

The Causes and Impact of Late Payments in The Construction Industry

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Abstract

Given that the South African construction industry is prone to late payments, and contractors experience a high level of late payment, non-payment, and insolvency, a study was conducted to investigate the causes of late payment, non-payment, negative cash flow, and payment disputes that arise during construction, and to evolve a framework of interventions to mitigate these. The quantitative method was adopted due to the nature of the data required, and an 'introductory' letter was e-mailed to medium to large general contractor members of the East Cape Master Builders Association (ECMBA), which included the online survey questionnaire URL. Given the sample size of 67 and the 20 responses, which equate to a response rate of 30.0%, the findings cannot be deemed generalisable, but are indicative. The salient findings are: late payment is a significant issue; factors such as inadequate client's finance, and inadequate client capacity for processing payments contribute to late payment; delay in completion of activities, and negative cash flow occur due to late and non-payment, non-payment by clients result in payment disputes; clients' poor financial management and clients' withholding of payments contribute to non-payment, and blockchain technology with a smart contract has the potential to mitigate payment problems. Conclusions include: the extent to which factors result in late payments indicates that it is a multi-stakeholder issue in addition to being attributable to clients, and although blockchain technology and the use of smart contracts can mitigate payment problems as they enable every transaction, payment, and business interaction to be followed, they cannot be viewed as the panacea for all payment related problems. Recommendations include consideration of a 'project payment charter', which indicates the role of all project stakeholders, and their commitment in the form of signatures to the charter.

Keywords: Blockchain, Late payment, Non-payment, Payment disputes

1. Introduction

The crucial factor to a project's success is the practice of efficient and timely payments on construction projects. Another significant issue is the delay in a project's completion, which may result in costly disputes (Koshe & Jha, 2016). Cash flow, in turn, is the lifeblood of an organisation because without it, outstanding financial obligations cannot be met (Arafat and Skaik, 2016, cited in Omopariola *et al.*, 2020). Cash flow dictates the scope, pace, quality, direction, and final product of the project (Usman *et al.*, 2016).

Azman *et al.* (2014) state that the construction industry faces more serious problems with late and non-payment than other industries. This is because, in contrast to other industries, construction projects typically take a long time to complete, each construction project is typically quite large, and progress payments are frequently quite substantial. Furthermore, payment terms are typically on credit, rather than delivery and services are provided before progress payments are made.

Delayed progress payments are ubiquitous and hinder the success of construction projects globally (Ramachandra and Rotimi, 2011, cited in Sonmez *et al.*, 2022). The causes of late payments include: claims without adequate supporting documents, and incorrectly calculated claims (Reva, 2003 cited in Ajayi *et al.*, 2018), and client's poor financial management,

client's wrongful withholding of payment, conflict among the parties involved, delay in certification, and disagreement concerning the valuation of work (Hasmori *et al.*, 2012). Azman *et al.* (2014) contend that failure by the contractor to secure consistent and prompt payments could cause project delays, decreased profitability, and, in the worst scenario, a contractor's insolvency. Furthermore, the entire construction value chain will be negatively impacted because all parties in the chain suffer if a client fails to pay the contractor on time.

Given the abovementioned, a study was conducted, the aim being to investigate late payments in construction, and identify interventions to mitigate the same. The objectives were to determine the extent to which:

- ten factors result in late payments;
- ten problems occur due to late payments, and
- Industry 4.0 interventions can mitigate late payments and cash flow problems.

2. Literature Review

2.1. Late payments

According to Badroldin *et al.* (2016), late payment occurs when a business has been supplying services or products but does not get paid by the agreed deadline. Delays concerning progress payments are a common problem hindering the success of construction projects globally (Ramachandra and Rotimi, 2011, cited in Sonmez *et al.*, 2022). Due to its nature and traits, the

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construction business has unfairly extended payment terms and a high rate of late payments. More fundamentally, the behaviours of construction corporations, and in some situations, government agencies that collaborate with them, are frequently directly linked to the causes of late payments (European Commission, 2020).

The Construction Industry Development Board (cidb) (2015) states that 60% of payments to contractors were delayed for longer than 30 days after invoicing, which reflects a noticeable deterioration in prompt payment practices over the period of 2012 to 2015. Furthermore, 52% of payments to the client's agents were delayed for longer than 30 days after invoicing (cidb, 2015).

2.2. Causes of late payments

According to Hasmori *et al.* (2012), clients, developers, contractors, and contractual matters are among the numerous variables that cause late payment issues. The main reason for late payment, according to Reva (2003), cited in Ajayi *et al.* (2018), is when there are errors in submitting claims. This includes claims without adequate supporting documents, incorrectly calculated claims, and those submitted without using procedures. When this happens, contractors need to resubmit the claims. According to Hasmori *et al.* (2012), there are also cases where clients' employees are wrongfully withholding payment, often to obtain a 'gift' from contractors once they expedite the payment.

2.3. Impact of late payments

According to Odenigbo *et al.* (2020), payment is the heart of the construction industry and project duration is automatically impacted by payment delays. Late payment is a significant issue in construction, and globally, the success of construction projects is hindered by late payments (Sonmez *et al.*, 2022). Late payment is a persistent and crucial issue that the construction industry faces, as it affects contractors' cash flow and impacts the delivery of projects (Ajei *et al.*, 2018). According to Mohamad *et al.* (2018), clients' inability to make timely and consistent payments can impede contractors' ability to complete their work on schedule, and both clients and contractors should equally share the risk of late or non-payment. The delays in payments, non-payments, and disputes that arise during construction can lead to contractors becoming insolvent.

2.4. Non-payment

According to Maritz and Robertson (2012), South African contractors and consultants have the same problem as those in other countries regarding non-payment for work done or services rendered. According to Ramachandra and Romiti (2015b), non-payment has an immediate effect on cash flow, which in turn drives the contractors and eventually subcontractors to source additional funding through overdrafts, trade credits, and other means. Non-payment and late payment lead

to disputes and subsequent suspension and termination of projects, which marginalise the productivity of the construction industry at large, but with more dire consequences for construction parties down the supply chain (Ramachandra & Romiti, 2015b).

2.5. Causes of non-payment

According to Ramachandra and Romiti (2015a), there are many factors associated with payment defaults in the construction industry. The construction sector is known for many unique characteristics, which could primarily contribute to payment problems. Based on a literature review conducted by Hasmori *et al.* (2012), client's poor financial management, client's withholding of payment, conflict among the parties involved, the use of a pay-when-paid clause relative to subcontractors, local culture or attitude, delay in certification, and disagreement concerning the valuation of work, were identified as the primary causes of non-payment in the construction industry.

2.6. Payment disputes

Due to its complexity, competitive environment, and complicated project documentation, the construction industry is prone to conflict and disputes (Shash & Habash, 2021). According to Awwad *et al.* (2016), cited by Gamil and Abd Rahman (2023), construction projects have a distinct execution process that may be associated with uncommon disputes between construction stakeholders, which ultimately can result in a project's collapse.

Conflicts are unavoidable in the construction sector due to differences in perceptions among project participants, and conflicts can quickly develop into disputes if they are not appropriately handled (Cakmak & Cakmak, 2014). According to Hassan *et al.* (2019), payment has always been the primary source of dispute relative to many construction contracts. Furthermore, the significance of positive cash flows in ensuring the continuity of a project has elevated all issues relating to timely payment, and the need to maximise positive cash flow will continue to escalate payment disputes. Then, disputes relating to payment issues are broadening and becoming more complicated (Hasmori *et al.*, 2012).

2.7. Negative cashflow

Cash flow impacts all aspects of the construction project implementation process. Cash shortages can lead to project failure and business bankruptcy (Al-Joburi *et al.*, 2012). Negative cash flow occurs when the cash outflow surpasses the cash inflow and is indicative of an organisation in financial difficulty (Omopariola *et al.*, 2020). According to Al-Nassafi (2022), poor cash flow in construction is caused by late payments and non-payments, which may cause delays in the completion of the project and, as a result, failure to meet economic feasibility, resulting in significant financial loss for the contractor.

2.8. *Potential of Industry 4.0 technologies to address payment-related problems*

Perera *et al.* (2020) identify a range of applications for blockchain technology in construction and the built environment, and in terms of 'payment management', they refer to late payments and cash flow-related issues as key issues on most construction projects. They also refer to default settlement durations, partial payments, and non-payments, and state that smart contract-enabled blockchain applications with automated payments can effectively be used to resolve these issues.

Smart contracts utilise protocols and user interfaces to facilitate all the steps in the contracting process. Lamb (2018) describes a smart contract as a contract using computer protocols to formalise elements of a relationship to automatically execute the terms encoded therein once the pre-defined conditions are met. Altay & Motawa (2020) highlight how key processes can be automated in construction using smart contracts and blockchain technology. A key feature of smart contracts is that transactions are performed without intermediaries, which mitigates interference.

A blockchain consists of units of data about specific transactions arranged in an ordered list (Lamb, 2018), which allows the automation of transactions within a contract once certain predetermined project variables and principles are met (Altay & Motawa, 2020). Smart contracts enable greater traceability and provide an opportunity for increased processing efficiency.

3. Research Methodology

The survey of the literature was conducted via the Nelson Mandela University library portal, including databases such as SpringerLink and Taylor & Francis Online. Terms such as 'Causes of late payments in construction', 'Impact of late payments in construction', 'Construction smart contracts', and 'Blockchain in construction' were used as search criteria.

The quantitative research study entailed an online questionnaire survey, and the questionnaire evolved from the review of the literature while considering the study's aim and objectives. The sample included 67 potential respondents, specifically general contractors (GCs) members of the East Cape Master Builders Association (ECMBA). Members of the ECMBA were selected because the authors' university is in the same metropole as the ECMBA, which increases the likelihood of interest in the study. Furthermore, GC members are paid directly by clients, and therefore, should be familiar with the status quo relative to client payments in construction. The questionnaire consisted of 23 closed-ended and three open-ended questions. Fifteen of the closed-ended questions were Likert scale-type questions, and eight were demographic-related questions. A total of 20 Responses were received,

which equates to a response rate of 30.0%. The online questionnaire process included the generation of an MS Excel data file, and the data analysis entailed the computation of frequencies and a measure of central tendency in the form of a mean score (MS).

4. Findings and Discussion

In terms of respondents' highest qualification, 45.0% have a Diploma, 25.0% have a B.Tech, 20.0% have a B.Sc. degree, and 10.0% have an honours degree. In terms of the number of years respondents have worked in construction, 35.0% have worked in construction for 11-15 years, 25.0% for 11-15 years, 20.0% for more than 20 years, and 15.0% for 16-20 years. Notably, only 5.0% have worked for less than 5 years.

Respondents were required to indicate on a scale of never to always, the frequency with which clients follow contractual progress payment requirements. The resultant MS of 3.00 is > 2.60 to ≤ 3.40 , which indicates that the respondents contend clients follow the contractual progress payment requirements between rarely to sometimes / sometimes.

Table 1 indicates the extent to which ten factors result in late payments in terms of percentage responses to a range of 'Does not' and 1 (Minor) to 5 (Major), and MSs ranging between a minimum value of 0.00 and a maximum value of 5.00. It is notable that 9 / 10 (90.0%) MSs > 2.50 , which indicates that, in general, respondents perceive that the factors result in late payments to a major, as opposed to a minor extent, as in the case of an MS ≤ 2.50 . 4 / 10 (40.0%) Factors have MSs > 3.34 to ≤ 4.17 , which indicates that respondents perceive that they contribute between some extent to a near major extent / near major extent to late payments – 'inadequate client's finance', 'inadequate client capacity for processing payments', 'client inability to process payments', and 'withholding of payment by client'. 5 / 10 (50.0%) Factors have MSs > 2.50 to ≤ 3.34 , which indicates that respondents perceive that they contribute between a near minor extent and some extent to late payments. The MS of 'incomplete submission of claim documents' is > 1.67 to ≤ 2.50 , which indicates that respondents perceive that it contributes between a minor extent to a near minor extent / near minor extent to late payments. This is contrary to the finding of Reva (2003) cited in Akinsiku and Ajayi (2018), that the main reason for late payment is errors in submitting claims, which includes claims without adequate supporting documents.

Table 2 indicates the extent to which ten problems occur due to late payments in terms of percentage responses to a range of 'Does not' and 1 (Minor) to 5 (Major), and MSs ranging between a minimum value of 0.00 and a maximum value of 5.00. Notably, 9 / 10 (90.0%) of the MSs are > 2.50 , which indicates that, in

Table 1: The extent to which ten factors result in late payments

Factor	Response (%)							MS	R
	Un-sure	DN	Minor Major						
			1	2	3	4	5		
Inadequate client's finances	0.0	0.0	10.0	5.0	20.0	30.0	45.0	3.95	1
Inadequate client capacity for processing payments	0.0	0.0	10.0	15.0	15.0	10.0	50.0	3.75	2
Client's inability to process payments	10.0	10.0	0.0	5.0	10.0	35.0	30.0	3.67	3
Withholding of payment by the client	0.0	0.0	15.0	10.0	10.0	30.0	35.0	3.60	4
Delay in certification of payment	5.0	5.0	5.0	15.0	30.0	25.0	15.0	3.16	5
Disagreement regarding the value of work completed	0.0	0.0	10.0	15.0	40.0	25.0	10.0	3.10	6
Inadequate project cost estimate by the client's agent	10.0	5.0	15.0	15.0	15.0	15.0	25.0	3.06	7
Involvement of too many parties in the process of honouring certification	10.0	5.0	10.0	30.0	15.0	10.0	20.0	2.83	8
Delay in the contractor's submission of the invoice	5.0	10.0	20.0	15.0	20.0	20.0	10.0	2.67	9
Incomplete submission of claim documents	15.0	5.0	10.0	45.0	15.0	5.0	10.0	2.24	10

Table 2: The extent to which ten problems occur due to late payments

Problem	Response (%)							MS	R
	Un-sure	DN	Minor Major						
			1	2	3	4	5		
Negative cash flow	0.0	0.0	10.0	0.0	15.0	40.0	35.0	3.90	1
Delay in the completion of activities	0.0	0.0	5.0	15.0	15.0	15.0	35.0	3.90	1
Inability to secure enough material to deliver the project	10.0	10.0	0.0	10.0	20.0	20.0	30.0	3.44	3
Loss of trade discount from suppliers	20.0	15.0	5.0	0.0	0.0	35.0	25.0	3.38	4
Poor productivity	10.0	10.0	5.0	10.0	10.0	40.0	15.0	3.22	5
Change in the sequence of programmed work	0.0	15.0	10.0	10.0	10.0	25.0	30.0	3.10	6
Loss of key personnel	5.0	10.0	5.0	15.0	30.0	10.0	25.0	3.05	7
Loss of expected profit due to high interest on overdue accounts	15.0	15.0	5.0	10.0	10.0	25.0	20.0	3.00	8
Low employee morale	5.0	10.0	0.0	0.0	45.0	20.0	20.0	2.89	9

general, respondents perceive that the problems occur due to late payments to a major, as opposed to a minor extent in the case of an $MS \leq 2.50$. 4 / 10 (40.0%) Problems have $MSs > 3.34$ to ≤ 4.17 , which indicates that respondents perceive the problems occur between some extent to a near major extent / near major extent due to late payments. 5 / 10 (50.0%) Problems with $MSs > 2.50$ to ≤ 3.34 , indicates that respondents perceive the problems to occur between a near minor extent to some extent / some extent due to late payments. The MS for 'abandonment of the project' is > 1.67 to ≤ 2.50 , which indicates that respondents perceive that it occurs between a minor to near minor

extent / near minor extent due to late payments. The findings are reinforced in terms of project delays (Odenigbo *et al.*, 2020; Ajei *et al.*, 2018; Mohamad *et al.*, 2018) and cash flow (Ajei *et al.*, 2018).

Table 3 indicates the extent to which Industry 4.0 interventions can mitigate late payment and cash flow problems in the construction industry in terms of percentage responses to a range of 1 (Minor) to 5 (Major), and MSs ranging between a minimum value of 1.00 and a maximum value of 5.00. It is notable that 4 / 8 (50.0%) of the MSs are > 3.00 , which indicates that in general, respondents perceive that the Industry 4.0

Table 3: The extent to which Industry 4.0 interventions can mitigate late payments and cash flow problems

Industry 4.0 intervention	Response (%)						MS	R
	Un-sure	Minor Major						
		1	2	3	4	5		
Blockchain technology for monitoring the progress of payment and mitigate late payment	15.0	0.0	5.0	45.0	20.0	15.0	3.53	1
Blockchain technology for monitoring contracts and mitigating non-payment	20.0	0.0	5.0	35.0	40.0	0.0	3.44	2
Blockchain technology for smart contracts to mitigate non-payment	10.0	15.0	10.0	30.0	25.0	10.0	3.17	3
Blockchain technology for mitigating payment disputes during construction	15.0	10.0	10.0	30.0	30.0	5.0	3.12	4
Blockchain technology for accelerating payments	30.0	5.0	15.0	35.0	10.0	5.0	2.93	5
Artificial Intelligence for Predicting Cost Overruns	30.0	10.0	30.0	5.0	15.0	10.0	2.79	6
Artificial Intelligence for reducing negative cash flow	45.0	5.0	25.0	5.0	20.0	0	2.73	7
Blockchain technology for boosting transparency to reduce disputes	10.0	25.0	15.0	35.0	10.0	5.0	2.50	8

interventions can mitigate late payments and cash flow problems to a major, as opposed to a minor in the case of a $MS \leq 3.00$. 2 / 8 (25.0%) MSs are > 3.40 to ≤ 4.20 , which indicates that the respondents perceive that they can mitigate late payments and cash flow problems between some extent to a near major / near major extent. 5 / 8 (62.5%) MSs are > 2.60 to ≤ 3.40 , which indicates that respondents perceive that the Industry 4.0 interventions can mitigate late payments and cash flow problems between a near minor extent to some extent / some extent. Only 1 / 8 (12.5%) MSs is > 1.80 to ≤ 2.60 , which indicates that respondents perceive that the Industry 4.0 intervention can mitigate late payments and cash flow problems between a minor to near minor extent / near minor extent. These findings are supported by Perera *et al.* (2020) regarding potential blockchain technology applications and by Altay and Motawa (2020) regarding smart contracts using blockchain technology.

5. Conclusions, Recommendations and Further Research

Given the sample size, the findings cannot be deemed generalisable, but are indicative, and hence the need for further in-depth related research.

Late payments are a persistent issue that the construction industry faces and have a significant impact on contractors' cash flow. A range of factors, such as inadequate client finance, inadequate client capacity for processing payments, client's inability to process payments, and withholding of payment by clients, contribute to late payment. The client's poor

financial management and withholding payment to obtain some 'kind of gift' from contractors results in non-payment. Non-payment by clients, in turn, results in payment disputes and financial problems for contractors and their supply chain.

Inadequate client capacity for processing payments, and client inability to process payments allude to competency challenges. This is likely to be more common in the case of 'once-off' clients who may not be familiar with construction contracts and payment processes. In such cases, the client's consulting quantity surveyor should assist along with the principal agent. The extent to which factors result in late payments indicates that it is a multi-stakeholder issue in addition to being attributable to clients e.g., delay in certification of payment may result from either a delay in contractor's submission of invoices, or an incomplete submission of claim documents by a contractor, or involvement of too many parties in the process of honouring certification, or a combination of all three factors.

Although the review of the literature indicates that blockchain technology with automated payments and smart contracts can be used to mitigate payment problems in the construction industry, the findings of the study marginally underscore the review of the literature. This is likely attributable to the respondents' lack of experience and exposure relative to blockchain technology. This, in turn, amplifies the need for further in-depth related research to interrogate and unequivocally confirm that blockchain technology can mitigate payment-related problems in construction.

Furthermore, given the extent to which factors result in late payments, blockchain technology cannot be viewed as a panacea for all payment-related problems. Therefore, a further intervention in the form of, say, a 'project payment charter' should be considered, which charter indicates the role of all project stakeholders, and

their commitment in the form of signatures to the charter. Following this, the required performance by the respective stakeholders will facilitate an effective implementation of blockchain technology, resulting in an indelible record of actions and transparency.

References

- Adjei, E.A.G., Fugar, F.D.K., Adinyira, E., Edwards, D.J. & Parn, E.A. (2018). 'Exploring the significant Cash Flow factors influencing building projects' profitability in Ghana', *International Journal of Construction Engineering and Management*, 7(1), pp. 35–46.
- Al-Joburi, K.I., Al-Aoma, R. & Bahri, M.E. (2012). 'Analysing the impact of negative cash flow on construction performance in Dubai', *Journal of Management in Engineering*, 28(4), pp. 382–390. DOI: 10.1061/(ASCE)ME.1943-5479.0000123
- Al-Nassafi, N.M. (2022). 'The effect of cash flow variation on project performance: An empirical study from Kuwait', *Journal of Asian Finance, Economic and Business (JAFEB)*, 9(3), pp. 53–63.
- Ajayi, O.M., Akinsiku, O.E. & Salami, T.O. (2018). 'Implementation of quality management of construction companies in Lagos state, Nigeria', *JES*, 2(1), pp. 127–139.
- Altay, H. & Motawa, I. (2020). 'An investigation on the applicability of smart contracts in the construction industry', In: *Proceedings ARCOM Doctoral Workshop*, Newcastle, United Kingdom, 25 March 2020, pp. 12–16.
- Azman, M.N.A., Dzulkalnine, N., Hamid, Z.A. & Bing, K.W. (2014). 'Payment issue in Malaysian construction industry: Contractors' perspective', *Journal Teknologi*, 70(1), pp. 57–63. <https://doi.org/10.11113/jt.v70.2804>
- Badroldin, M.K.A.M., Hamid, A.R.A., Raman, S.A., Zakaria, R. & Mohandes, S.R. (2016). 'Late payment practices in the Malaysian construction industry', *Malaysian Journal of Civil Engineering*, 28(3), pp. 149–162.
- Cakmak, E., & Cakmak, P.I. (2014). 'An analysis of causes of disputes in the construction industry using analytical network process'. *Procedia - Social and Behavioural Science*, 109(2014), pp. 183–187. <https://doi.org/10.1016/j.sbspro.2013.441>
- European Commission (2020). *Late payment in the construction sector. Analytical Report 2020*. Luxembourg: Office for Official Publication of the European Communities.
- Gamil, Y. & Abd Rahman, I. (2023). 'Impact of poor communication on dispute occurrence in the construction industry: A preliminary exploratory study of Yemen construction industry', *International Journal of Construction Management*, 23(16), pp. 2729–2735. <https://doi.org/10.1080/15623599.2022.2092388>
- Hasmori, M.F., Ismail, I. & Said, I. (2012). 'Issues of late and non-payment among contractors in Malaysia', In: *Proceedings 3rd International Conference on Business and Economic Research*. Bandung, Indonesia, 12–13 March 2012, pp. 1–12. Available at <http://bit.ly/45jMOWE> [Accessed 18 May 2022]
- Hassan, A.A., Adan, H., Kamil, A.I.M. & Mahat, N.A.A. (2019). 'Challenge against adjudication decisions on payment disputes within the construction industry', *IOP Conference Series: Earth and Environmental Science*, 233(2), pp. 1–7.
- Koshe, W. & Jha, K.N. (2016). 'Investigating causes of construction delay in Ethiopian construction industries', *Journal of Civil, Construction and Environmental Engineering*, 1(1), pp. 18–29. <https://doi.org/10.11648/j.jccee.2016101.13>
- Lamb, K. (2018). *Blockchain and smart contracts: What the AEC sector needs to know (CDBB_REP_003)*, Centre for Digital Built Britain (CDBB), University of Cambridge. doi:<https://doi.org/10.17863/CAM.26272>
- Maritz, M.J. & Robertson, D.C. (2012). 'What are the legal remedies available to contractors and consultants to enforce payment?' *Journal of the South African Institution of Civil Engineering*, 54(2), pp. 27–35.
- Mohamad, N., Suman, A.S., Harun, H., & Hashim, H. (2018). 'Mitigating delay and non-payment in the construction industry', *IOP Conference Series: Earth and Environmental Science*, 117, 012087. <https://doi.org/10.888/1755-1315/117/1/012037>
- Odenigbo, O.G., Odusami, K.T., Okolie, K.C. & Okafori, V.C. (2020). 'Causes of Delayed Payment in Construction Project in Nigeria', *European Journal of Engineering Research and Science*, 5(9), pp. 1049–1053.

- Omopariola, E.D., Windapo, A., Edwards, D.J. & Thwala, W.D. (2020). 'Contractor's perceptions of the effects of cash flow on construction projects', *Journal of Engineering, Design and Technology*, 18(2), pp. 308–325. <https://doi.org/10.1108/JEDT-04-2019-0099>
- Perera, S., Nanayakkara, S., Rodrigo, M.N.N., Senaratne, S. & Weinand, R. (2020). 'Blockchain technology: Is it hype or real in the construction industry?' *Journal of Industrial Information Integration*, 17(March 2020). <https://doi.org/10.1016/j.jii.2020.100125>
- Ramachandra, T. & Rotimi, J.O. (2015a). 'Mitigating payment problems in the construction industry through analysis of construction payment dispute', *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 7(1), pp. 1–7.
- Ramachandra, T. & Romiti, J.O.B. (2015b). 'Causes of payment problems in the New Zealand construction industry', *Construction Economics and Building*, 15(1), pp. 43–55. DOI: <http://dx.doi.org/10.5130/ajceb.v15i1.4214>
- Shash, A.A. & Habash, S.I. (2021). 'Disputes in construction industry: Owners and contractors' views on causes and remedies', *Journal of Engineering, Project, and Production Management*, 11(1), pp. 37–51. http://www.ppl.url.tw.EPPM_Journal/volumes/10_01_January_2021/ID_283_11_1_37_57.pdf
- Sonmez, R., Ahmadiheykhsarmast, S. & Gungor, A.A. (2022). 'BIM integrated smart contract for construction project progress payment', *Automation in Construction*, 139(2022) 104294, pp. 1–12. DOI: <https://doi.org/10.1016/j.autcon.2022.104294>
- Usman, N., Sani, A. & Tukur, R.I. (2016). 'An appraisal of factors affecting cash flow in building project delivery in Nigeria' *Journal of Applied Science*, 2(1), pp. 10–21. <https://www.ijrdo.or/index.php/as/article/view/1201/1126>.