.1016/j.autcon.2020.103401.

Alawi, M., (2021): Delay in payment effects on productivity of small and medium construction companies in Oman: exploration and ranking. *Asian Journal of Civil Engineering* (2021) 22:1347–1359; https://doi.org/10.1007/s42107-021-00387-8.

Ansah, S.K., (2011): Causes and effects of delayed payments by clients on construction projects in Ghana. *Journal of Construction Project Management and Innovation* Vol. 1 (1): 27 45, (November) 2011; ISSN 2223 7852.

Bisson, S., & Outridge, D., (2020): Delayed payments impacts on planned cash flow of small and medium contractors for a special purpose company. The International Conference on Emerging Trends in Engineering and Technology (IConETech-2020); Faculty of Engineering, The UWI, St. Augustine | June 1st – 5th, 2020

Bolhassan, D.N., Changsaar, C., Khoso, A.R., Siawchuing, L., Bamgbade, J.A., & Hing, W.N., (2021): Towards Adoption of Smart Contract in Construction Industry in Malaysia. Pertanika *Journal of Science and Technology*, DOI: https. // doi.org/10.47836.pjst.30..1.08; http://www.pertanika.upm.edu.my/.

Borvorn, I.N.A., (2019): Factors Causing Delay in Payment of Residential Building Projects in Thailand. TS01C - *Construction Economics and Management* I, 5480; FIG Working Week 2012; Rome, Italy, 6-10 May 2012.

Dresch, A., Lacerda, D.P., Antonio, J., & Antunes Jr, V., (2015): Design science research; a method for science and technology advancement. ISBN 978-3-319-07373-6 ISBN 978-3-319-07374-3 (eBook); DOI 10.1007/978-3-319-07374-3

Dumas, M., La Rosa, M., Mendling, J., & Reijers, H., (2013): Fundamentals of Business Process Management, ISBN 978-3-642-33142-8 ISBN 978-3-642-33143-5 (eBook); DOI 10.1007/978-3-642-33143-5; Springer Heidelberg New York Dordrecht London.

Ekweani, C.P (2022): Payment Process Modelling: A Panacea For Delayed Payment Of Construction Projects. *International Journal of Novel Research and Development*; Vol 7, Issue 8, August, 2022**.**

Emenike, O. F., (2010): Late and non-payment issues in the Nigerian Construction industry-contractors' perspective in enugu state. Published MSc thesis from the department of building, Faculty of Environmental Sciences, Nnamdi Azikiwe university, Awka Nigeria

FIDIC (2017): Conditions of contracts for construction, 2nd ed., FIDIC, Available at https://fidic.org/books/construction-contract-2nd-ed-2017-red-book, (2017). Accessed date: 24 October 2019.

Guide to Best "Fair Payment" Practices, (2019): Office of Government Commerce, OGC available at: https://delta.bipsolutions.com/docstore/pdf/18463.pdf, (2007). Accessed date: 24 October 2019.

Hamledari, H., & Fischer, M. (2021): Role of Blockchain-Enabled Smart Contracts in Automating Construction Progress Payments. *Journal of legal affairs and dispute resolution in engineering and construction,* 13, 04520038.

Hansen, S., Rostiyanti, S.F., & Purnomo (2017): Conditional Payments in the Indonesian Construction Industry; DOI: 10.1061/(ASCE); LA.1943-4170.0000226.© 2017 *American Society of Civil Engineers.*

JCT, (2016): Joint contract tribunal Standard building contract with quantities SBC/Q 2016

Article published on boldscholar.com. Verify this document by clicking here

Mbachu, J., (2011): Sources of contractor's payment risks and cash flow problems in the New Zealand construction industry: project team's perceptions of the risks and mitigation measures. *Construction Management and Economics*, 29:10, 1027-1041, DOI: 10.1080/01446193.2011.623708

Moumita, D., Han, L., & Cheng, J.C.P., (2020): Securing interim payments in construction projects through a blockchain-based framework, Automation in Construction, Volume 118, 2020, 103284, ISSN 0926-5805, https://doi.org/10.1016/j.autcon.2020.103284. (http://www.sciencedirect.com/science/article/pii/S0926580519312944)

Niazi, G.A., & Painting, N., (2017): Significant Factors Causing Cost Overruns in the Construction Industry in Afghanistan. 7th International Conference on Engineering, Project, and Production Management; Procedia Engineering 182 (2017) 510 – 517; Available online at www.sciencedirect.com

Okereke, R., (2020): The Effect of Delayed Payments and Retention on Contractors Cash Flow. PM World Journal (ISSN: 2330-4480) Vol. IX, Issue VIII – August 2020. www.pmworldjournal.com

Olusola, O.A., (2019): Management practice for delayed payment by contracting firms in lagos state, Nigeria. Published MSc thesis at the department of building, faculty of environmental design and management, Obafemi Awololo University, Ile-Ife Nigeria.

Peters, E., Subar, K.A.M.,& Martin, H., (2019): Late Payment and Nonpayment within the Construction Industry: Causes, Effects, and Solutions, DOI: 10.1061/(ASCE); LA.1943-4170.0000314. © 2019 American Society of Civil Engineers.

Ramachandra, T., & Rotimi, J.O.B (2015): Causes of Payment Problems in the New Zealand Construction Industry. Construction Economics and Building, 15(1), 43-55. DOI: http://dx.doi.org/10.5130/ajceb.v15i1.4214

Ramachandra, T., & Rotimi, J.O.B., (2015): Mitigating payment problems in the construction industry through analysis of construction payment disputes, *J. Leg. Aff. Dispute. Resolut. Eng. Constr.* 7 (1) (2014) A4514005, https://doi.org/10.1061/(asce)la.1943-4170.0000156.

Ramachandra, T., & Rotimi, J.O.B., (2011): The nature of payment problems in the New Zealand construction industry, *Australas. J. Constr. Econ. Build*. 11 (2) (2011) 22–33, https://doi.org/10.5130/ajceb.v11i2.2171.

Interim valuation and payment 2015 (1st edition): RICS professional guidance, UK. August, 2015.

Senarathne, E., Bandara, G., & Dissanayake, K., (2017): Significant Causes behind Payment Delays in Public Sector Building Construction Projects in North Western Province of Sri Lanka. 13th International Research Conference; General Sir John Kotelawala Defence University; Built Environment and Spatial Sciences Sessions.

Tariq, J., Gardezi, S.S., (2022): Study the delays and conflicts for construction projects and their mutual relationship: A review. Ain Shams Engineering Journal; https://doi.org/10.1016/j.asej.2022.101815; journal homepage: www.sciencedirect.com

Tran, H. Carmichael, D.G. (2012). Contractor's financial estimation based on owner payment histories, Int. J. Organ. Technol. Manag. Constr. 4 (2) (2012) 481–489 https://doi.org/10.5592/otmcj.2012.2.4

The Nigerian construction industry standard form (2018): Articles of agreement and conditions of contract for building projects.

UK Cabinet Office, Government Construction (2019); A Guide to the Implementation of Project Bank Accounts (PBAs) in Construction for Government Clients, Available at, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/62118/

Article published on boldscholar.com. Verify this document by clicking here

A-guide-to-Project-Bank-Accounts-in-construction-for-government-clients-July-2012.pdf, (2012) Accessed date: 24 October 2019.

Weske, M., (2012): *Business process management, concepts, languages, architecture;* second edition. ISBN 978-3-642-28615-5 ISBN 978-3-642-28616-2 (eBook); DOI 10.1007/978-3-642-28616-2; Springer Heidelberg Dordrecht London New York.

Wieringa, R.J., (2014): *Design science methodology for information systems and software Engineering*. ISBN 978-3-662-43839-8 (eBook); DOI 10.1007/978-3-662-43839-8; Springer Heidelberg New York Dordrecht London.

Wu, J., Kumaraswamy, M., & Soo, G., (2015): Payment problems and regulatory responses in the Construction Industry: Mainland China Perspective; *Journal of Professional Issues in Engineering Education and Practice*, Vol. 134, No. 4, October 1, 2008. ©ASCE, ISSN 1052-3928/2008/4-399–407. DOI: 10.1061/ (ASCE)1052-3928 (2008)134: (399).

Article published on boldscholar.com. Verify this document by clicking here